VikingCCS

Viking CCS pipeline

Preliminary Environmental Information Report Volume II

Main PEIR

Applicant: Chrysoar Production (U.K.) Limited,
a Harbour Energy Company

PINS Reference: EN070008

November 2022

Harbour Energy

AECOM

Chapter 3

The Viking CCS Pipeline

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3 The Viking CCS Pipeline

3.1 Introduction

3.1.1 This chapter provides a description of the various components of the Viking CCS Pipeline, hereafter referred to as 'the Project', for the purposes of identifying and reporting the potential environmental impacts and likely significant effects in this Preliminary Environmental Information Report (PEIR).

3.1.2 The description of the Project presents the current evolution of the design in response to feedback provided during the Non-Statutory Consultation. Where necessary the design will be further updated, post Statutory Consultation, to incorporate feedback received. An updated version of the description will be provided as part of the Environmental Statement (ES) that will be submitted in support of the Development Consent Order (DCO) application currently planned for submission in summer 2023.

3.1.3 Where flexibility is required relating to certain elements of the design, high-level design parameters are set out to aid the initial understanding of the Project. These parameters will enable a reasonable worst-case assessment of the potential impacts of the Project to be included in this PEIR.

3.1.4 This PEIR chapter is split into the following sections:

- Section 3.2 identifies some of the key terms that are used in the PEIR when describing the Project;
- Section 3.3 describes the wider Viking CCS Project, of which the Viking CCS Pipeline forms a key element;
- Sections 3.6 to 3.11 describe the key components of the Project;
- Section 3.12 provides information on the construction of the Project, including information on the proposed construction methods and programme;
- Section 3.14 includes details on the operational phase of the Project; and
- Section 3.15 provides an overview of the Proposed Decommissioning Strategy for the Project.

3.1.5 As part of their commitments to tackling climate change, the UK government has set legally binding targets to become net-zero in all greenhouse gases by 2050 for England and Wales. In addition, the Government has shown clear commitment to developing Carbon Capture Usage and Storage (CCUS) infrastructure, with a goal of delivering four CCUS clusters, capturing 20-30 Million Tonnes of CO_2 ($MtCO_2$) across the economy, including 6 $MtCO_2$ of industrial emissions, per year, by 2030 (Ref 3-1).

3.1.6 The Humber industrial cluster represents a unique emissions density within the UK, with 18.5 million tonnes of CO_2 equivalent (CO_2e) emitted in 2019 (Ref 3-2). Decarbonisation of the Humber Energy Intensive Industry Cluster is required to meet the UK Government's legally binding target of achieving Net Zero in 2050. The wider Humber region will require multiple CO_2 storage options to promote greater onshore capture infrastructure development and underpin robust storage risk management through diversity of storage options.

3.1.7 Chrysaor Production (U.K.) Limited, a Harbour Energy company, (hereafter 'The Applicant') wishes to promote regional collaboration towards future development of CO_2 transportation infrastructure, to enable a broader decarbonisation development across the Humber and

Lincolnshire region and to present the opportunity for new inward investment into a future low-carbon economy. The Applicant wants to promote and enable future regional collaboration, which will better enable consistent and factual public engagement and knowledge dissemination across the multiple potential decarbonisation projects within the wider Humber region.

3.1.8 Although not part of this DCO application the Applicant is also working together with Associated British Ports at the Port of Immingham in order to develop opportunities for ship-based import and export of CO_2. This vision could create a CO_2 trading hub in the Humber region and increase both trade and inward investment.

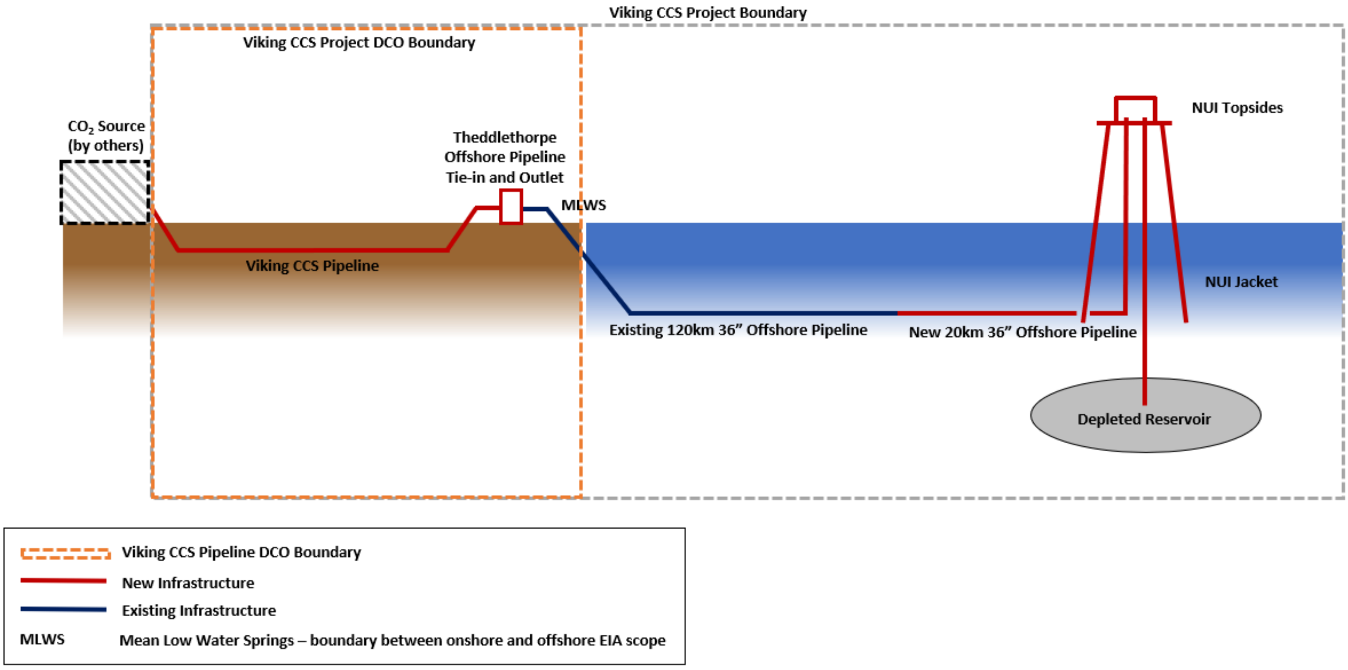
3.1.9 The Viking CCS Project intends to transport compressed and conditioned CO_2 from the Immingham Facility to store in depleted gas reservoirs in the Southern North Sea. The Oil and Gas Authority (OGA) awarded the Applicant a CO_2 appraisal and storage licence in 2021. The Viking CCS Project aims to transport and store up to 10 million tonnes of CO_2 annually by 2030.

3.1.10 The main elements of the overall Viking CCS Project (**Figure 3-1**), comprise:

- CO_2 source, conditioning and compression (e.g., by HumberZero, which is a ground-breaking project aimed at decarbonising energy intensive industry);
- The Viking CCS Pipeline (the Project to which this PEIR relates), which consists of the Immingham Facility, an onshore pipeline from Immingham to the Theddlethorpe Facility, and an offshore pipeline tie-in and outlet up to Mean Low Water Springs (MLWS);
- Transportation, via the existing and repurposed Lincolnshire Offshore Gas Gathering System (LOGGS) pipeline system (the existing offshore pipeline) from the MLWS tide mark, to approximately 120 km offshore, along with the development of an additional 23 km subsea pipeline spur extension;
- Installation of a Not Permanently Attended Installation (NPAI) containing injection facilities, including wellheads; and
- The utilisation of depleted gas reservoirs in the Viking area of the North Sea for CO_2 injection and storage.

3.1.11 This PEIR specifically covers the Viking CCS Pipeline from the point of receipt of CO_2 at the Immingham Facility, through its onshore transportation in the new pipeline to the Theddlethorpe Facility, and onward transportation through the existing LOGGS offshore pipeline to MLWS tide mark. Subsequent transmission would be part of a separate consent application.

Figure 3-1: Schematic of the Viking CCS Project



3.2 Key Terms used in this PEIR

3.2.1 The following terms are used throughout this PEIR which are of key importance:

- **Draft Order Limits:** The Draft Order Limits illustrate the provisional outer limits of the Project. It comprises both the temporary and permanent land take required for construction and operation of the Project for which powers are sought through the DCO.
- **Scoping Boundary:** The Scoping Boundary demarcated the land within which the scope of the Environmental Impact Assessment (EIA) was determined in the Scoping Report. The Scoping Boundary has since been refined to form the Draft Order Limits, following non-statutory consultation feedback, and further design and environmental work.
- **The Project:** The Project is comprised of the onshore elements of the wider Viking CCS Project, from the point of receipt of CO_2 at Immingham, through its onshore transportation in the new pipeline to the former TGT site, and onward transportation through the existing LOGGS offshore pipeline to MLWS tide mark. Onward transmission from this point will be subject to a separate consent application.

3.3 Development Envelope / Design Parameters

3.3.1 The Planning Inspectorate's Advice Note 9: Using the '*Rochdale Envelope*' (Ref 3-3), provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008 (Ref 3-4). The advice note acknowledges that there may be aspects of a proposed project design that are not yet fixed, and therefore, it may be necessary for the EIA to assess likely credible worst-case variations to ensure that all foreseeable significant environmental effects of a project have been assessed.

3.3.2 The National Policy Statements (NPS) for energy infrastructure (Ref 3-5) provide further guidelines on flexibility and should be referred to in justifying the amount of design detail contained within an application. The National Infrastructure Planning Association (NIPA) has published papers on striking the right balance between design detail and flexibility in DCOs and their recommendations for best practice will be considered in preparing the DCO application.

3.3.3 Consequently, it is prudent to maximise flexibility given the long durations required to gain consent and subsequent engagement of Engineering, Procurement and Construction (EPC) Contractors. This is particularly the case under the Planning Act 2008, where the process for post consent amendments can add unnecessary costs and delays to project delivery. It is typical for a DCO (especially linear schemes) to include the ability to alter the final design of a scheme by having "limits of deviation". For the Viking CCS Pipeline, the limits of deviation are set at 100 m, and the working width of the pipeline construction swathe would be a maximum of 30 m located anywhere within the limits of deviation, with the exception of major crossings of roads, railways or watercourses where the working width would be greater than 30 m. In most areas the limits of deviation are contiguous with the Draft Order Limits.

3.3.4 Design parameters have been developed for this Statutory Consultation and presented below. Final parameters and limits of deviation will be presented in the ES, draft DCO and works plans.

3.3.5 When presenting the Project design in the ES, the requirements of The Planning Inspectorate's Advice Note 9 will be complied with to ensure that the likely significant effects of the Project are assessed on a reasonable worst-case basis.

3.4 Viking CCS Pipeline – Key Components

3.4.1 Key components of the Viking CCS Pipeline comprise the following, which are discussed in more detail in sections 3.6 to 3.11:

- Immingham Facility;
- Approximately 55.6 km buried 24 inch (") onshore steel pipeline (including cathodic protection);
- Three Block Valve Stations;
- Theddlethorpe Facility; and
- Existing LOGGS Pipeline to the extent of the DCO limits at MWLS, and shutdown and isolation valves.

3.4.2 The location of each of these facilities are shown on **Figure 3-2.**

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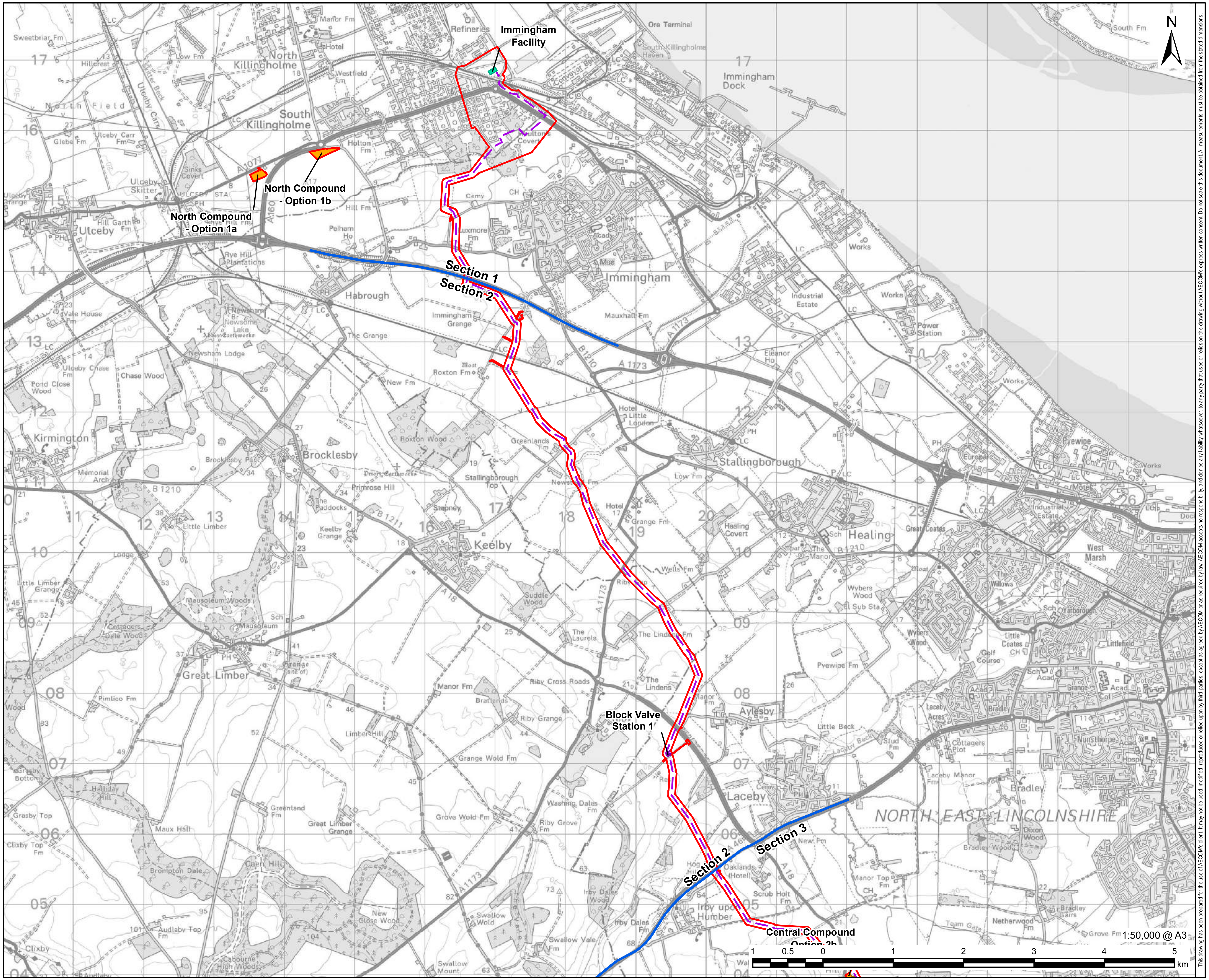

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PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Preferred Pipeline Route
- Temporary Construction Compound
- Block Valve Station
- Reception Pipeline Facility

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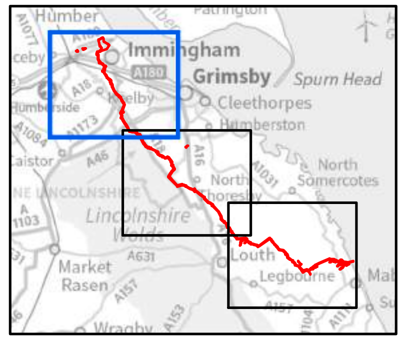

FIGURE TITLE

Figure 3-2 (1 of 3) Viking CCS Pipeline - Key Components

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

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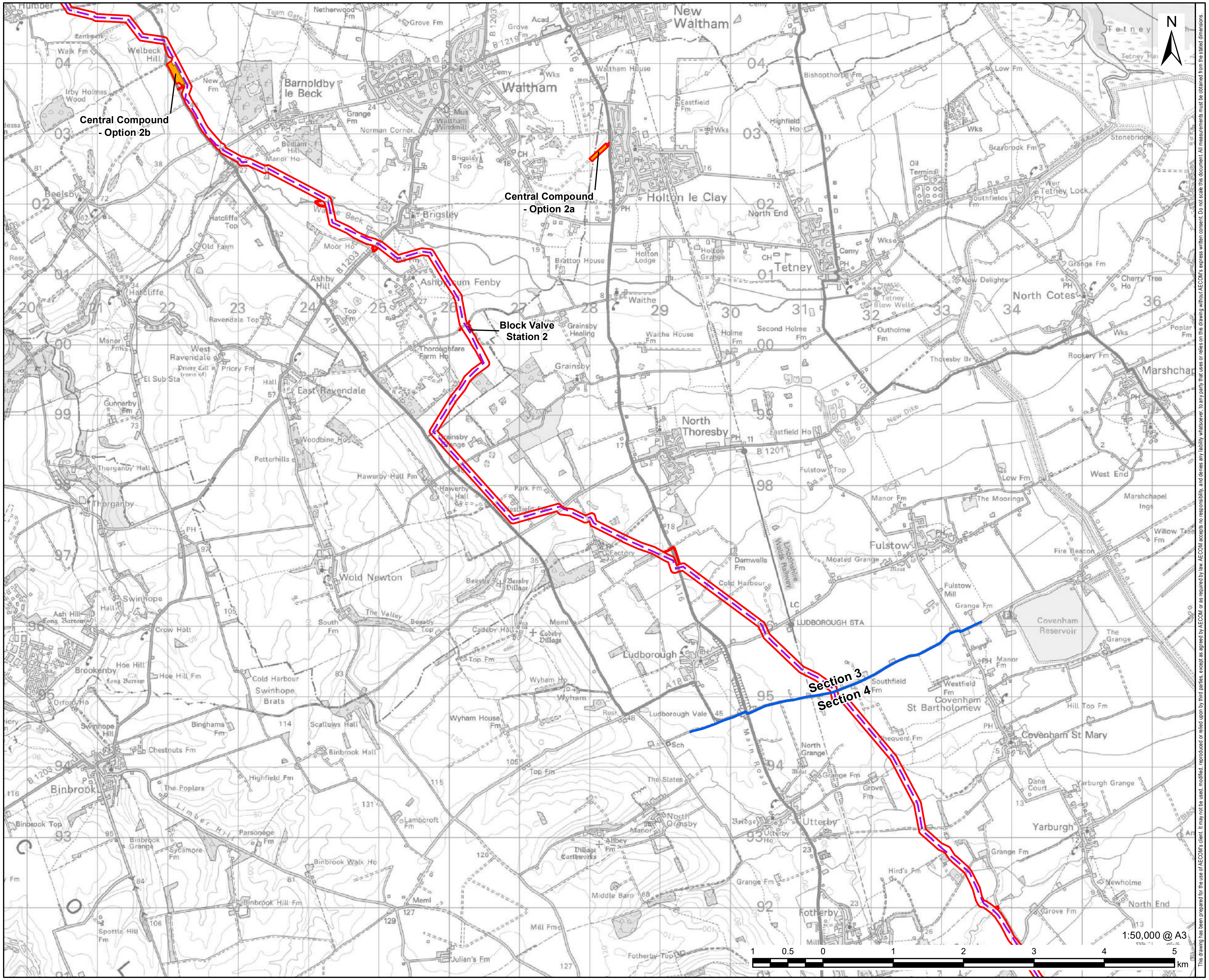

Viking CCS

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PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Preferred Pipeline Route
- Temporary Construction Compound
- Block Valve Station

NOTES:

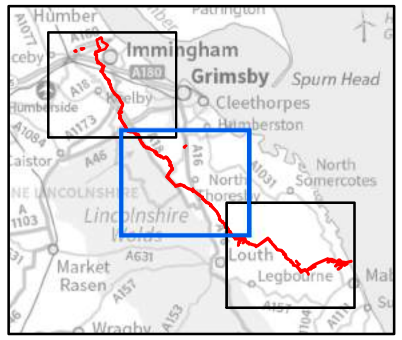

FIGURE TITLE

Figure 3-2 (2 of 3)
Viking CCS Pipeline -
Key Components

ISSUE PURPOSE

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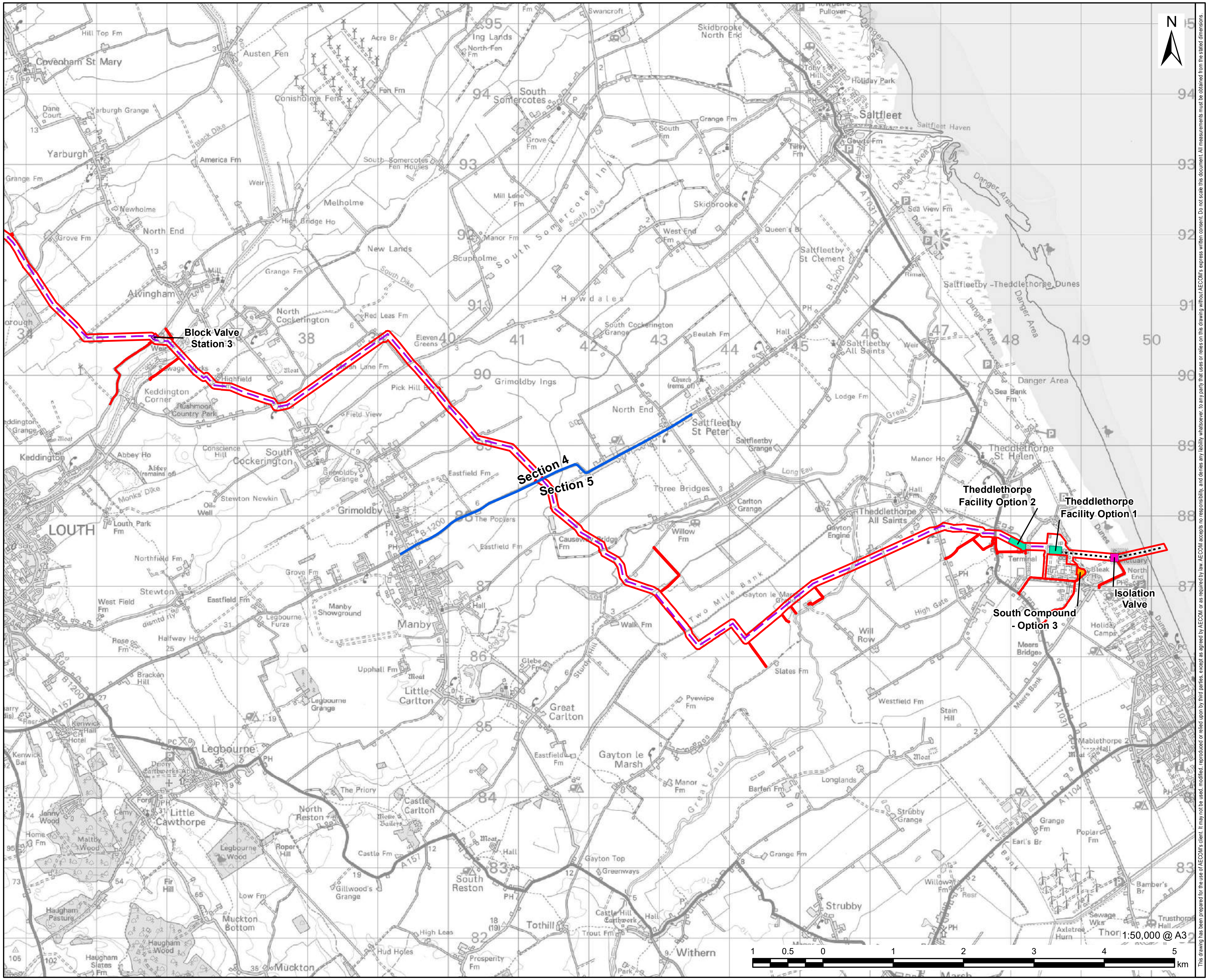

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PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Isolation Valve
- Preferred Pipeline Route
- Existing Loggs Pipeline
- Temporary Construction Compound
- Block Valve Station
- Reception Pipeline Facility

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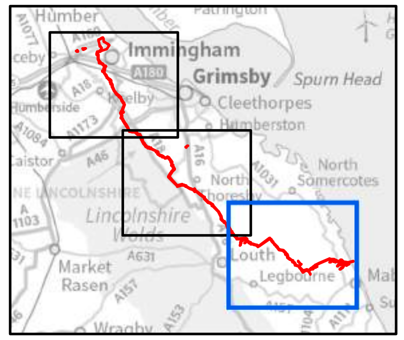


FIGURE TITLE

Figure 3-2 (3 of 3) Viking CCS Pipeline - Key Components

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221114_PEIR_3-2

3.5 Safety

3.5.1 Harbour Energy is the Applicant's parent company and so its policies on health and safety apply.

Overview

3.5.2 Safety is of highest priority, and the Applicant operates responsibly, securely and in accordance with applicable regulation, across all their activities. The Applicant works to reduce risks and protect their staff, contractors and the communities within which their activities have the potential to cause impact through the rigorous application of safe operating practices.

Responsibility

3.5.3 Harbour Energy's Board of Directors oversee health and safety matters through the Health, Safety, Environment and Security (HSES) Committee. This Committee has a wide scope of responsibilities and is supported by their CEO, the Executive Vice President HSES and Global Services, business unit and HSES leaders. Harbour Energy's Leadership Team reviews HSES performance on an ongoing basis and carries out periodic reviews in each business unit. These reviews cover a wide range of leading and lagging key performance indicators which Harbour Energy use to further support continuous improvement efforts. Everyone working for or on behalf of Harbour Energy has a personal responsibility to undertake their work in a safe and respectful manner.

Approach

3.5.4 Harbour Energy's HSES Policy is implemented through their Business Management System (BMS), which comprises a comprehensive set of standards and procedures that define their expectations and requirements for managing all their business activities. Their HSES Policy, endorsed by their CEO, supports and confirms their commitment to continually improve performance. Harbour Energy strive to achieve process safety excellence and work continually to reduce the likelihood and potential severity of process safety events and improve occupational health and safety practices.

3.5.5 Harbour Energy has extensive experience of managing major hazard potential facilities in accordance with the Control of Major Accidents and Hazard Regulations, both onshore and offshore, developed throughout the operating history of the heritage companies in the UK. Harbour Energy apply best practices in the design, use and maintenance of their equipment, planning every stage of their operations with the highest levels of control in order to minimise safety risks.

3.5.6 Harbour Energy are committed to implementing robust controls to systematically identify, evaluate and manage risks during all phases of the project lifecycle from design through to construction, operation and ultimately decommissioning, in line with their commitments of achieving no harm to people and protecting the environment. Furthermore, Harbour Energy promote robust regulator and public engagement to ensure correct design and planning are demonstrated to all stakeholders throughout the project lifecycle.

3.5.7 The Applicant will ensure that the pipeline is designed, constructed and operated in accordance with the Pipeline Safety Regulations 1996 and with best design practice standards.

3.5.8 During operation regular inspections will ensure the system is free from defects or damage and in a safe condition to operate.

3.5.9 The Applicant will ensure that the pipeline is adequately signposted and incorporate mitigation measures to prevent accidental damage by third parties. The burial depth of the pipeline will be sufficient to protect the integrity of the pipeline and avoid any impact on it from regular activities such as farming or road use.

3.6 Immingham Facility

3.6.1 The first component of the Project will consist of the Immingham Facility to be located in a currently unused section of land to the south of the VPI Immingham site. This facility would require a relatively small area, consisting of approximately 10,900m^2. The existing land is shown in **Figure 3-3** and comprises a grassed field to the west of Rosper Road, which was formerly used for construction laydown for the Immingham power station.

3.6.2 Provision has been made for approximately five connections from emitters to the Immingham Facility. The facilities to capture, meter and compress any captured CO_2 for transport would be performed by the emitters themselves, such as at the Humber refinery run by Phillips 66 or the Immingham combined heat and power plant operated by VPI (Vitol). Proposals by Phillips 66 and VPI (Humber Zero) are part of separate applications which are currently been prepared by these developers, under the Town and Country Planning Act 1990. These works therefore do not form part of the Project. Each emitter would also undertake flow metering and compositional analysis to an agreed standard which would be auditable by Harbour Energy.

3.6.3 The Immingham Facility would consist of the following key components:

- Inlet manifold with valve access platform;
- Permanent pig receiver to allow the pipeline to be cleaned and inspected during commissioning and operation and be suitable for intelligent pigging;
- High-integrity pressure protection system (HIPPS);
- Permanent pig launcher to allow the onshore CO_2 pipeline to be cleaned and inspected during commissioning and operation and be suitable for intelligent pigging;
- Common pig handling area for the pig receiver and launcher;
- Emergency Shutdown Valve (ESDV) for each pipeline;
- Venting system;
- Various instruments installed on the pipework, including temperature and pressure measurement and ultrasonic flowmeter;
- Local equipment room (LER); and
- Analyser house.

3.6.4 The Immingham Facility would be secured by a single palisade security fence 3.2m high.

3.6.5 An indicative layout of the Immingham Facility is located in **Figure 3-4**.

Figure 3-3: Location of the Immingham Facility

Inlet Manifold

3.6.6 The inlet manifold is where the incoming pipelines from each emitter are combined into common piping prior to entry to the onshore pipeline. A valve access platform (ca. 14 x 2m) is provided to permit maintenance on the valve actuators installed on each incoming pipeline.

Pig Traps

3.6.7 Pipeline Inline Inspection (ILI) tools, referred to as 'Pigs', are used for activities such as checking for defects, and inspection of the inside of the pipeline. Pig traps are used for inserting pigs into a pipeline then launching, receiving at the other end, and finally removing them without flow interruption. Immingham Facility would have two pig traps; one associated with the pipeline from EPUKI/shipping, and one associated with the pipeline to Theddlethorpe Facility. There is a common pig handling area with a projectile blast wall. The blast wall is provided in case a pig escaped from a pig receiver/launcher in an uncontrolled manner due to residual pressure present when the pig trap door was opened. The blast wall is designed as a 20m long and 5m high structure made of steel or concrete.

Emergency Shutdown Valves (ESDV)

3.6.8 A shutdown valve is a hydraulic actuated and spring return valve designed to stop flow in the pipeline upon the detection of a potentially dangerous event or non-standard operating condition. The shutdown valves will quickly enable pipeline sections to be isolated in the extremely unlikely case of loss of containment from the pipeline. This minimises risk of possible harm to people, equipment or the environment. The shutdown valves are designed to automatically operate in the event of a potentially dangerous event.

Isolation Valves

3.6.9 Isolation valves are required to allow discrete pieces of equipment to be maintained and for the safe loading and pressurisation of the pig launcher.

High-integrity Pressure Protection System

3.6.10 A high-integrity pressure protection system (HIPPS), consisting of a series of ESDVs and manual isolation valves. The ESDVs valves would automatically close in response to a high pressure being detected. The manual valves are provided for maintenance of the automatic valves. To allow for full testing in service, a duty/standby flow path arrangement is provided.

Venting System

3.6.11 A new stand-alone vent stack will be required to be used to de-pressure facilities for maintenance or for de-pressurisation. The height of the required vent stack is elevated at 25m above ground level. For more information on the venting systems, refer to section 3.9.

Local Equipment Room

3.6.12 The local equipment room (LER) is likely to be a 12 m by 5 m containerised steel structure. The LER would consist of a battery room and an instrument equipment room. The battery room would house a number of electrical batteries to supply back-up power if required. The instrument equipment room would house a series of cabinets which marshal all incoming local Input/Output (I/O) cables into a single point to allow data cables to be routed back to the Central Control Room. There is also a desk with workstation available in the instrument room.

Analyser House

3.6.13 The analyser house is likely to be a 6 m by 2.5 m containerised steel structure where analyser equipment is located. There will be one or more analysers installed for confirming the purity of the CO_2 going into the pipeline and any impurities present. There will also be gas bottles used for calibration and maintenance of the analysers.

Central Control Room

3.6.14 The system will be operated from a permanently attended Central Control Room (CCR). This will be co-located within the existing control room of VPI Immingham and so is not part of the DCO application.

3.6.15 The measurement data captured by the emitters would be transferred real time to the Inlet Facility CCR so that the pipeline operator can monitor CO_2 flow and quality and flow rate is monitored for control and leak detection purposes. The Immingham Facility would receive the captured and conditioned CO_2 from the emitters in the area and combine them prior to transportation via the onshore pipeline.

Utilities

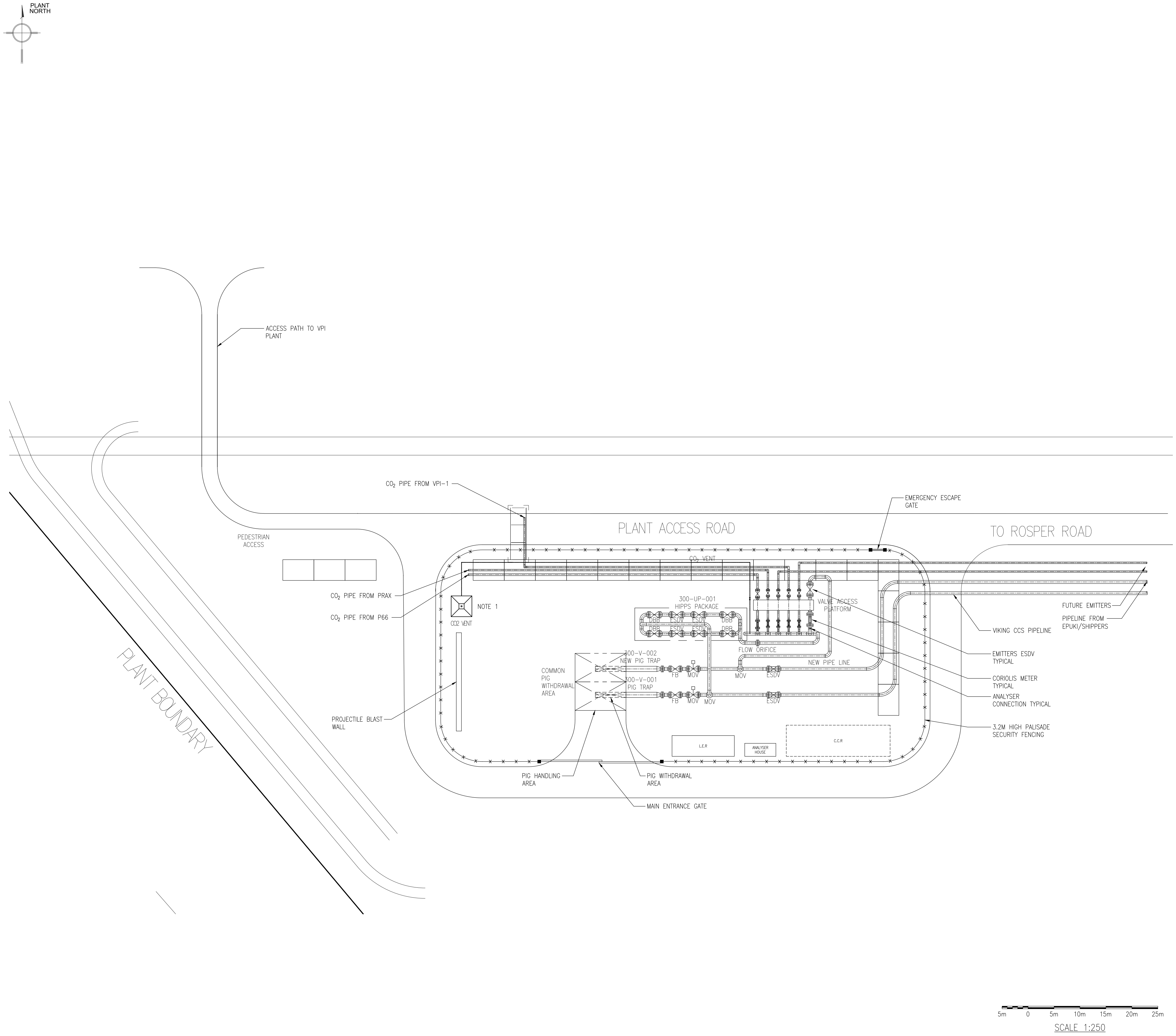
3.6.16 The utilities required for the Immingham Facility would likely comprise:

- Electrical power for the motorised valves, for the local equipment room and field instruments and for electric lighting;
- Instrument air for the feed and pipeline ESDVs;
- Water for emergency shower;
- Nitrogen, to purge the analysers and sample points, as well as purging the pig launcher prior to opening; and
- Local venting / draining for the pig launcher and analysers.

3.6.17 The power requirement is estimated to be 67 kW and would be supplied by Immingham combined heat and power plant operated by VPI (Vittol).

Lighting

3.6.18 The Immingham Facility would be lit outside of daylight hours, similar to the existing VPI Immingham and P66 site in the immediate vicinity.



NOTES:

1. VENT STACK OPEN END TERMINATION ELEVATION = +25.0M ABOVE GRADE-NB. THE VENT WILL ONLY BE RAISED WHEN REQUIRED.

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A2	19/05/2022	ISSUED FOR LAYOUT REVIEW	JB	SG	PH	PH
A1	11/04/2022	ISSUED FOR CLIENT COMMENTS	JB	SG	PH	PH
A0	07/04/2022	ISSUED FOR IDC	JB	SG	PH	PH

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PROJECT

VIKING CCS PIPELINE FEL-2

TITLE

THE IMMINGHAM FACILITY
PLOT PLAN
OPTION A

CLIENT DRAWING NUMBER.
KNT-UKOS-H-HZI-X-EN-30-00001-00

KENT DRAWING NUMBER.
5211584-PI-PLP-001-01

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3.7 Onshore Pipeline

Route Refinement

3.7.1 Detailed engineering design and environmental work has continued since the EIA Scoping stage to define the proposed pipeline route alignment within the currently identified Draft Order Limits. This has been informed by the Non-Statutory Consultation undertaken between April and June, and September and October 2022, as described in *Chapter 4: Consultation* as well as further engineering and safety driven considerations. Further details on how the route evolved is included in *Chapter 2: Design Evolution and Consideration of Alternatives*.

Draft Order Limits

3.7.2 The onshore pipeline will be designed in line with best design practice standards and PD8010 Code of Practice for Pipelines – Part 1 Steel Pipelines on Land (Ref 3-18) and constructed, operated and maintained in accordance with Pipeline Safety Regulations 1996 (Ref 3-6). The key design standards, codes and regulations relevant to the design of the Project are listed in section 3.7.13.

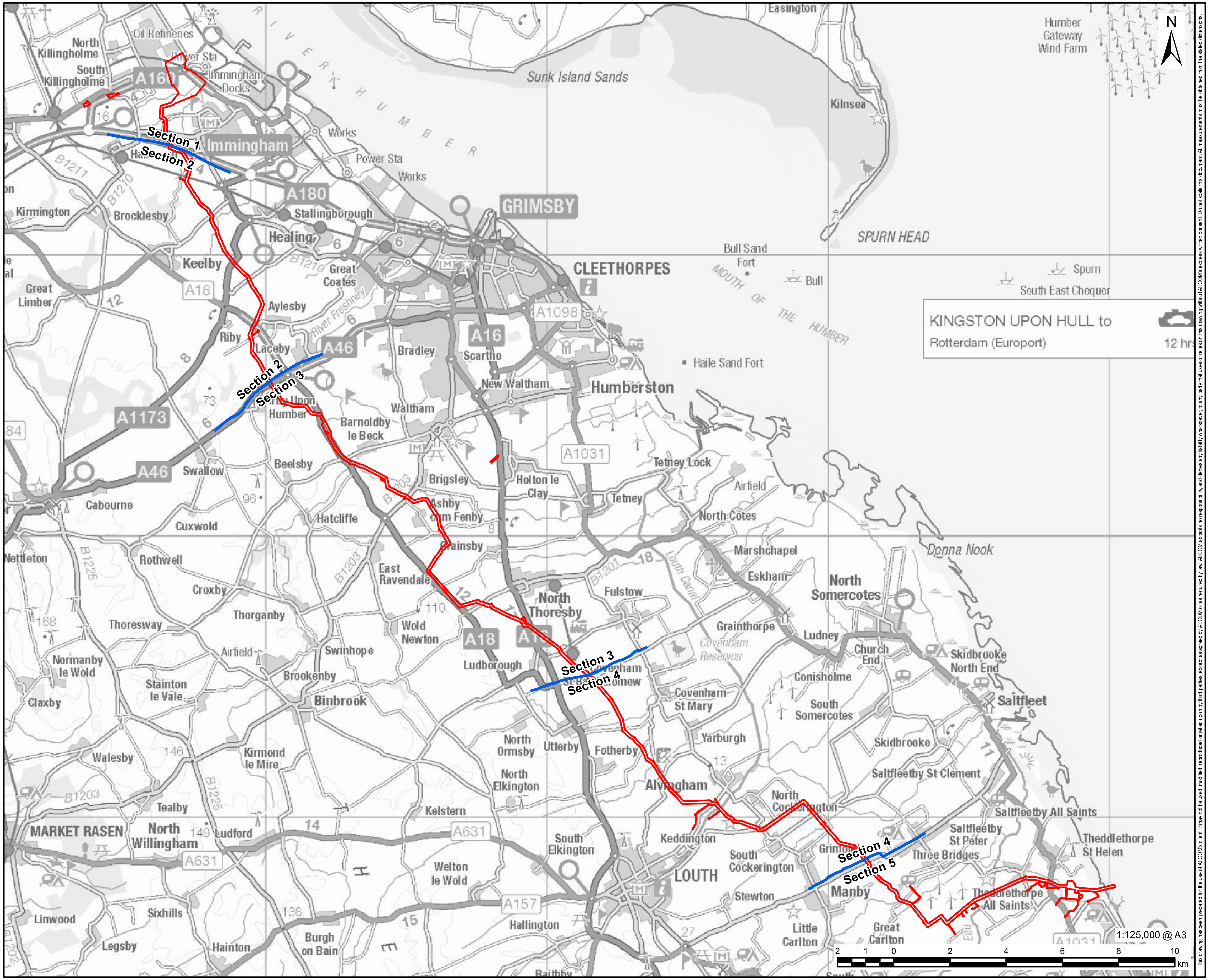
3.7.3 The Draft Order Limits for the DCO have been developed around an indicative pipeline route. The length of the indicative route within the Draft Order Limits is approximately 55.6 km and is shown in **Figure 3-5**.

3.7.4 To aid in the understanding of the potential environmental impact, the Draft Order Limits have been separated in to five sections (Sections 1-5). A summary of the key features of each section are described in **Table 3-1**.

Table 3-1: Key Features of Draft Order Limit Sections

Section	Description
Section 1 – Rosper Road to A180	The pipeline leaves the tie-in at the Immingham Facility, crosses the railway line, and runs parallel to Manby Road before heading in a south-westerly direction north of Immingham and the former Immingham Golf Club (closed in 2018). The pipeline then travels in a south easterly direction, passing east of Immingham, crossing the B1210, then the A180.
Section 2 – A180 to A46	After the A180 crossing, the pipeline travels east, southeast, then south, crossing Roxton Road and the Network Rail line between Cleethorpes and Harbrough. The corridor continues in a south-easterly direction, passing to the west of Little London and Stallingborough and east of Keelby, crossing Keelby Road and North Beck Drain (ordinary watercourse) then crossing the A1173. From here, the pipeline continues in a south easterly direction, then turns south/southwest to cross the A18 to the west of Aylesby and Laceby. From here, it continues south to the A46.
Section 3 – A46 to Pear Tree Lane	The pipeline crosses the A46, at which point it enters into the Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB) to the east of Irby upon Humber. After travelling through the AONB for approximately 2.34 km it exits by crossing the A18 for a second time. From here, it continues in a south-easterly direction paralleling the AONB boundary

Section	Description
	to the west of Barnoldby le Beck, crossing Waltham Road. The pipeline then turns in an easterly direction and crosses Waithe Beck (a main river), continuing southeast where it crosses the B1203. From here, it travels around Ashby cum Fenby turning southwest towards the AONB boundary at Grainsby Grange. It then turns southeast, paralleling the AONB boundary for approximately 1.7 km, crossing Grainsby Lane then travelling in a south-easterly direction, crossing the A16, Station Road and Pear Tree Lane.
Section 4 – Pear Tree Lane to Manby Middlegate (B1200)	The pipeline continues south between Utterby to the west and Covenham St Mary to the east. From here, it continues southeast crossing the Louth Canal and River Ludd to the south of Alvingham (both of which are main rivers). The pipeline continues in an easterly direction to the north of South Cockerington and Grimoldby, crossing the Grayfleet Drain (main river) towards the B1200.
Section 5 – Manby Middlegate (B1200) to Theddlethorpe and down to MLWS	The pipeline crosses Manby Middlegate (B1200) to the east of Manby then travels in a south-easterly direction crossing the River Long Eau (a main river), Two Mile Bank Drain (ordinary watercourse) and the River Great Eau (a main river) to the south of Theddlethorpe All Saints. From here, the pipeline continues in an easterly direction, crossing Mill Road and the A1031 before connecting to the existing LOGGS pipeline at TGT. On exiting TGT the existing LOGGS pipeline travels east up to MLWS. An existing isolation valve is located on the existing LOGGS pipeline, west of the sand dunes.



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Viking CCS

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PROJECT

Viking CCS Pipeline

LEGEND

Draft Order Limits

Route Section Break

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FIGURE TITLE

Figure 3-5
Draft Order Limits

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60668955 / VCCS_221028_PEIR_3-5

Pipeline Characteristics

3.7.5 The pipeline will be designed for a minimum operational life of 25 years, and it may be possible for measures to be taken to extend its operational lifecycle. It should be noted that the operational life was stated as 40 years in the Scoping Report submitted to the Planning Inspectorate in March 2022 as this was based on an initial estimate of the anticipated length of time the equipment would be functional for. This has since been revised to a minimum operational life of 25 years to align with the manufacturers recommended lifespan for equipment. Regular maintenance and options for refurbishment are likely to greatly extend the potential operational lifespan of the Project to well in excess of 25 years, if it were required.

3.7.6 The pipeline is expected to have an internal diameter of up to 24” and be buried to a minimum depth of 1.2 m to the top of the pipe. This will be greater at crossing points of railways, roads and watercourses.

3.7.7 The pipeline will be constructed in its entirety using thick wall steel pipe.

3.7.8 The external coating for the pipeline to protect welded pipe joints would comprise either:

- A Three-Layer Polyethylene (3LPE);
- Multi-Component Liquid (MCL) which is a type of paint that is typically used where pipe is laid in difficult ground conditions and particularly for Horizontal Directional Drill crossings; or
- 3-Layer Polypropylene (3LPP).

3.7.9 The pipeline system would operate in the following modes:

- *Gas Phase (up to 40 barg)*: Gas phase operation is envisaged to be short-term, potentially following systems commissioning for a period of a few months and is limited to a maximum of 40 barg to avoid two-phase flow in the pipeline; and
- *Dense Phase (100 – 150 barg)*: For most of the operational life, the pipeline will operate in dense phase and pipeline pressure is a function of CO_2 flowrate. The pipeline pressure is kept above 100 barg to avoid two-phase flow in the pipeline. The higher the flowrate, the higher the pressure at the Immingham Facility, up to a maximum of 150 barg.

3.7.10 There are several potential ramp-up profiles for the pipeline system which are dependent upon emitters timescales and rates. The CO_2 ramp-up profiles have estimated a low, medium and high scenario as 6, 10 and 18 million tonnes per year respectively.

Pipeline Crossings

3.7.11 Anticipated crossing numbers and types are provided in **Table 3-2**. Details of the construction techniques expected to be used, whether open cut or trenchless, are also provided. A description of the different types of trenchless crossings and open cut crossings are provided in section 3.12.37 onwards.

Table 3-2: Preliminary Crossing Types and Numbers

Crossing type	Trenchless crossings	Open Cut crossings	Total
Buried powerlines	3	9	12
Overhead powerlines	NA		23

Crossing type	Trenchless crossings	Open Cut crossings	Total
Buried pipelines including: • Water pipelines; • Wastewater pipelines; • Gas pipelines; and • Condensate pipelines	7	17	24
Telecoms cables	0	4	4
Hornsea No1 cable and Hornsea No2 cable	0	2	2
Roads	42	4	46
Drains	38	76	114
Railways	2	0	2
Tracks	1	9	10
Rivers	7	1	8
Canal	1	0	1
Total number of crossings			**245**

3.7.12 **Figure 3-6** identifies the key crossings along the Draft Order Limits. Figure 3-6a in *PEIR Volume III* provides more detailed plans.

Revision: 1 Drawn: LC Checked: HT Approved: MW Date: 2022-10-31

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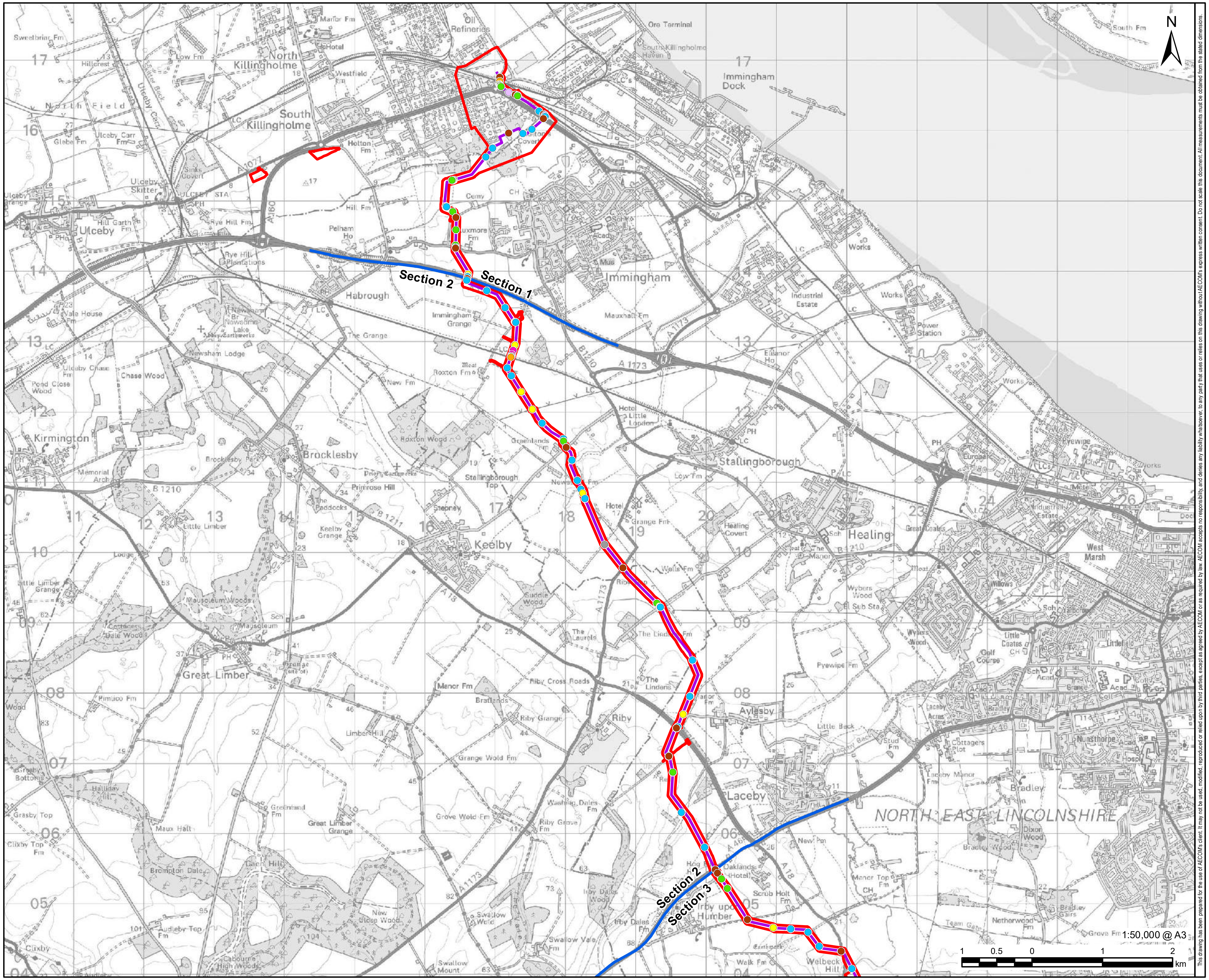

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Preferred Pipeline Route

Crossing Location - Type

- Drain
- Buried Powerline
- Hornsea Cable 1/2
- Pipeline
- Road
- Railway
- Track
- Telecoms Cable

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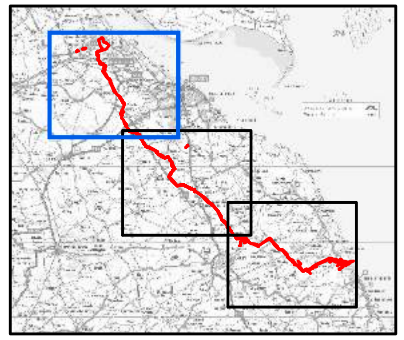

FIGURE TITLE

Figure 3-6 (1 of 3)
Key Crossing Locations

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221031_PEIR_3-6

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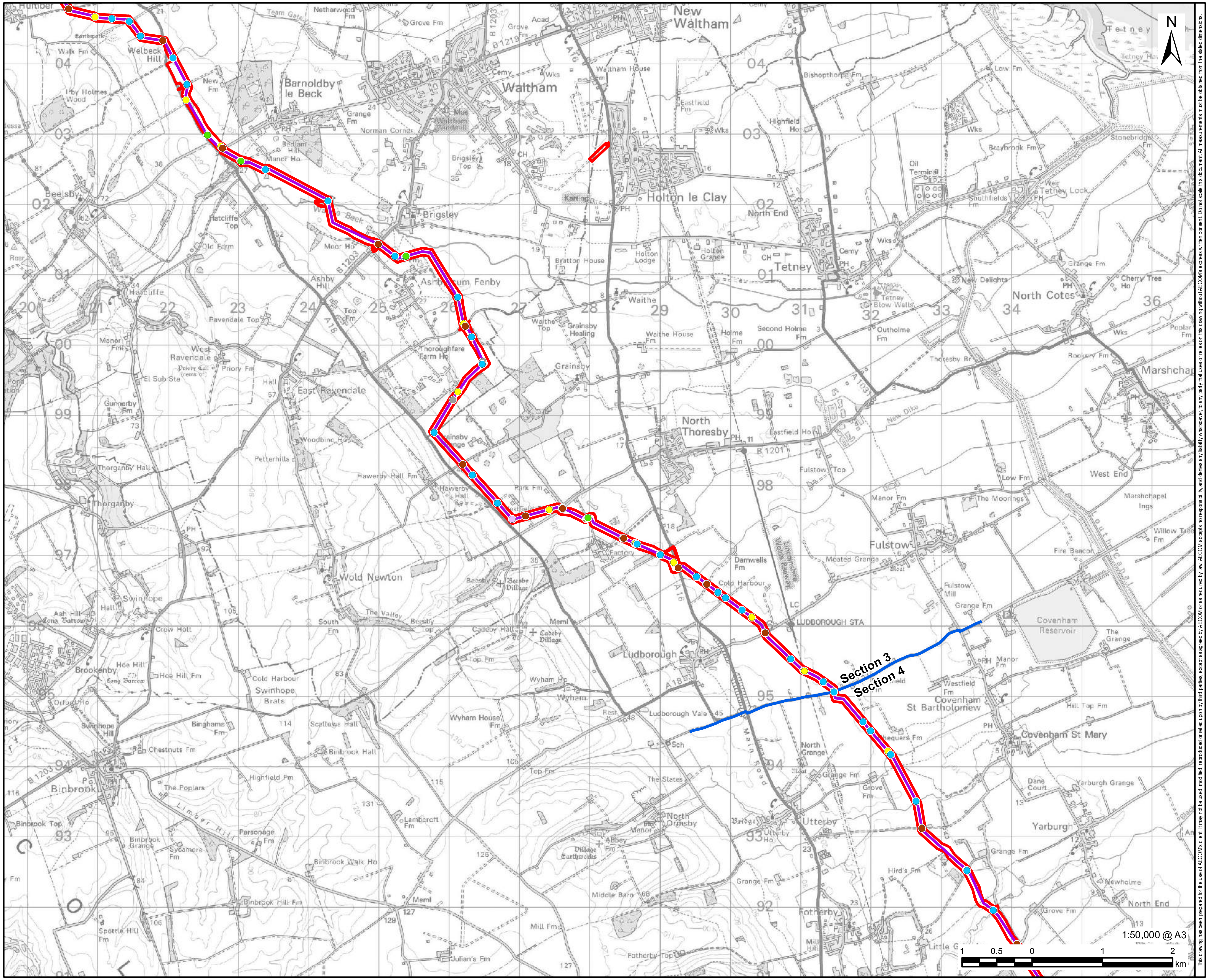

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Preferred Pipeline Route

Crossing Location - Type

- Drain
- Buried Powerline
- Pipeline
- Road
- Track
- Telecoms Cable

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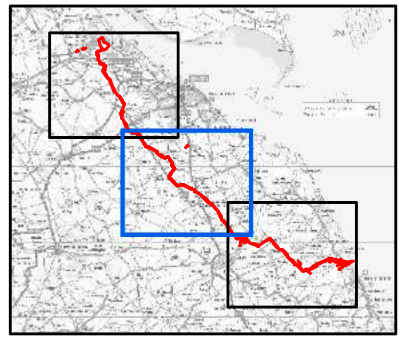

FIGURE TITLE

Figure 3-6 (2 of 3)
Key Crossing Locations

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221031_PEIR_3-6

Revision: 1 Drawn: LC Checked: HT Approved: MW Date: 2022-10-31

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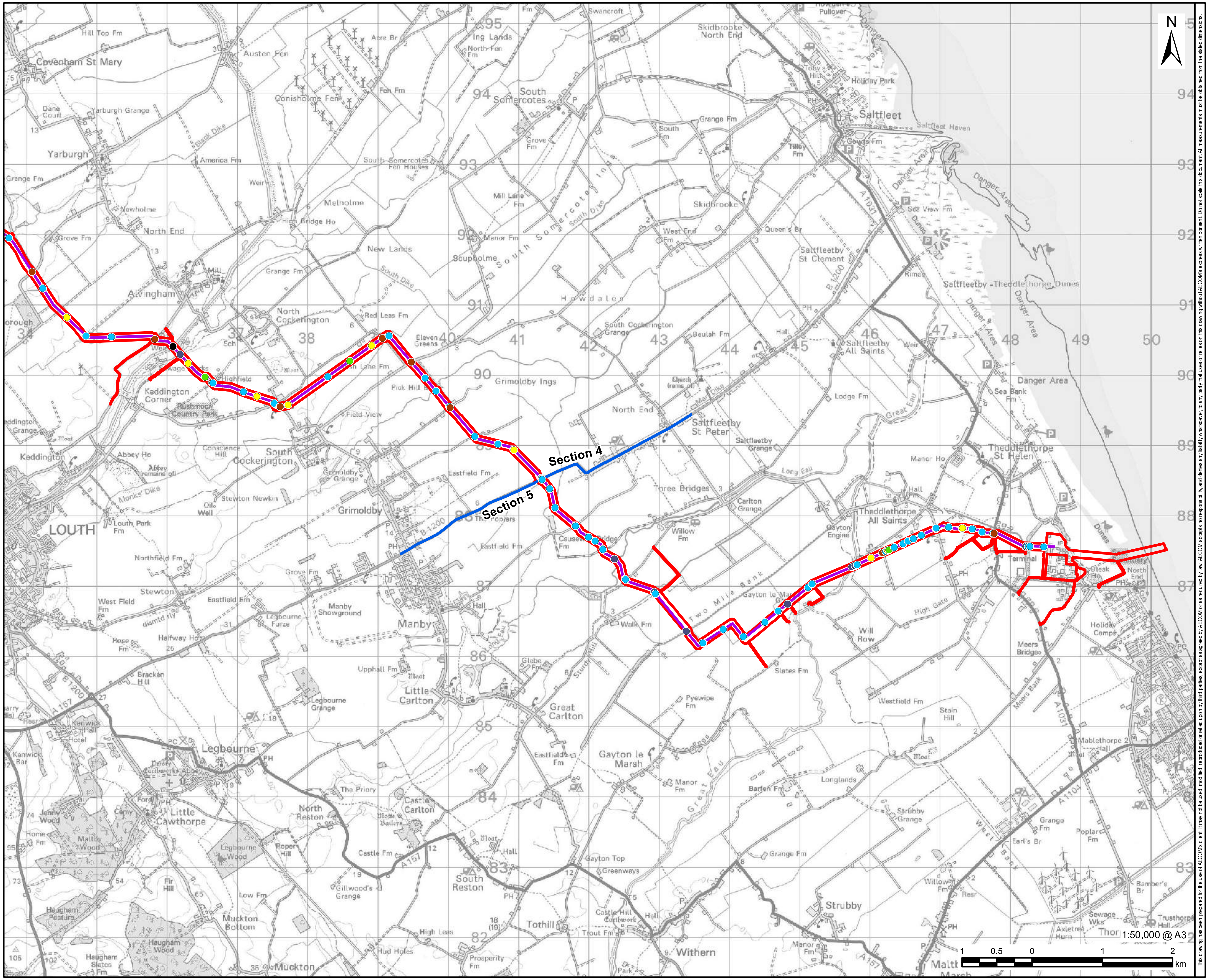

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Preferred Pipeline Route

Crossing Location - Type

- Canal
- Drain
- Buried Powerline
- Pipeline
- Road
- River
- Track

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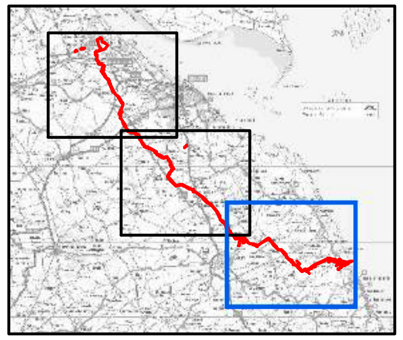


FIGURE TITLE

Figure 3-6 (3 of 3)
Key Crossing Locations

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221031_PEIR_3-6

Pipeline Design Standards, Codes and Regulations

3.7.13 Key design standards, codes and regulations relevant to the design of the Project include:

- Pipeline Safety Regulations 1996 (Ref 3-7);
- Construction (Design and Management) Regulations 2015 (Ref 3-8);
- Health and Safety at Work Act 1974 (Ref 3-9);
- Management of Health and Safety at Work Regulations 1999 (Ref 3-10);
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulation 2013 (Ref 3-11);
- PD8010-1: Pipeline Systems. Steel pipeline on Land, second Edition, March 2015 (Ref 3-12);
- ASME B31.3 Code for Pressure Piping (Ref 3-13);
- IGEM/TD/13 Pressure regulating installations for Natural Gas, Liquefied Petroleum Gas and Liquefied Petroleum Gas/Air (Ref 3-14); and
- API Specification 5L Specification for Line Pipe (Ref 3-15).

Pipeline Cathodic Protection

3.7.14 In order to prevent external corrosion of the pipeline, a combination of external coatings and cathodic protection (CP) would be required. The CP system will be designed in accordance with ISO 15589-1 Petroleum, petrochemical and natural gas industries – Cathodic protection on pipeline systems, Part 1 On-land pipelines (Ref 3-16).

3.7.15 Groundbeds would be installed horizontally comprising a series of anodes laid end to end in a trench in locations of low resistivity soil, the availability of electrical power and ready access for maintenance and monitoring. The groundbeds would be installed approximately 100 m from the connection and be approximately 30m in length.

3.7.16 Most elements of the CP system would be buried below ground and installed as part of the pipeline construction. Above ground features would comprise:

- CP test posts would be installed at intervals along the length of the pipeline;
- Transformer Rectifiers will be installed at some Block Valve Stations; and
- Mains power cabinets close to each end of the pipeline and at the Block Valve Stations.

3.7.17 The permanent CP test posts are to be installed at regular intervals along the pipeline to allow monitoring of the pipeline during its operational life. CP test posts will be placed in positions accessible from the public highway.

3.7.18 A temporary CP system would be in place which is designed to protect the pipeline until the permanent system is commissioned. Pre-packaged magnesium anodes would be distributed along the pipeline route at test facilities. In locations with very low resistivity, more anodes may be required. The design life of the temporary system would typically be for a minimum of two years.

Telecommunication and VSAT

3.7.19 Fibre Optic Cable (FOC) communication system would be installed to provide telecommunications between the Immingham and Theddlethorpe facilities including the pipeline route. Supervisory control and data acquisition (SCADA), telephony, Closed Circuit Television (CCTV), Leak Detection System (LDS) and all other services over the communications system would use IP packets. Very-small-aperture-terminal (VSAT) communication system may be installed to serve as the secondary or backup communication link to transport all Telecom, SCADA and IP related signals between the Immingham Facility and Theddlethorpe Facility.

3.7.20 Up to two FOC cables would be either buried directly above or adjacent to the pipeline and would be utilised to monitor and alert of third-party interference and/or leak detection in the vicinity of the pipeline depending on the sensitivity parameters established.

Pipeline Leak Detection System

3.7.21 A pipeline Leak Detection System (LDS) would monitor the whole pipeline length and would alert the operator to potential leaks, together with their location, along the pipeline route. Presented with this information, the operator would have the ability, via the SCADA system, to exercise direct control of the pipeline isolation valves as necessary. The type of LDS system would be considered at the FEED stage and may result out of the findings of a detailed Quantitative Risk Assessment (QRA).

Permanent Pipeline Easement

3.7.22 At this stage, the permanent pipeline easement width has not been confirmed. An easement is required covering an area either side of the outside edge of pipeline to allow maintenance and inspection access during the lifespan of the pipeline.

3.8 Block Valve Stations

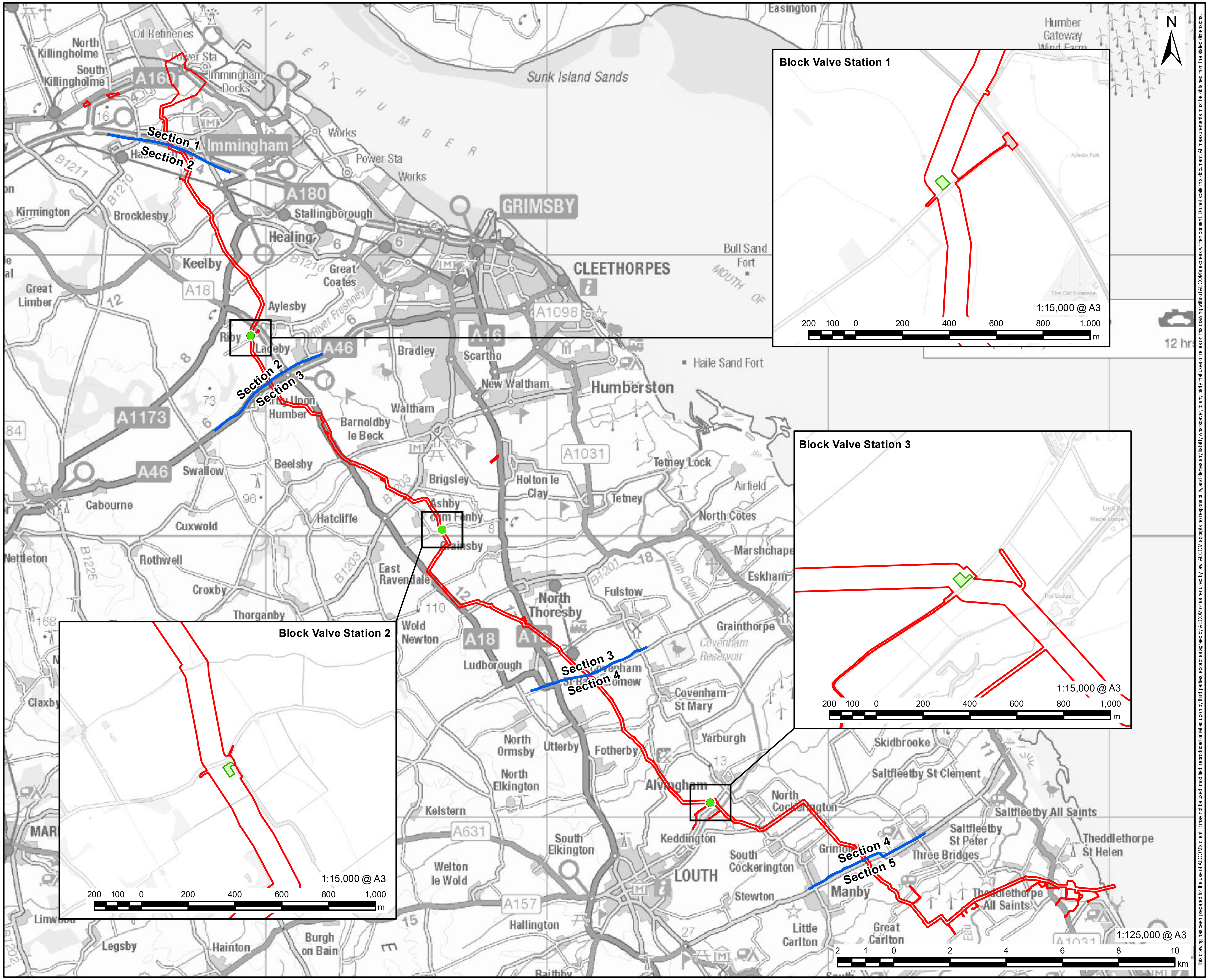
3.8.1 Three Block Valves Stations are required for the Project and as shown on **Figure 3-7**. Engineering design work has been undertaken to refine and optimise the specific location for the block valves along the preferred pipeline route based on the safety case as described in *Chapter 2: Design Evolution and Consideration of Alternatives*, ensuring all would be located within the preferred Pipeline Corridor. This work identified block valve locations at approximately 13 km, 24 km and 39 km along the pipeline route.

3.8.2 The block valves allow the pipeline to be remotely monitored from the main control centre, with local control monitoring/control capable when maintenance personnel are physically on site. The block valves also allow the pipeline to be isolated in sections in an emergency.

3.8.3 The block valve would be buried with a valve actuator extended above ground (circa 1.5 metres), currently the bypass valves and pipework are also assumed to be buried but are currently being investigated further by the engineering team. The valves may be operated remotely for which the necessary equipment on site will be housed in a kiosk, which would be typically between 2-3m in height, subject to final design. The Block Valve Stations would include a local vent to ensure that bypass pipework maintenance activities can be performed safely, it is not the intention for pipeline venting to be undertaken at these locations.

3.8.4 The Block Valve Stations would require security fencing, typically 2.4m high with double-leaf access gates for vehicles with access from the adjacent road network, access tracks or similar. Provision will be provided for maintenance operatives to safely park their vehicle(s) off the highway and open the gates.

3.8.5 The Block Valve Stations would include associated landscaping such as planting or bunds to provide screening, dependent upon final planning requirements. Block Valve Stations would be unlit except during maintenance or potential breakdown/emergency requirements, when permanent task lighting columns (approximately 4m high) would be employed.



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PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Block Valve Station Location
- Block Valve Station Location - Outer Fence Boundary

NOTES:

FIGURE TITLE

Figure 3-7
Location of Block Valve Stations

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221028_PEIR_3-7

3.8.6 The Block Valve Stations would be connected to the local electrical distribution, with alternative sources of power as backup, should the permanent supply fail.

3.8.7 A typical layout of a Block Valve Station is shown in the schematic provided within **Figure 3-14**.

3.8.8 Block Valve Station No1 is located off Washingdales Lane accessed from the A18, approximately 770m south west of Aylesby on arable land. The nearest residential receptor is approximately 820m to the south east on Barton Street in the village of Aylesby. The permanent land acquisition would be approximately 50m x 40m with a 15m x 15m entrance. A new entrance would be created from an existing lay-by along Washingdales Lane, a cul-de-sac off the A19 Barton.

Figure 3-8: Location of Block Valve Station No1 (view looking north off Washingdales Lane)

Figure 3-9: Entrance to Block Valve Station No1 (view looking north off Washingdales Lane)

3.8.9 Block Valve Station No2 is located on arable land and is approximately 800m southeast of the village of Ashby cum Fenby. The nearest residential receptor is approximately 470m northwest of the station on Main Road in Ashby cum Fenby. The permanent land acquisition would be approximately 50m by 40m with a 15m by 15m entrance. This station takes advantage of an existing gated farm-track immediately off a public road called Thoroughfare.

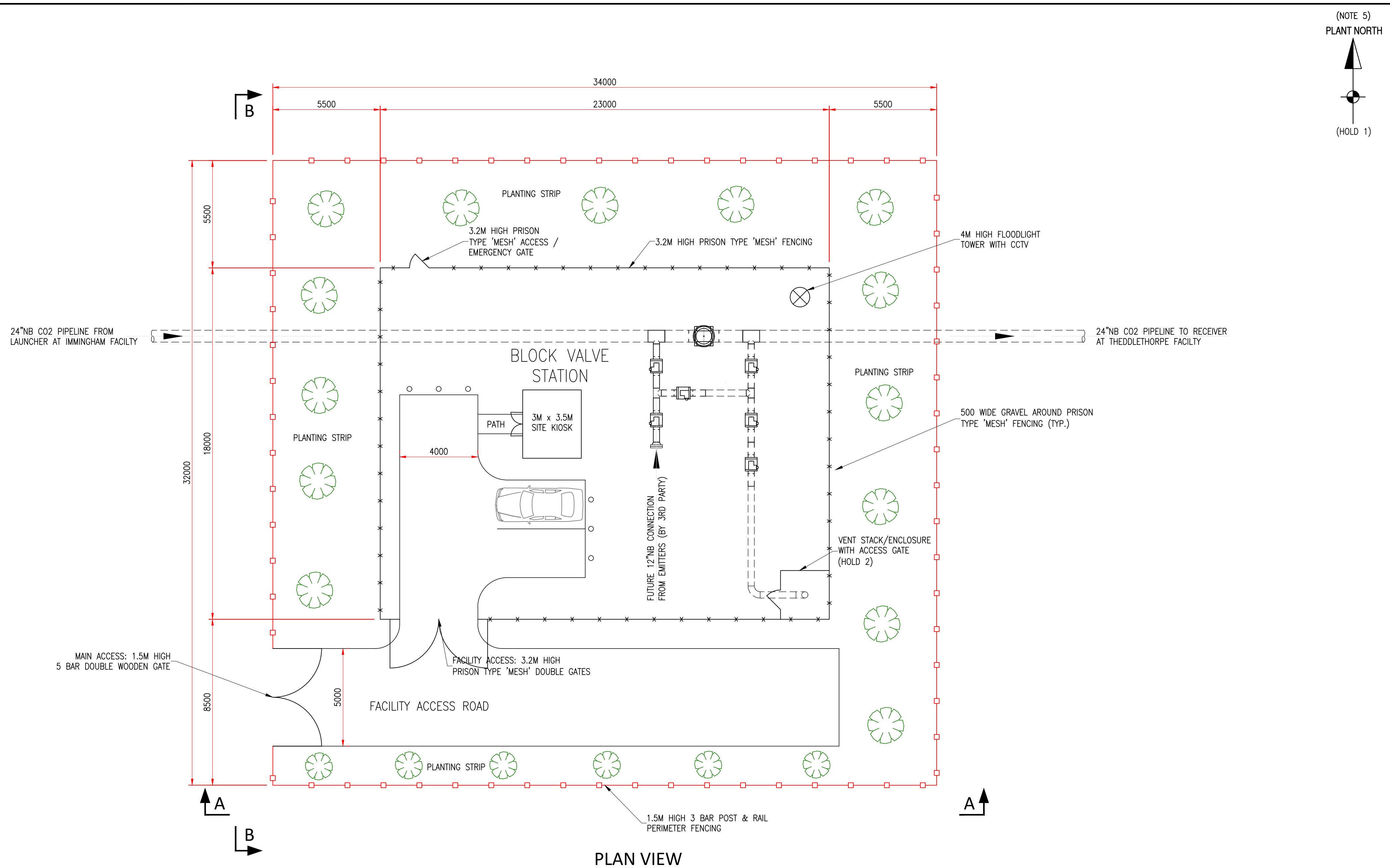
Figure 3-10: Location to Block Valve Station No2 (view looking west from farm track)

Figure 3-11: Entrance to Block Valve Station No2 (view looking south from public road called Thoroughfare)

3.8.10 Block Valve Station No3 is located on arable land to the south of Alvingham and is accessed off Alvingham Road. The nearest residential receptor is approximately 370m to the east of the station on Lock Road, Alvingham. The permanent land acquisition would be 50m x 40m with an entrance of 24m x 15m. This station takes advantage of an existing entrance into the field.

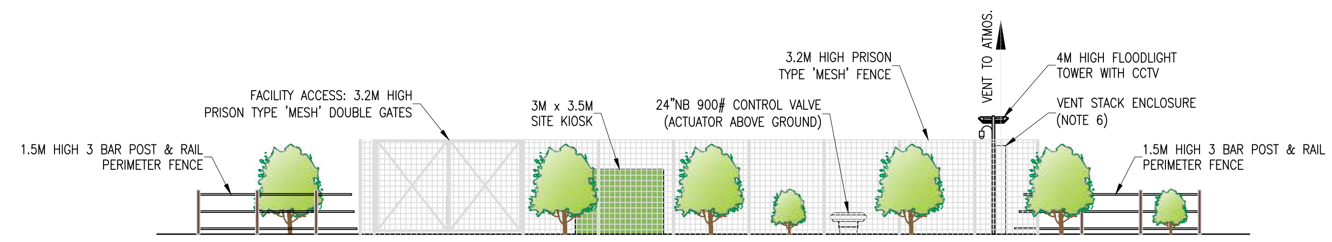
Figure 3-12: Location of Block Valve Station No3 (view looking north from Alvingham Road)

Figure 3-13: Entrance to Block Valve No3 (view looking north from Alvingham Road)

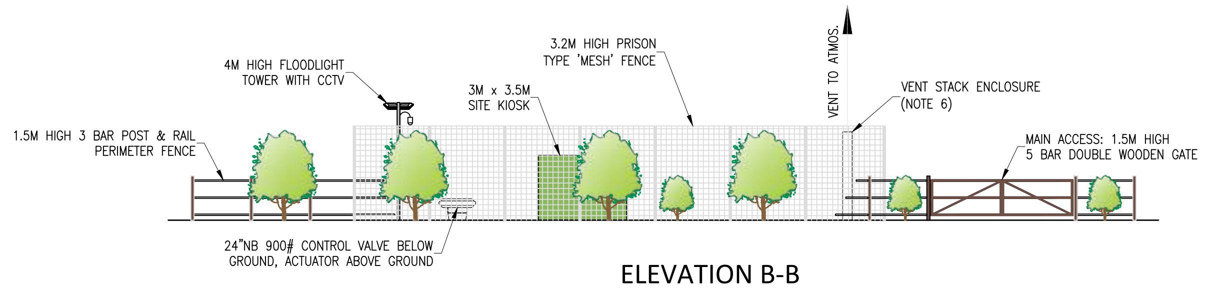


PLAN VIEW

ALL VALVES & PIPELINE INSTALLED BELOW GROUND



ELEVATION A-A



ELEVATION B-B

GENERAL NOTES

1. ALL PIPELINE LAYOUTS & DIMENSIONS ARE INDICATIVE/PRELIMINARY & WILL BE UPDATED DURING FEED DESIGN.
2. PLOT ARRANGEMENT IS INDICATIVE ONLY AND SUBJECT TO FINAL LANDOWNER / PLANNING AGREEMENTS.
3. EQUIPMENT LAYOUT IS PRELIMINARY AND WILL BE CONFIRMED DURING FEED DESIGN.
4. VENTING/PURGING REQUIREMENTS TO BE DETERMINED DURING FEED DESIGN & IN ACCORDANCE WITH CLIENT DIRECTIVE.
5. FACILITY TRUE NORTH ORIENTATION TO BE DETERMINED AT FEED DESIGN STAGE; BASED ON NUMBER & GEOGRAPHICAL LOCATION OF BLOCK VALVE SITES AND SHOULD BE IN AGREEMENT WITH LANDOWNER / PLANNING.
6. VENT STACK / ENCLOSURE POSITION IS INDICATIVE ONLY, WILL VARY DEPENDING ON REQUIREMENTS, FINAL FACILITY GEOGRAPHICAL LOCATION, PREVAILING WIND & AGREED BY CLIENT AT FEED DESIGN.

HOLDS

1. FACILITY TRUE NORTH UNKNOWN – NOTE 5
2. REQUIREMENT FOR, LOCATION OF VENT STACK & ENCLOSURE.

Rev	Rev. Date	Purpose of Revision	Drawn	Checkd	Appv'd
0	21/10/2022	ISSUED FOR INFORMATION	DD	GK	NC
A	28/07/2022	ISSUED FOR INFORMATION	DD	GK	NC

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Registered in England and Wales No. 00584446

PENSPEN

Client

Viking CCS Pipeline
Rubislaw House
Anderson Dr
Aberdeen
AB15 6FZ

VikingCCS

Project

VIKING CCS PIPELINE

Drawing title

PLANNING DRAWING
BLOCK VALVE STATION

Drawing status

ISSUED FOR INFORMATION

Scale	NTS	DO NOT SCALE	
Sheet Number	01 / 01	Original Sheet Size	A1
Penspen Drawing Number	20428-CI-XLY-000-0002	Rev	0
Viking CCS Pipeline Drawing Number	PEN-GEN-P-XX-X-EN-51-00003-00	Rev	D1

3.9 Venting Systems

3.9.1 It is anticipated that a 25m high vent will be required at both the Immingham Facility, and at the Theddlethorpe Facility. The vents are required for periodic maintenance of the pipeline system.

3.9.2 Venting would be required for maintenance; these works are anticipated to be required approximately bi-annually (every 2 years). In the highly unlikely event that larger volumes of CO_2 are required to be discharged a taller temporary vent may installed and used, then removed again.

3.10 Theddlethorpe Facility

3.10.1 There are currently two options for locating the Theddlethorpe Facility:

- **Option 1:** new facility at the former TGT site. Demolition of the former TGT was completed in 2021. The site is currently clear with a mixture of hard standing, stoned areas and pipeline stubs as shown in **Figure 3-15**; and
- **Option 2:** new facility to the west of the former TGT site, located on arable land directly west of The Cut (an ordinary watercourse). This facility would be accessed from the south off the A1031 Mablethorpe Road.

Figure 3-15: Former TGT Site and Option 1 for Theddlethorpe Facility

3.10.2 For Option 1, the onshore pipeline would enter the repurposed TGT site from the west and terminate at new facilities built next to the existing LOGGS Pipeline, which enters the site from the east. The CO_2 would enter the site via the 24'' onshore pipeline and would be routed into the 36'' LOGGS pipeline. An additional connection would be provided to allow for future carbon capture projects to connect to the Theddlethorpe Facility.

3.10.3 For Option 2 the existing LOGGS pipeline would be extended to the west using sections of 36” pipeline.

3.10.4 The Theddlethorpe Facility is required to enable the CO_2 to flow from the new 24” pipeline into the existing LOGGS (36”) pipeline.

3.10.5 The Theddlethorpe Facility would comprise the following key components:

- LOGGS pipeline tie-in;
- Emergency Shutdown Valves;
- Pig receiver and launcher;
- High-integrity Pressure Protection System;
- Venting system;
- Local equipment room (LER); and
- Central Control Room.

3.10.6 The Theddlethorpe Facility would be secured by a single palisade security fence 3.2m high.

3.10.7 An indicative layout of the Theddlethorpe Facility is located in **Figure 3-16**.

LOGGS pipeline tie-in

3.10.8 The principal function of the proposed facilities at the Theddlethorpe site is to connect the new 24” onshore pipeline to the existing and re-purposed 36” LOGGS offshore pipeline which will allow the CO_2 to flow seamlessly from onshore to offshore and onwards to the proposed storage reservoir. This will be achieved through a simple pipeline configuration that will directly connect the two pipelines and will include an appropriate section that will increase the diameter of the pipe from 24” to 36”. An additional connection is provided to allow for future carbon capture projects to connect to the T&S facilities at Theddlethorpe.

High-integrity Pressure Protection System

3.10.9 Currently, the offshore LOGGS pipeline design pressure is less than the onshore pipeline design pressure, therefore a High-integrity Pressure Protection System (HIPPS) is provided to protect the offshore pipeline from overpressure. The HIPPS at Theddlethorpe Facility will be similar to the Immingham HIPPS, i.e., a series of ESDVs and manual isolation valves. The ESDVs valves would automatically close in response to a high pressure being detected. The manual valves are provided for maintenance of the automatic valves. To allow for full testing in service, a duty/standby flow path arrangement is provided.

Emergency Shutdown Valves

3.10.10 Isolation of the Theddlethorpe Facility from the onshore pipeline is provided by an above-ground Emergency Shutdown Valve (ESDV). Isolation of Theddlethorpe from the offshore pipeline is provided by an ESDV which will replace the existing LOGGS ESDV.

Permanent pig receiver and launcher

3.10.11 There is a permanent pig receiver provided for the onshore 24” pipeline and a permanent pig launcher for the 36” offshore pipeline. The pigging facilities allow the onshore and offshore CO_2 pipelines to be cleaned and inspected during (pre-)commissioning and during the operational life. The pig receiver and launcher will be suitable for intelligent pigging. The pig receiver and pig launcher are oriented opposite of each other in line with their respective pipeline directions. They have a pig handling area with associated projectile blast wall. The blast wall is provided in case a pig escaped from a pig receiver/launcher in an uncontrolled manner due to residual pressure present when the pig trap door was opened. Each blast wall is designed as a 20m long and 5m high structure made of steel or concrete.

Venting System

3.10.12 A vent stack is provided to depressurise the Theddlethorpe facilities if required. The vent stack also allows depressuring of the onshore or offshore pipeline if required. For more information on venting systems please refer to section 3.9.

Local equipment room

3.10.13 The local equipment room (LER) is likely to be a 12 by 5m containerised steel structure similar to what is proposed at Immingham. The LER would consist of a battery room and an instrument equipment room. The battery room would house a number of electrical batteries to supply back-up power if required. The instrument equipment room would house a series of cabinets which marshal all incoming local Input/Output (I/O) cables into a single point to allow data cables to be routed back to the Central Control Room. There is also a desk with workstation available in the instrument room.

Central Control Room

3.10.14 The Theddlethorpe control and emergency safety systems will be operated remotely from the Central Control Room (CCR) managing the integrated T&S system and will run autonomously during normal operation.

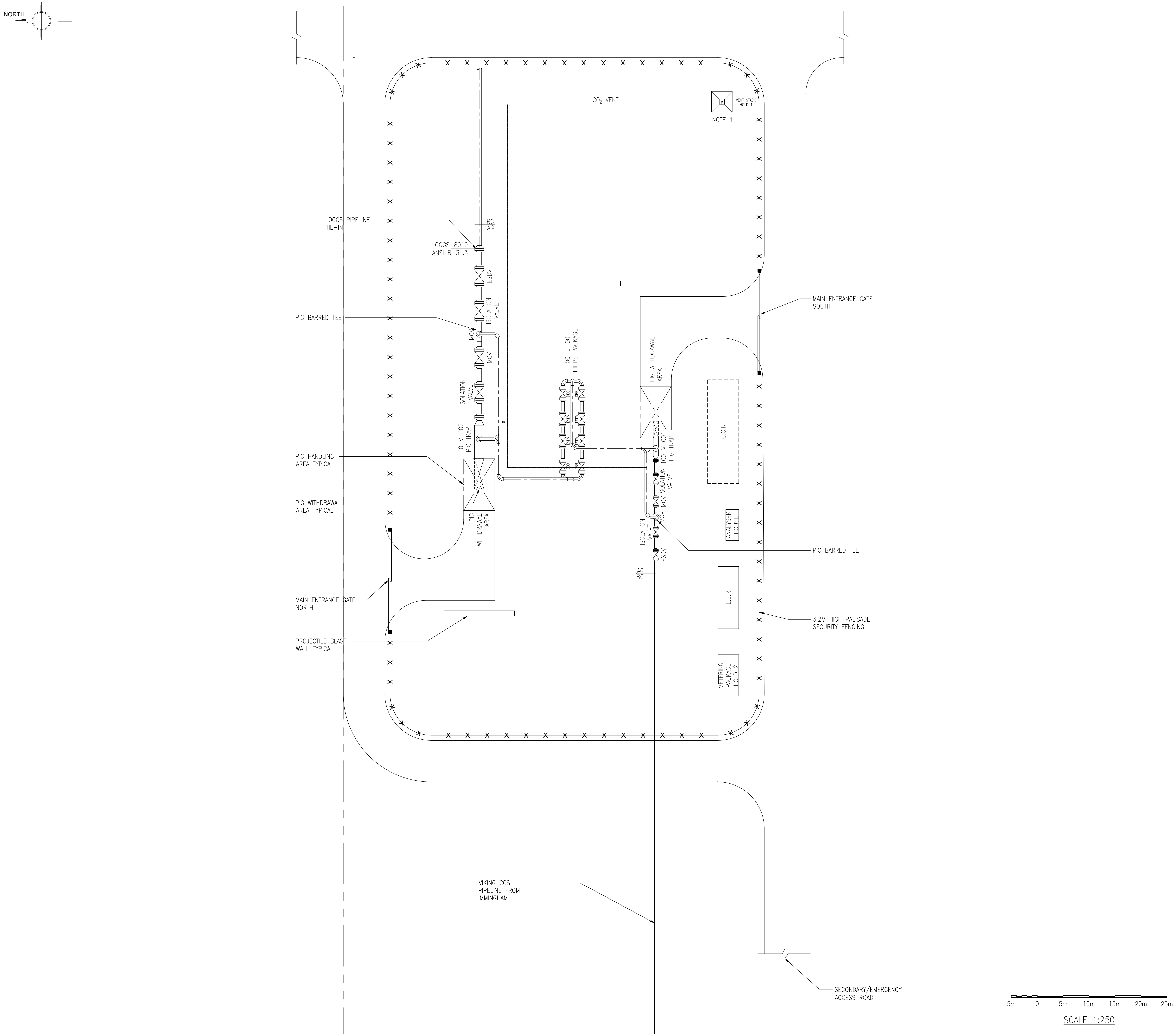
Lighting

3.10.15 As the Theddlethorpe Facility will be unmanned, lighting requirements are minimal. Maintenance visits would be undertaken during daylight hours. The lighting requirements at this site are to be confirmed, however, should there be an exceptional or emergency circumstance, the facility would have additional lighting available or temporary lighting would be brought on to the facility for any overnight maintenance works as required.

Utilities

3.10.16 The Theddlethorpe Facility would be powered by electricity provided via a local connection to the national grid network within the fenced boundary.

3.10.17 Nitrogen is used to purge the pig launcher/receiver prior to opening. The supply of nitrogen will be from bottles/quads supplied during the pigging campaign.



NOTES:

1. VENT STACK OPEN END TERMINATION ELEVATION = +25.0M ABOVE GRADE-NB. THE VENT WILL ONLY BE RAISED WHEN REQUIRED.

HOLDS:

1. VENT STACK DETAILS AND LOCATION.
2. METERING PACKAGE REQUIREMENTS.
3. DETAILS FOR EXISTING UNDERGROUND PIPING.

REV.	DATE	REVISION DESCRIPTION	ORIG'D	CHK'D	REV'D	APP'D
A2	HOLD	ISSUED FOR USE	JB	SG	PH	PH
A1	19/05/2022	ISSUED FOR LAYOUT REVIEW	JB	SG	PH	PH
A0	19/05/2022	ISSUED FOR IDC	JB	SG	PH	PH

kent | Harbour Energy

SCALE 1:250 | ORIGINAL DRAWING SIZE A0

PROJECT
VIKING CCS PIPELINE FEL-2

TITLE
THE THEDDLETHORPE FACILITY
PIPE ROUTING DRAWING
OPTION B

CLIENT DRAWING NUMBER.
KNT-UKOS-T-TGT-P-EN-19-00001-01

KENT DRAWING NUMBER.
5211584-PI-DWG-002-02

REV
A2

3.11 Existing LOGGS pipeline

3.11.1 The existing LOGGS 36” pipeline (offshore pipeline) enters the former TGT site from the east and terminates at an existing shutdown valve within the site. The LOGGS pipeline was first operated in 1988, transporting collected natural gas from a variety of gas fields (including the Viking field) in the North Sea to shore. The pipeline ceased operations in 2018, and in line with regulations, it was flushed clean of any hydrocarbons. Several assessments have been undertaken of the pipeline including a fracture assessment, integrity assessment and CO_2 corrosion assessment, which have resulted in high confidence that the pipeline will be suitable for the transportation of the CO_2 as part of the wider Viking CCS Project.

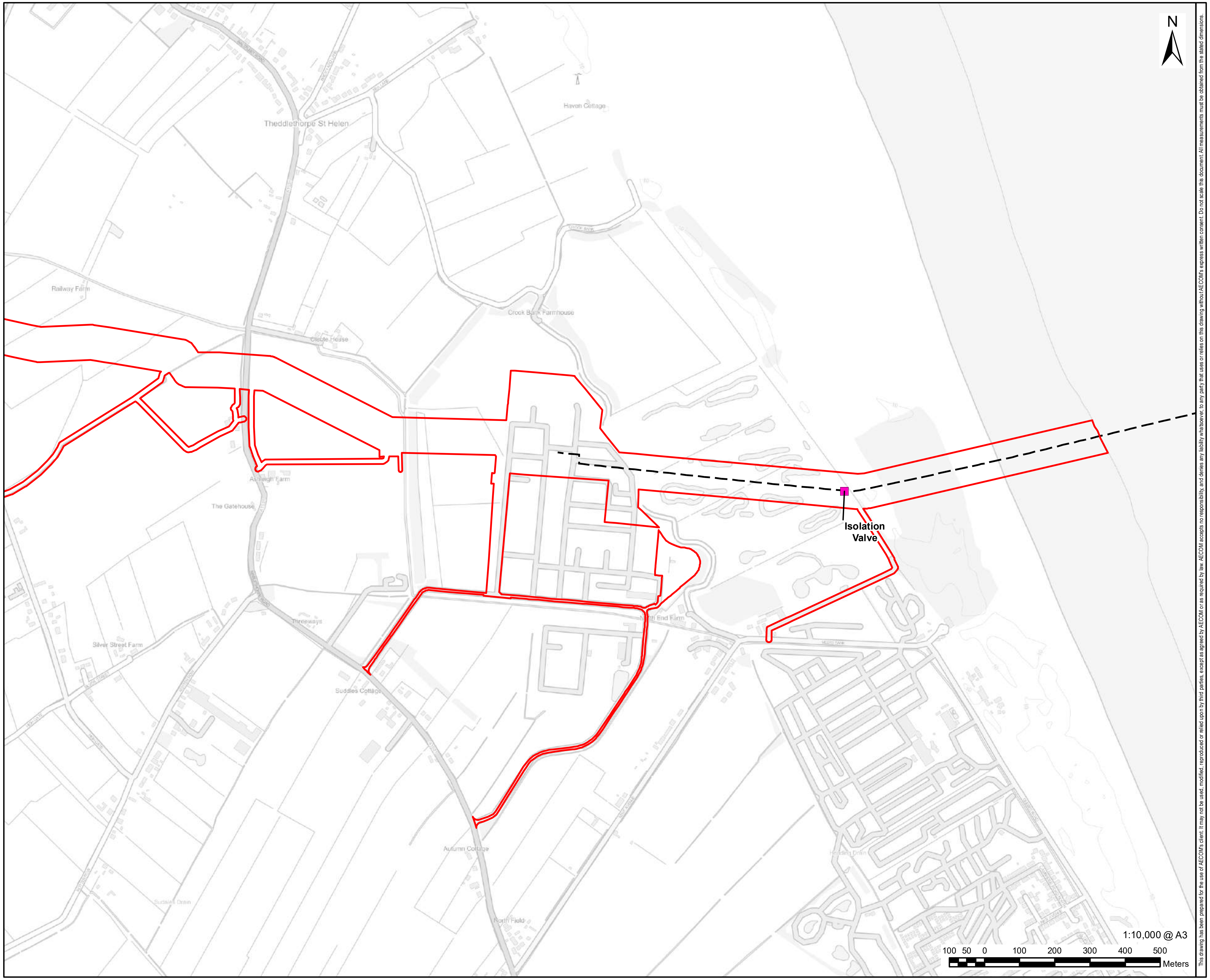
Isolation Valve

3.11.2 There is an existing isolation valve on the onshore section of the LOGGS pipeline, located close to the sand dunes to the east of the existing TGT site, which was used as an isolation valve for Theddlethorpe when importing gas from offshore. A new valve will be provided in the same location, in order to reduce the risk of LOGGS pipeline inventory impacting the Theddlethorpe Facility and neighbouring populations, in the event of a leak upstream of this isolation valve.

3.11.3 Additionally, further inspection of the existing LOGGS Pipeline will be undertaken, which will be completed using an intelligent pigging tool to assess the internal surfaces of the pipeline.

Revision: 2 Drawn: LC Checked: HT Approved: MW Date: 2022-11-11

Filename: \\eu.aecomnet.com\EMIA\UKIUKNCL2\Jobs\60668955 V_Net_Zero_Project\900_CAD_GIS\920_GIS\02_Maps\PEIR\VCCS_PEIR_3-17_Existing_LOGGS_Pipeline_and_Isolation_Valve_v2_20221111_LC.mxd



VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Isolation Valve
- Existing Loggs Pipeline

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FIGURE TITLE

Figure 3-17
Existing LOGGS Pipeline and Isolation Valve

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221111_PEIR_3-17

3.12 Construction Phase of the Project

Summary of Construction Philosophy

3.12.1 The pipeline would comprise an all-welded construction, generally laid at a minimum depth of cover of 1.2 m. At road, rail and watercourse crossings, the depth would be greater and may be constructed as open cut or trenchless. Pipeline construction will commence from the northern end at the Immingham Facility and move in a southernly direction.

Construction Schedule and Working Hours

3.12.2 A detailed construction schedule has yet to be developed however, subject to the grant of a DCO, it is anticipated that site preparation would commence in late 2025 with main construction taking place in 2026 and the project becoming operational in early 2027. From the commencement of the construction activities to completion of commissioning, the construction programme is expected to last 12 months.

3.12.3 The construction process would be programmed as a series of concurrent work packages along the length of the pipeline, where possible, to ensure that the construction programme is minimised. A work package may focus on a specific area or location where a group of construction workers would carry out a particular aspect of the main pipeline construction activities, including topsoil stripping, trench excavation, pipe installation and backfilling of trenches.

3.12.4 A working day of 12 hours (07:00 to 19:00) Monday to Friday, five days a week, and six and a half hours (07:00 to 13:30) on Saturday is expected, with exceptions to this only in the case of hydrotesting and commissioning and in special circumstances. These special circumstances could include continual 24 hour working, where HDD is required. There would be no Sunday working unless this was agreed in advance with the relevant Local Authority.

3.12.5 The establishment of pipeline route working area would commence from the beginning of April and remain in place until after the hydrostatic test of each section, which would occur between August/September. Backfill would begin once the lower and lay of the pipeline has been completed, however top soil reinstatement would only commence after the section’s hydrotesting is completed.

3.12.6 The reinstatement of the pipe storage areas within the construction compounds would commence once all the pipe has been transported onto the pipeline working width, except where pipe is kept at a management compound where not all of the site would be reinstated at that time.

3.12.7 Temporary side accesses would remain in place until reinstatement works are completed, however those can be expedited to complete works ahead of the main construction and/or removed once heavy equipment is withdrawn in location.

Pre-construction Activities

3.12.8 Ahead of construction, any required pre-commencement surveys would be undertaken which may comprise of:

- Ecological pre-construction surveys and subsequent mitigation work;
- Intrusive archaeological investigation work;
- Contaminated land surveys;
- Geotechnical surveys;
- Detailed utility and drainage surveys;

- inline inspection of the LOGGS pipeline by intelligent pigging; and
- inspection and function test of the installed ESD valve and the isolation valve located outside the former TGT site boundary with potential remedial work.

3.12.9 Existing utilities within the Draft Order Limits have been identified and reviewed to determine if they require diversion, or whether the route of the pipeline needs to be modified to accommodate existing utilities. Those present which require crossing are included in the crossing schedule shown in **Table 3-2**. The full crossing schedule is provided in *PEIR Volume IV Appendix 3.1* which also details the proposed crossing methods.

3.12.10 The pipeline route would be surveyed and pegged out in consultation with the landowners / occupiers. This will establish the precise alignment of the pipeline, particularly in relation to any environmentally sensitive sites and field boundaries. This temporary working width, also known as the “Spread”, would be fenced.

3.12.11 The location and condition of existing land drainage would be investigated and recorded. Two distinct phases would be identified, one for preconstruction and one for post construction. Where necessary, field drainage would be newly installed or restored elsewhere to:

- enable landowner’s field drains to continue working throughout the construction period;
- help prevent soil structure damage and waterlogging of the working width;
- aiding recovery post-construction; and
- help prevent any future drainage problems.

3.12.12 Pre-construction drainage assist prevention of unnecessary flooding and water damage to the working width. A specialist Land Drainage contractor would be procured to undertake this work. A post construction drainage scheme will be designed by a land drainage expert.

3.12.13 The relevant permits and consents for such activities as construction near water, abstraction and discharging of water will be sought from the Environment Agency, Lead Local Flood Authority / Internal Drainage Board (IDB) / Canal and River Trust where necessary.

3.12.14 Pre-entry meetings with landowners / occupiers will be undertaken to discuss requirements for temporary fencing, access, monitoring and reinstatement.

3.12.15 During the pre-construction phase of the Project an intelligent pigging run along the LOGGS pipeline will be required.

Construction Activities

Temporary Access Tracks

3.12.16 The temporary access tracks would typically be 4.5 m wide, and up to 9 m wide at passing places, which, coupled with the area for soil storage and drainage between the track and the fence line, would give a maximum swathe of 12 m.

3.12.17 The entrance directly off the public highway would be laid to hardcore. The temporary access tracks which lead to the pipeline spread and the running track itself would have the top-soil removed and stored to one side. Upon completion of construction, these tracks will be levelled and the top-soil replaced.

3.12.18 Culvert installations would be required for temporary access tracks to cross ditches and watercourses. The size of the culvert would vary per crossing depending on the dimensions of the crossing, sensitivity and importance of the watercourse.

3.12.19 Where new accesses or widening of existing accesses from the public highway are required bellmouths would be installed. The installation of bellmouths may require the creation of visibility splays to create a clear line of sight for the safe use of the junction.

Construction Compounds and Laydown Areas

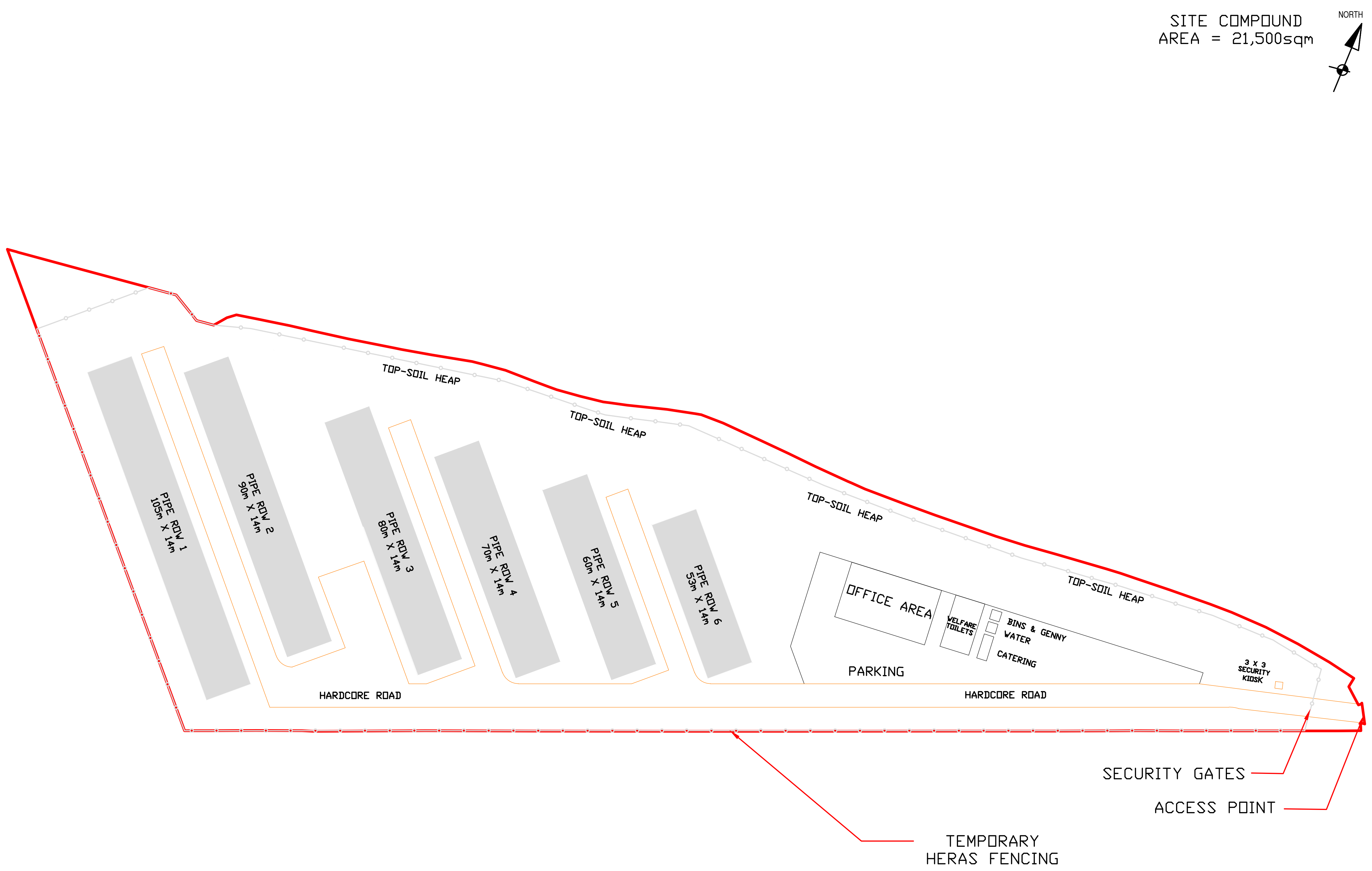
3.12.20 As part of the Project, areas of land would be temporarily required to be used as:

- **Main Construction Compounds with pipe storage areas:** these would comprise of a management and construction site office, welfare facilities, parking, and storage facilities for equipment, materials and machinery and would serve as a point for accepting deliveries of and storage of pipe and other materials/equipment, from which pipe sections would later be transported directly on to the pipeline spread when required;
- **Temporary facilities at both the Immingham Facility and Theddlethorpe Facility:** this would likely include a site office/cabin with electricity and water supply and welfare facilities, a materials and equipment storage area including crane, earth movers. A concrete batching plant is envisaged for the Theddlethorpe Facility as there are no nearby facilities; and
- **Temporary facilities adjacent to the Block Valve Stations:** these would include a security cabin, welfare facilities and storage container and the temporary land take would be approximately 50m x 40m.

3.12.21 At this stage of the Project, there are various options for the temporary construction compounds and pipe storage areas described in section 3.12.20. These comprise:

- **North Compound:**
  - *Option 1a:* located to the south of A1077, approximately 23,300m^2. This land has been used previously as a construction compound. This would be used as both a main construction compound and pipe storage area; and
  - *Option 1b:* located to the south of Habrough Roundabout, approximately 21,500m^2. This is greenfield land (arable) and would be used as a main construction compound and pipe storage area. This is the preferred option.
- **Central Compound:**
  - *Option 2a:* located at the former Grimsby Airfield off A16 Louth Road, near Holton Le Clay, approximately 17,100m^2. This would be used as a pipe / material storage area only and it is estimated it would be able to hold 3000 pipes. This land has been previously used as a construction compound and is the preferred central compound option; and
  - *Option 2b:* located at Welbeck Hill to the east of Barton Street, approximately 20, 900m$^{2.}$ This would be used as a pipe / material storage area only and it is estimated it would be able to hold 3000 pipes.
- **South Compound:**
  - *Option 3:* located at the car park on the former TGT site, approximately 13,000m^2. This would be used as pipe storage area.

3.12.22 Indicative layouts of the preferred construction compounds are shown in **Figure 3-18**, **Figure 3-19** and **Figure 3-20**.



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4. UTILITY INFORMATION OMITTED FOR PLANNING PURPOSES.

Rev	Rev. Date	Purpose of Revision	Drawn	Checkd	Apprv'd
A	27-OCT-2022	ISSUED FOR REVIEW	DD	GK	NC

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Registered in England and Wales No. 00584446

Client

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Project

VIKING CCS PIPELINE

Drawing title

NORTH COMPOUND
(PREFERRED OPTION)

Drawing status

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Scale	1:1000	DO NOT SCALE	
Sheet Number	01 / 01	Original Sheet Size	A1
Penspen Drawing Number	20428-PL-XKY-000-0011	Rev	A
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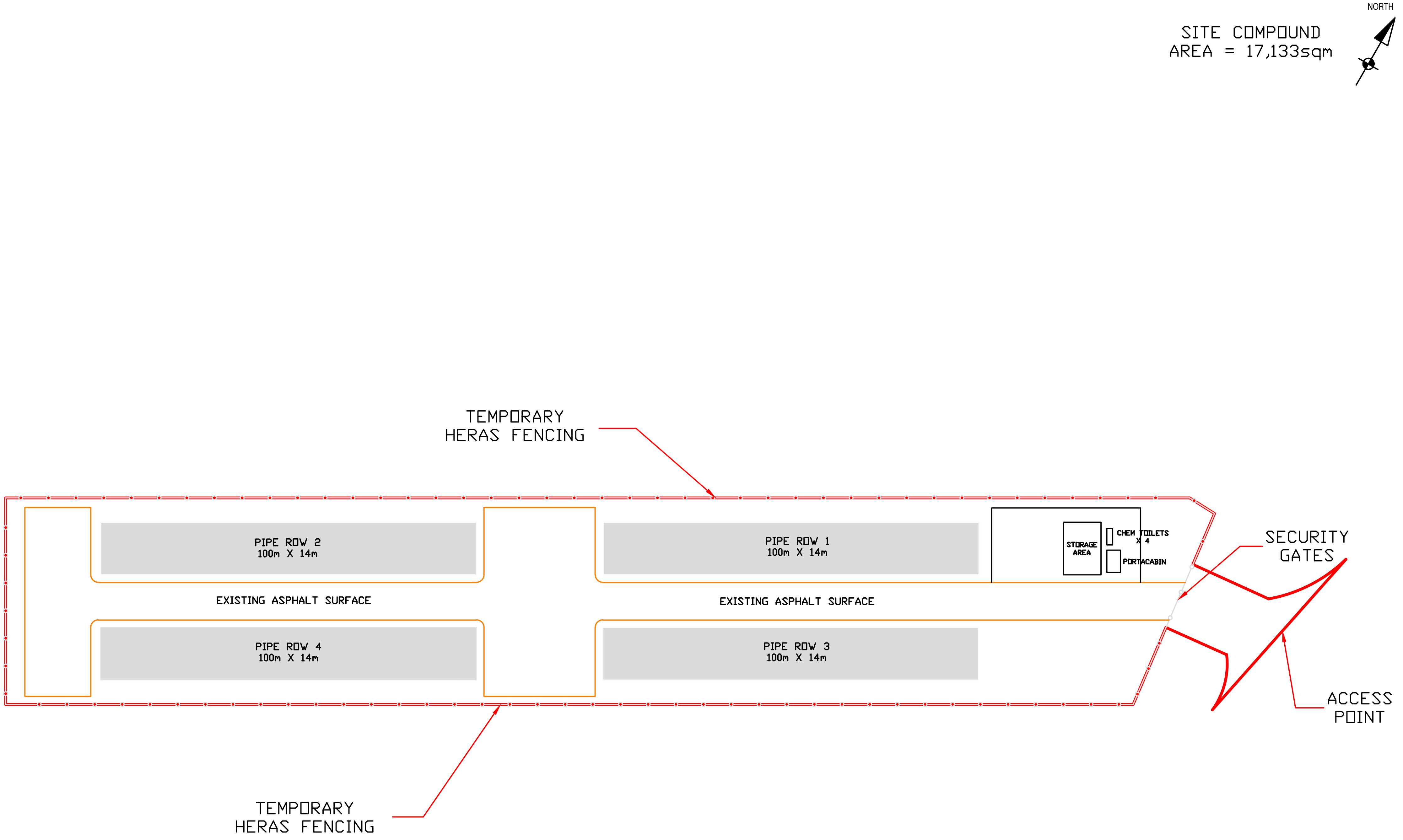

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5. THERE IS AN EXISTING ASPHALT SURFACE PRESENT AT THIS SITE. (CENTRAL COMPOUND PREFERRED OPTION).

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VIKING CCS PIPELINE

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CENTRAL COMPOUND
(PREFERRED OPTION)

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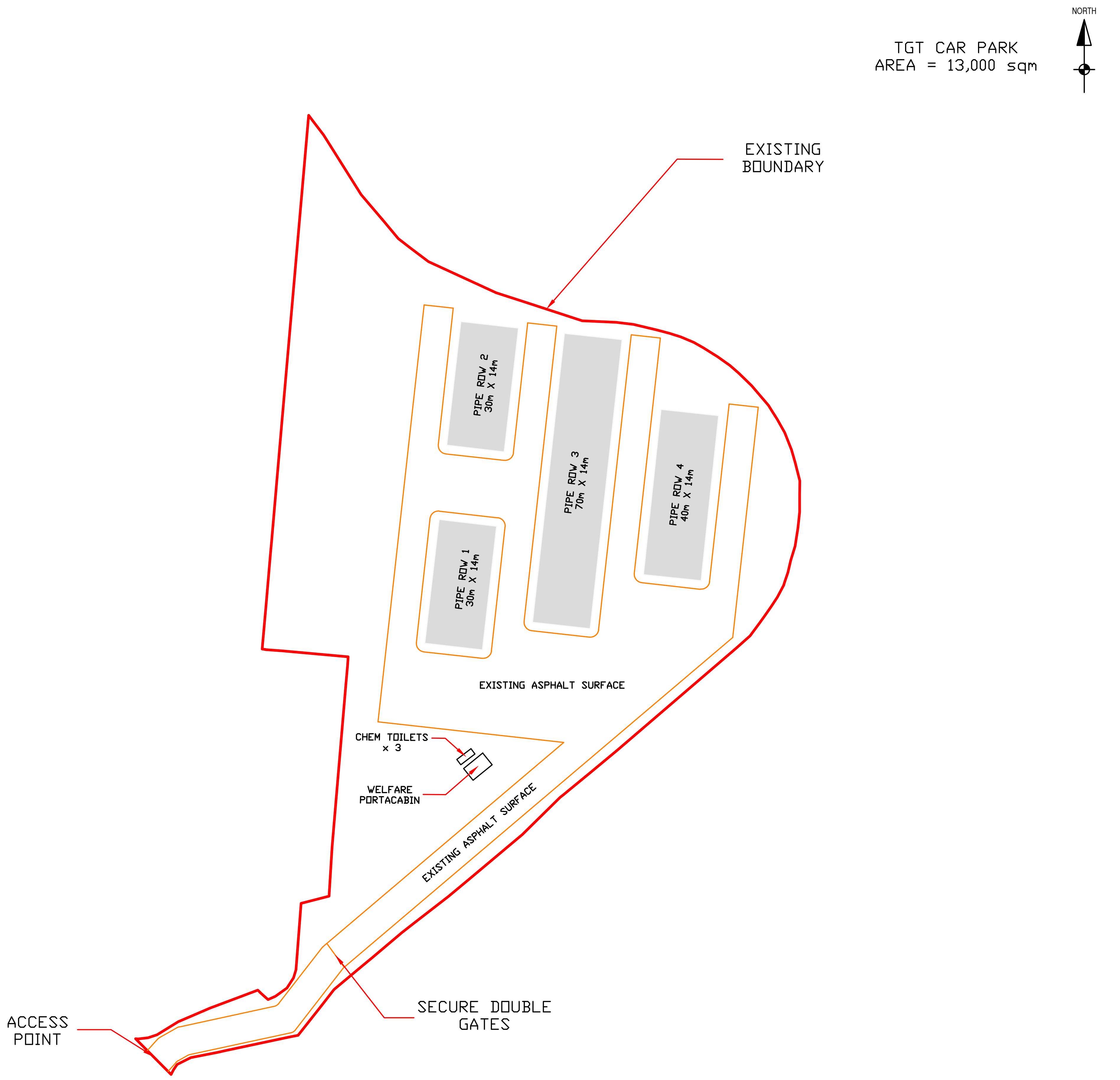

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3. THIS DRAWING IS IN METRES UNLESS STATED OTHERWISE.
4. UTILITY INFORMATION TO BE DETERMINED DURING THE FEED PHASE OF THE PROJECT.
5. SITE BOUNDARY ALREADY EXISTING AROUND COMPOUND.

Rev	Rev. Date	Purpose of Revision	Drawn	Checkd	Apprv'd
A	27-OCT-2022	ISSUED FOR REVIEW	DD	GK	NC

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Project

VIKING CCS PIPELINE

Drawing title

SOUTH COMPOUND

Drawing status

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Sheet Number	01 / 01	Original Sheet Size	A1
Penspen Drawing Number	20428-PL-XKY-000-0013	Rev	A
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Preparation of working width for the pipeline

3.12.23 The standard working width of the pipeline spread would be 30m. This would provide sufficient area for a running track (described in 3.12.26 below), topsoil storage, separate subsoil storage and would enable safe excavation of the trench (in open cut sections). The working width would increase to up to 50m for major crossings to allow additional space to manoeuvre and laydown of specialist equipment, whilst maintaining access along the working width.

3.12.24 The pipeline route would be surveyed and pegged (marked) out, and temporary fencing erected along the boundaries of the working width. The temporary fences within arable fields would comprise of rope supported on wooden posts whereas in areas where there are livestock, the fencing would comprise of plain or barbed wire and/or square mesh netting.

3.12.25 Working areas will be cleared of vegetation, scrub and hedgerow as appropriate, in the winter immediately in advance of pipeline construction. Topsoil and subsoil would be stripped and stored separately within designated storage areas.

3.12.26 A haul road known as a running track will be created within the working width and will be used to access the entire length of the construction swathe.

3.12.27 Where the working width is located within 250 m of an identified Great Crested Newt (GCN) habitat, a temporary low level GCN fence would be installed along the perimeter of the working width. This activity will be carried out prior to commencement of erecting the Spread demarcation fencing.

Land drainage

3.12.28 The existing land drainage will be carefully inspected and recorded by a local drainage expert, and where necessary a pre-construction drainage scheme will be developed. These schemes could include the installation of new drainage to intercept existing land drainage which would be severed by the pipeline.

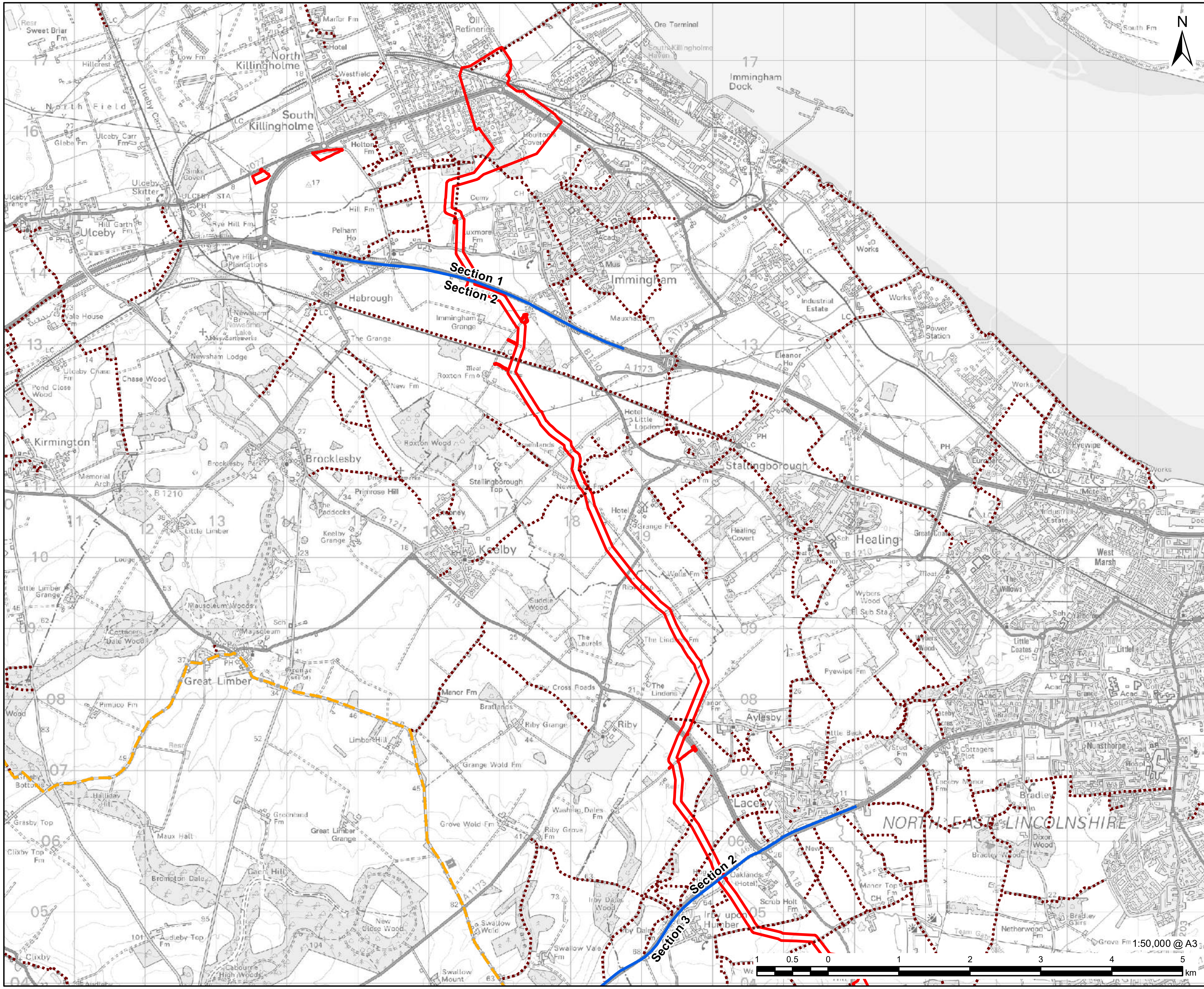
3.12.29 During the construction, all the drains encountered would be recorded and an appropriate method of permanent reinstatement would be devised in consultation with the landowner/occupier.

Review and maintenance of Public Rights of Way

3.12.30 The Public Rights of Way (PRoW) that intersect the Project are identified on **Figure 3-21**. PRoWs would only be temporarily diverted or closed to allow for construction works to be carried out safely. Where a PRoW requires to be temporarily diverted or closed, an alternative or new route will be identified, included in the draft Order limits and assessed prior to submission of the DCO application.

3.12.31 The temporary diversion or closure of PRoWs which intersect the pipeline spread would comprise of a fence with gates that can temporarily close to allow free flow of construction traffic along the running track. When it comes to digging the trench, a diversion would be set up at approximately 20m to 50m along the pipeline centreline, with a walkway placed across the trench and fenced off. The pipe-string would then be laid into the trench, backfilled, compacted and the PRoW diversion removed to allow the PRoW to reopen. This process is likely to be in place for approximately 48 hours.

3.12.32 Public Rights of Way will be maintained and suitable arrangements to protect the public implemented. These arrangements would be detailed in the CEMP.



VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- National Cycle Route
- Public Right of Way

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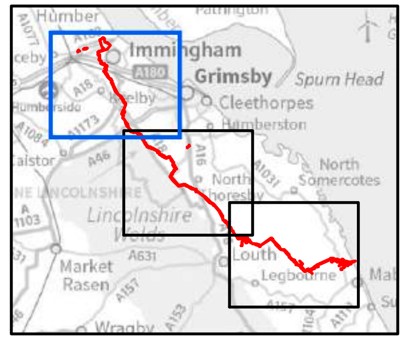

FIGURE TITLE

Figure 3-21 (1 of 3)
Public Rights of Way and National Cycle Network

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221108_PEIR_3-21

Revision: 3 Drawn: LC Checked: HT Approved: MW Date: 2022-11-08

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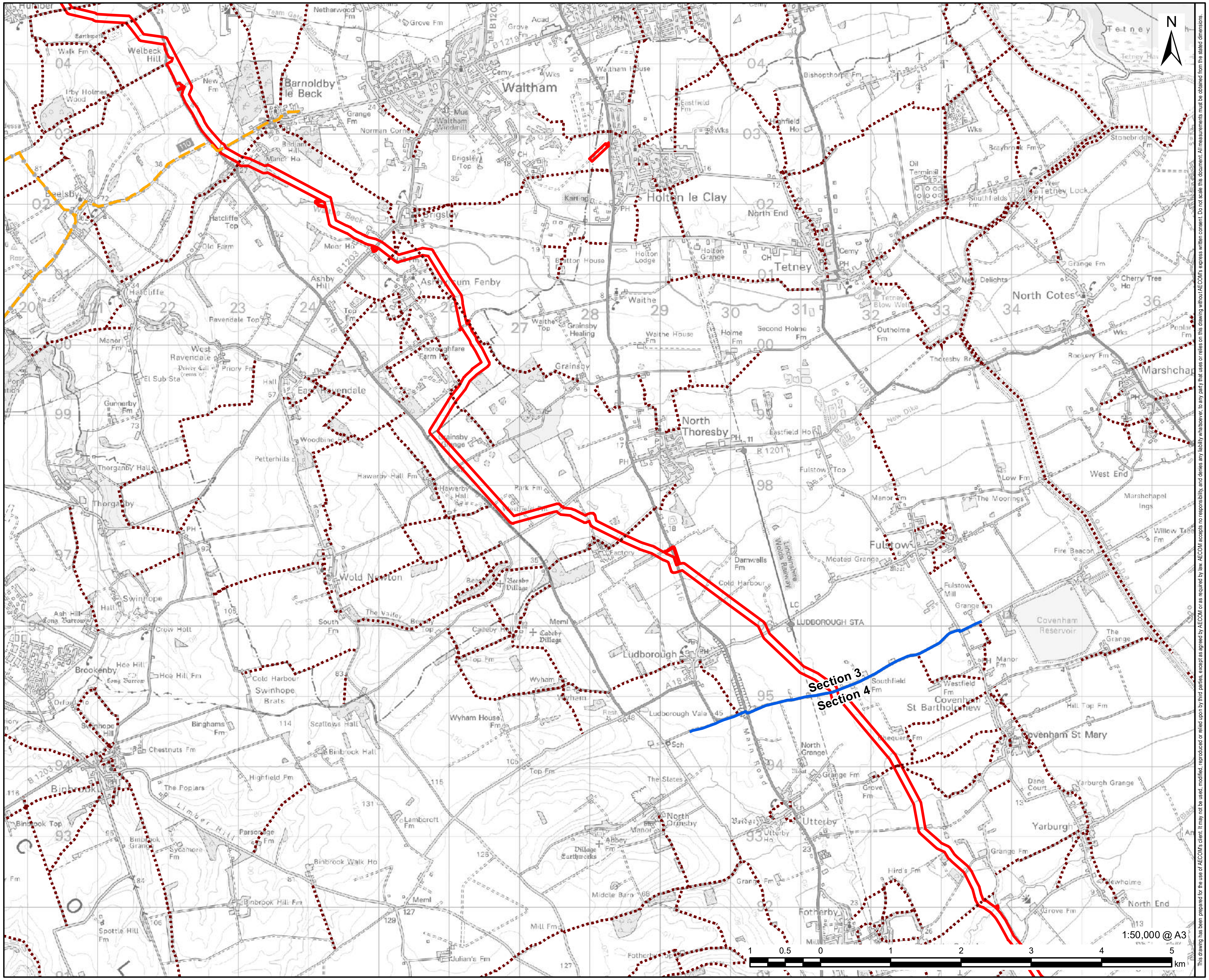

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VikingCCS

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PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- National Cycle Route
- Public Right of Way

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FIGURE TITLE

Figure 3-21 (2 of 3)
Public Rights of Way and National Cycle Network

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

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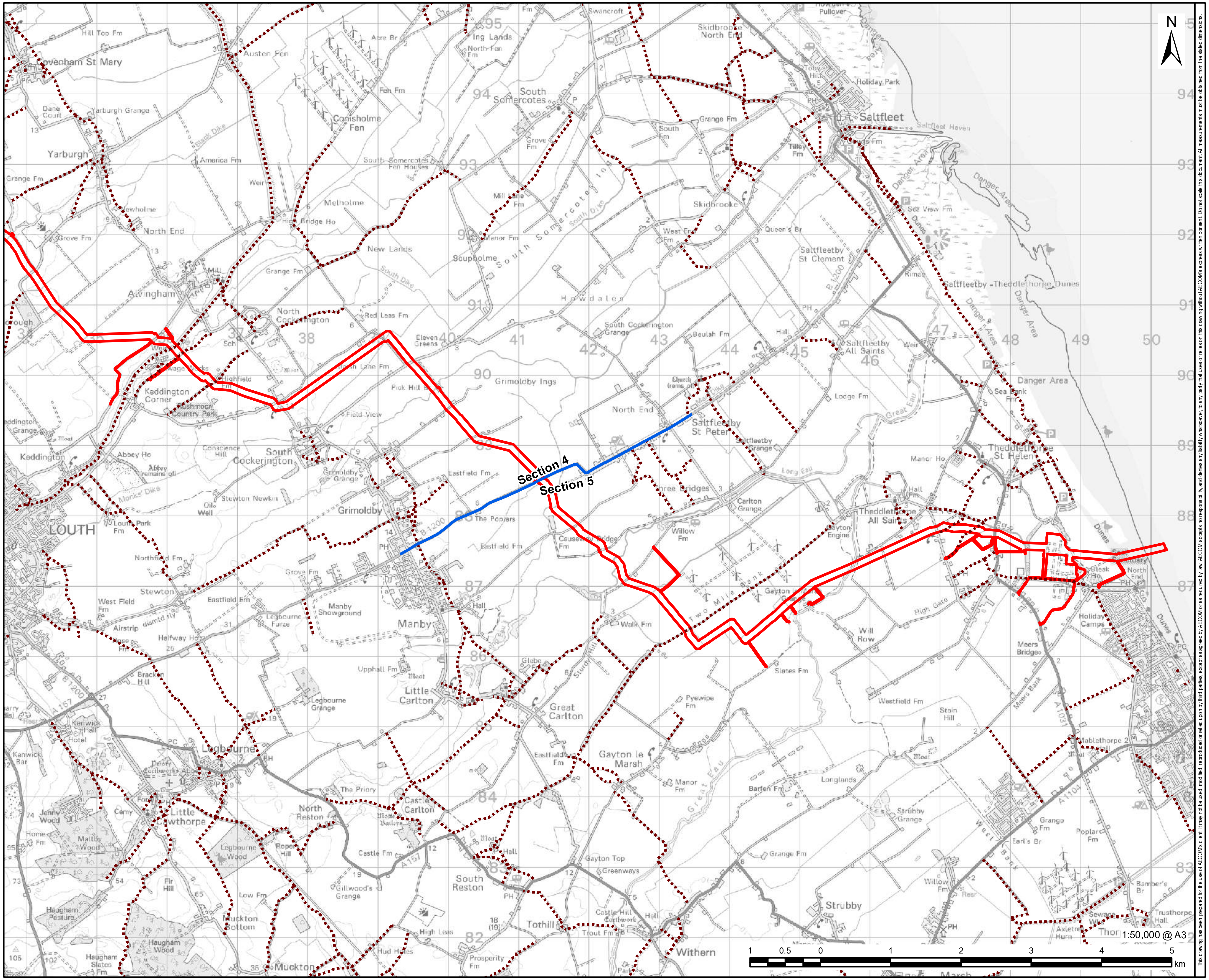

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VikingCCS

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PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Public Right of Way

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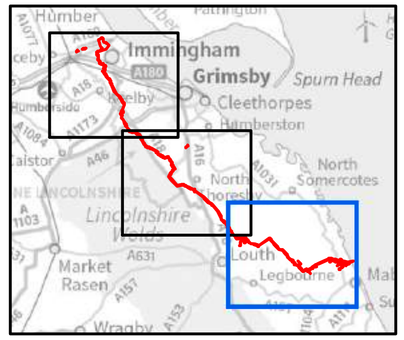

FIGURE TITLE

Figure 3-21 (3 of 3)
Public Rights of Way and National Cycle Network

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

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Pipeline Construction techniques and sequencing

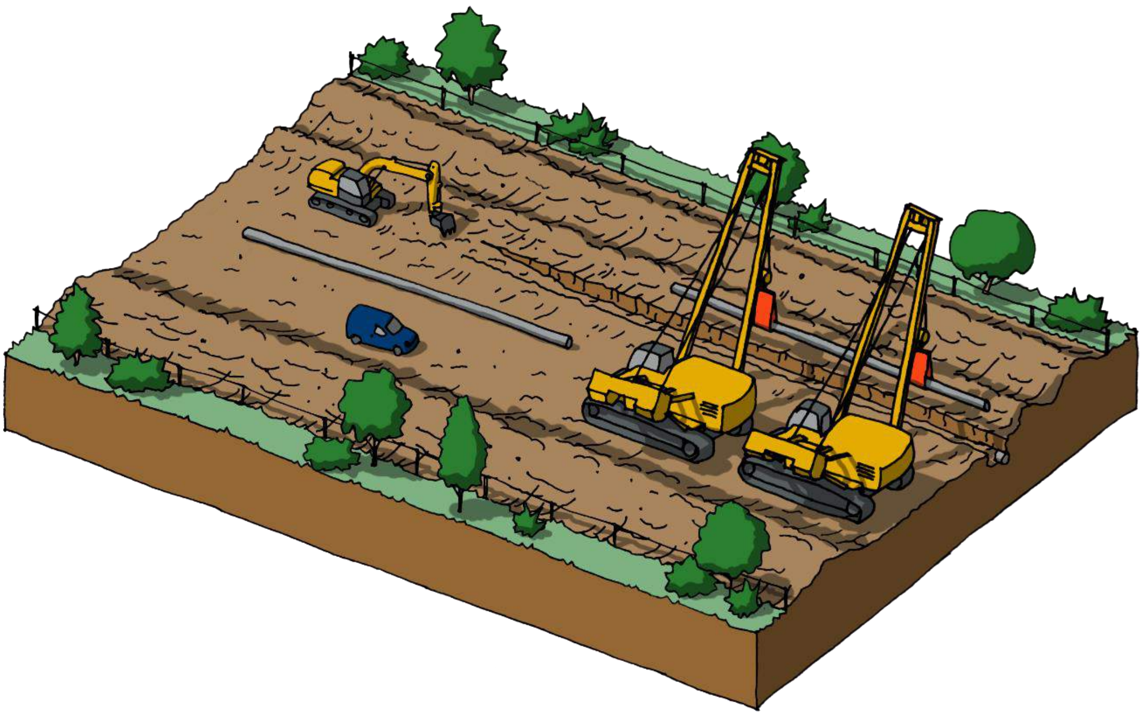
3.12.33 Approximately 55.6 km of steel pipe will be required. The pipe will be manufactured in specific pre-determined lengths (12m) and delivered to designated sites by road from collection point(s). Temporary storage of pipeline and materials/equipment would be required at the Construction Compounds before they are distributed along the pipeline route.

3.12.34 The pipe trench would be dug either with mechanical excavators straddling or running alongside the pipeline trench or using a specialised trenching machine, down to a minimum depth of 1.8 m. The depth from the top of the pipeline to the ground surface will be a minimum of 1.2m and will likely be deeper in some locations, such as major crossings where it will increase to 2m or is subject to agreement with the utility/asset owner. Where necessary, to aid construction and in order to maintain the integrity of the excavated trench, trench supports, and close sheet piling may be used if necessary.

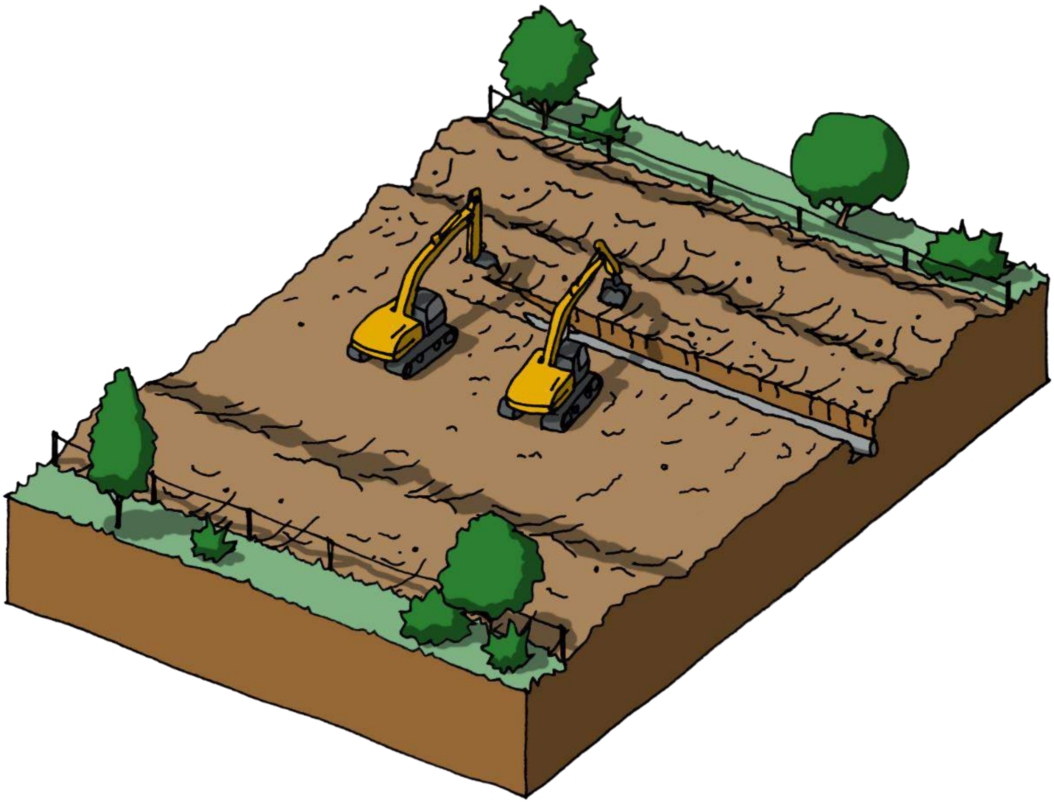
3.12.35 Pipe strings would be fabricated and welded on site adjacent to the pipeline trench. Boom cranes would lift the welded pipe and place it into the trench. The required cathodic protection and fibre optics would be installed and then pipeline testing and GPS survey would be undertaken. Only following completion of all these required works would the trench be then backfilled, and the reinstatement works commenced.

3.12.36 Dewatering of the trench and other excavations may be required in some areas to stabilise the surrounding ground during construction. This activity would be subject to a separate consent under the Environmental Permitting (England and Wales) Regulations and an approved Permit to Pump would be required for all pumping operations (before dewatering or discharges commence). Water would never be pumped directly to a watercourse or be allowed to directly enter a watercourse or be discharged to ground.

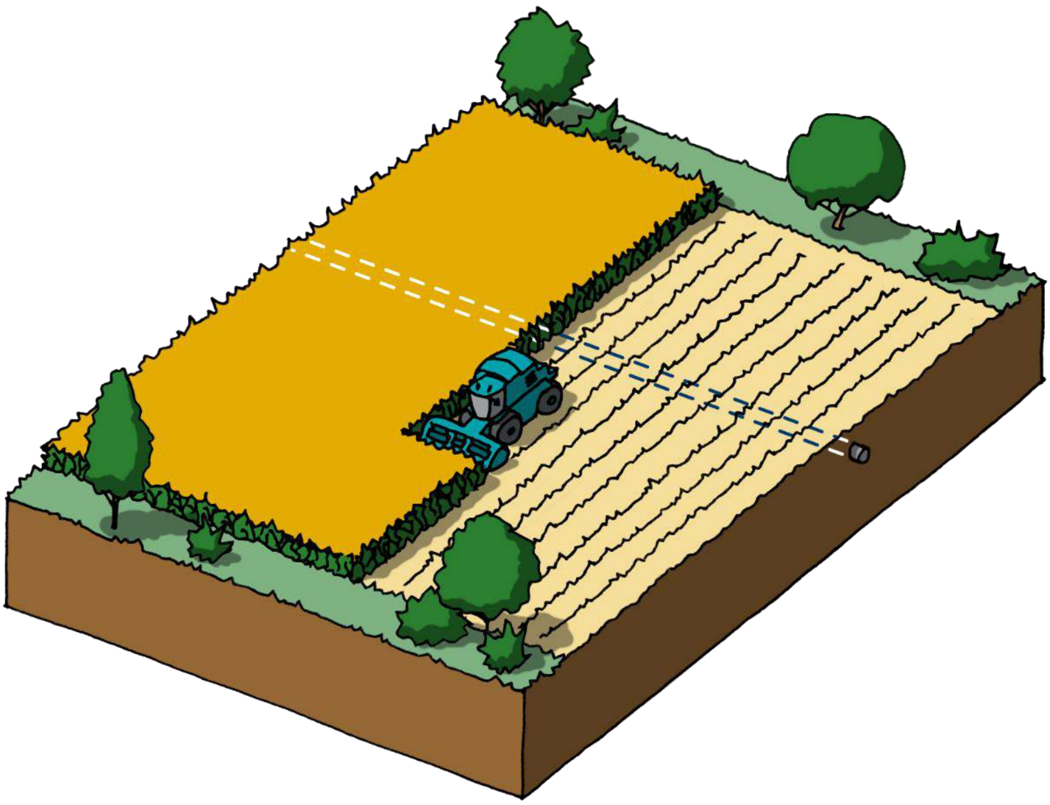
Figure 3-22: Overview of Pipeline Laying Sequence



1) Trench excavation and laying of the pipeline



2) Backfilling the trench



3) Reinstated land returned to its original use.

Pipeline Crossing Techniques and Locations

3.12.37 The pipeline will inevitably need to cross railways, roads, other utilities and watercourses. In some instances, a crossing is made using open cut techniques; however in other instances trenchless crossing techniques are used. The working width at these locations would be typically wider than the standard 30m working width. A variety of trenchless crossing techniques will be used when open-cut methods are not appropriate. These crossing techniques include:

- Auger boring;
- Horizontal Directional Drilling (HDD); and
- Guided auger boring.

3.12.38 Design work is currently ongoing to identify the appropriate method required for each crossing and details will be included within the ES.

3.12.39 At trenchless crossings of roads, watercourses and railway lines and other major infrastructure, the pipeline would be laid at a deeper depth. The depth of highway crossings would also be influenced by services and the depth of adjacent ditches.

3.12.40 The depth of the watercourse crossings is influenced by the depth of the true clean bottom of the watercourse, the ground and the groundwater conditions, where the watercourse is navigable and the flexibility (bend radius) in the pipe and installation equipment. Watercourse would be crossed as close to 90 degree angles where possible, and not less than 67 degrees.

Open-cut crossing

3.12.41 This crossing technique involves digging a trench directly across the asset or infrastructure to be crossed, following which a short section of the pipe is installed and the trench backfilled with the graded excavated material. The surface is then reinstated with appropriate material. It is not anticipated that any major roads would require closing for open-cut crossings however in the event a road closure is unavoidable, then a diversion route would be implemented, and suitable signage provided. Roads would be closed for as short a time as possible.

Figure 3-23: Open Cut Technique

Auger Boring

3.12.42 This crossing technique involves digging two pits either side of the crossing section. The side of the pit would either be stabilised, if space allows, or sheets and frames installed to support the pit from collapse. The width of the drilling pit needs to accommodate the set of rails upon which the auger equipment runs and long enough to accommodate the full length of the pipe required for the crossing section.

3.12.43 In areas of auger boring, the working width would need to be widened to accommodate the extra equipment required, though this would be accommodated within the Limits of Deviation.

3.12.44 During drilling, a short length of sacrificial pipe is placed between the drilling-head and the live pipe and thrust through the ground until it reaches the reception pit on the other side of the crossing. The head of the auger boring tool has “wings” that flip out when rotation starts so that the borehole is slightly larger than the “live” pipe being driven through the bore. An auger tool also has a “helix” attached that by definition removes the spoil from within the pipe and returns it to the drilling pit where it is fed into a skip and lifted out of the pit.

Figure 3-24: Auger Boring at a Road Crossing

Horizontal Directional Drilling (HDD)

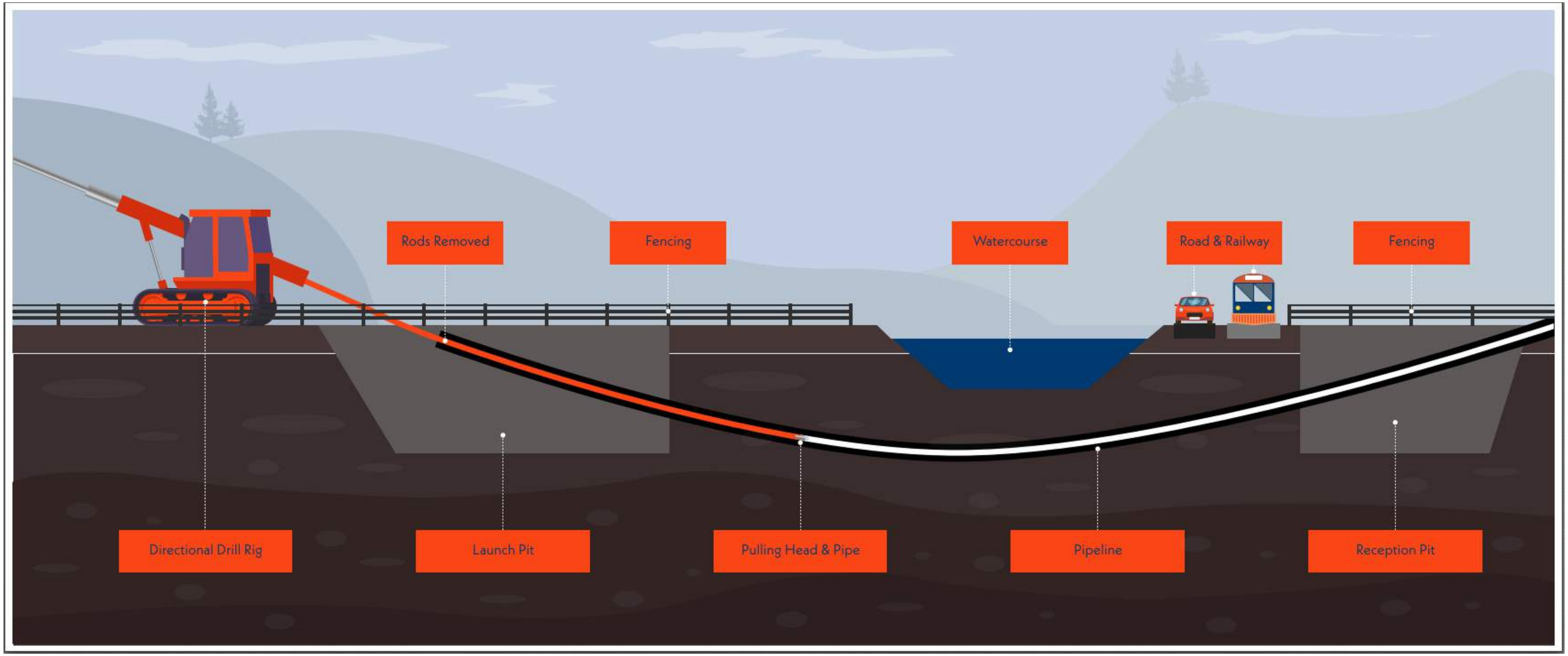
3.12.45 The drill enters the ground at a shallow angle to bore a small pilot hole and is then steered to follow a pre-determined radius to achieve the required clearance from the crossing. The drill emerges on the other side of the required crossing. The diameter of the drilled hole is then increased incrementally by subsequent pull-throughs of a reamer or hole-opener, normally 1.5 times the diameter of the live pipe until the hole is of a suitable dimension for installation of the pipe.

3.12.46 The pipe is then connected to the end of the drill pipe and the drill string rotated and withdrawn. Bentonite, a non-toxic, biodegradable natural clay is used as a drilling lubricant, which is pumped from tanks to the head of the drilling bit. The lubricant is mixed with the drillings, forced back along the hole under pressure and into a recycling plant which recovers most of the bentonite. The waste material is transported away.

3.12.47 The working width would need to be widened immediately adjacent to the crossing to accommodate extra plant.

Figure 3-25: HDD Technique

Figure 3-26: HDD Technique Cross Section



Guided Auger Boring

3.12.48 Guided, or Directional, Auger Boring is a technique whereby a pipeline is installed between two prepared shafts.

3.12.49 The auger boring rig is set up in the launch shaft and the laser guided probe is then jacked through the ground to the reception exit shaft.

3.12.50 Assisted by pilot rods equipped with optical passage, steering head, and theodolite with CCD camera and monitor, open-guided auger boring can be carried out in displaceable ground. The pilot pipe is pushed through the ground towards the target shaft. The direction is monitored by the CCD camera throughout the whole process. The direction of the head is adjusted by rotating the pilot pipes to guide the steering head on the cross hair image on the guidance monitor.

3.12.51 The precision-guided bore made by the pilot pipe is then followed by the steel cased auger sections which enlarges the bore to the same size as the product pipes.

3.12.52 The product pipes are then jacked through whilst the casings are being retrieved in the reception pit.

Backfilling

3.12.53 Once each pipe-string has been safely laid into the shaft and each welded joint location captured by Global Positioning System (GPS), the shaft would be backfilled with the original material, if the material is suitable for direct contact with the pipe. It may be necessary to “riddle / sieve” the material to obtain good “intimate backfill” to surround the pipe. If there is insufficient satisfactory material then imported sand would be used, normally to 300mm above the pipe, then the general excavated trench material can be placed into the trench. The subsoil would be carefully compacted around and over the pipe, and up to the top of the trench using a compacting machine called a “Rammax”. These vary in size from a small remotely controlled version to the larger sit-on machines. Where it is necessary to dispose of surplus trench material, this will be transported away to a suitable site.

Cleaning and Gauging

3.12.54 Once the pipeline is in situ, the pipeline would then be cleaned internally using a variety of scrappers known as Pipeline Inspection Gauges or “pigs”. They comprise of foam pigs for initial removal of debris and dirty water, and bi-directional pigs with brushes and/or magnets attached, driven through the pipeline under water pressure or compressed air.

Figure 3-27: Variety of Cleaning Pigs (Brushes and Magnetic)

Figure 3-28: Bi-Directional Pig Being Inserted into the Pipeline

Construction Lighting

3.12.55 Lighting on the pipeline spread is not currently envisaged to be required, as work is planned during summer months, however there may be localised lighting for the Immingham and Theddlethorpe Facilities and hydrotesting at the latter stages of the construction works.

3.12.56 There may be some lighting at the construction compounds, however once the stored pipe has been delivered to the pipeline spread it will be scaled back. The lighting would be static lighting points fixed to temporary structures such as the masts, cabins, workshops, gantry cranes and silos. These would be used to illuminate regularly used work areas, the car park and access areas. Baffles would be installed on all lighting columns and light is to be angled to face works.

3.12.57 Where lighting is required during construction, this will be directed away from mature trees, hedgerows, watercourses or properties.

Indicative List of Construction Equipment

3.12.58 A variety of construction plant and equipment would need to be deployed during the construction of the Project.

3.12.59 The plant and equipment that would be used on the pipeline spread includes dozer D6, backhoe/excavators, 24'' pipe bender and mandrel, side-boom 583s, pay-welder, crawler crane, cold bending machine, pipe carrying crawler, front-end welding equipment, guided auger-boring equipment, standard auger-boring equipment, HDD equipment, NDT Testing equipment and land drainage trenching/laying unit.

Indicative List of Required Materials

3.12.60 An indicative list of the materials required for the Project are presented in **Table 3-3.**

Table 3-3: Indicative list of Materials Required for the Project

Material	Size	Quantity
Immingham Facility		
Pig trap (launcher)	24"x7m	1
Pig trap (receiver)	24"x8.5m	1
HIPPS package	22x5x3m	1
Piperack	80x4x8m	1
Vent stack	24"x25m	1
LER building	12x5x3m	1
Analyser house	6x2.5x3m	1
Security fence	300m	1
Pipeline		
Line Pipe	24" (approx. 60mm) in 12m sections	approximately 5000
Block Valve Station		
Ball Valves	24"	3
Ball/Plug Valves	12"	18
Barred Tees	24"x12"	6
Tee	12"x12"	6
I&C Kiosk	-	3
Auxiliary Transformers	-	2
LV AC Panel	-	3
Cathodic Protection		
Transformer Rectifier Unit, 50V 10A	-	2
Anode Cable. 35 mm^2 tin-coated stranded single core copper with Kynar primary insulation and high molecular weight black polyethylene	-	16
Drain cable 35 mm^2 tin coated stranded single core copper with XLPE/PVC insulation	-	4030
Cable 10mm2 tin coated stranded single core copper with XLPE/PVC insulation	-	200

Material	Size	Quantity
Silicon Iron Chromium Anode 1.2 m x 0.076 m c/w 16 mm^2 10m tail	-	100
Anode junction box SS 316	-	700
Negative junction box	-	2
Permanent reference electrodes (Cu/CUSO4) with tail	-	2
M28 test post	-	5
AC Coupons 1 cm^2 exposed area with 10 m tail	-	70
DC Coupons 25 cm^2 exposed area with 10 m tail	-	15
Polarisation Cell Replacement (PCR)	-	55
Monobloc Isolating Joints	-	2
Pre-packaged High Potential Magnesium anodes	9.1 kg 1.9 m x 0.12m	2
Theddlethorpe Facility		
Pig trap (launcher)	36”x8.5m	1
Pig trap (receiver)	24”x8.5m	1
HIPPS package	22x5x3m	1
Hydraulic power unit	2kW	1
Diesel generator	50kW	1
Vent stack	24”x25m	1
LER building	12x5x3m	1
Security fence	450m	1

Pre-Commissioning Testing (hydrostatic testing)

3.12.61 After the pipeline sections are cleaned and gauged, they are subjected to a hydrostatic test. Temporary test ends are welded or bolted to both end of the pipeline which is then filled with water.

3.12.62 The water would either preferably be sourced from a local watercourse or from groundwater extraction. The water will be cleaned and/or treated prior to discharged back to a watercourse through such methods as straw bales, sand filters or carbon treatment as needed. If local watercourses are unsuitable, water would either be brought in by tanker or drawn off a mains water stand-pipe supply. Design details are currently evolving to cover this component and details relating to the proposed sources and disposal methods will be included within the ES.

Figure 3-29: Hydrotesting in Operation

3.12.63 Once hydrotesting is complete, the pipe-strings would be welded together to form a continuous steel tube.

Soak Test

3.12.64 Some residual water will be left inside the pipe from the hydrostatic testing that would corrode the internal wall if it were not dried. Air compressors are used to thoroughly dry the inside of the pipeline, this is called a "Soak-test". The soak test period shall be of sufficient time to determine that all free water has been removed from the system and be no less than 24 hours. The pipe is monitored until an acceptable reading is obtained. Evidence that all free water has been removed shall be indicated by the pressure remaining below the calculated saturated vapour pressure with the plotted trend showing signs of stable pressure. Should an increasing pressure trend be detected with no signs of any pressure stabilisation then the vacuum drying shall resume and continue the vaporisation phase.

3.12.65 The criterion for the acceptance of the first soak test and the termination of the vacuum drying operation will be when an agreed or better stable dew point is achieved.

3.12.66 A “calliper pig” is propelled from one end of the pipeline to the other to detect for any defects and provide a record of the internal status of the pipeline and welded joints.

3.12.67 The pipeline is then filled in nitrogen which is left in the pipeline until the pipeline commissioning and introduction of CO_2.

Immingham Facility, Theddlethorpe Facility and Block Valve Station Installation Process

3.12.68 The sites would be cleared, excavated and graded to achieve the approximate required finished levels. Surfaces would be constructed to falls, so that rainwater can drain to existing open ground, to soakaways or to existing drainage facilities, as appropriate. The majority of the site would be permeable surface to minimise runoff. Swales and soakaways will be utilised to promote sustainable drainage. A cut-off drainage channel will be provided at the site entrance gate.

3.12.69 Concrete bases would be poured for the required above ground infrastructure e.g., control kiosk, block valve and vent stacks. The GRP kiosk and block valve (block valve station) would be delivered prefabricated and placed on their bases. The pipeline would be welded through, and the actuators, monitoring gauges and stems, and valve handles would be installed. All trenches would be backfilled and compacted. Roads and hardstanding would have flush concrete kerbs to allow surface water run-off.

3.12.70 The temporary fencing would be replaced with secure, permanent fencing and outer post and rail erected. The electrical cabling and instrumentation would be fitted and tested. Gravel would be spread over the site, and the outer strip planted up.

LOGGS Pipeline Emergency Shutdown Valve and Isolation Valve

3.12.71 Depending on the outcome of the emergency shutdown valve and isolation valve assessment, there may be minor activities involved to ensure the valves move freely such as connecting a nitrogen gas bottle to the existing actuator or setting up and connecting temporary hydraulic systems, removing the installed actuator and attempting to manipulate the valve stem directly. Should all of these minor activities fail to move the valves then there is a possibility the valves will need to be removed, overhauled and then re-installed.

3.12.72 It would take approximately one month to remove and lift out the old valve and install the refurbished one. This would involve lifting equipment (potentially a crane), bolt tensioning equipment and flatbed trucks to remove the valve and bring it back refurbished. The removal would also involve welding as the existing valve is welded onto the LOGGS pipeline.

3.12.73 For the purposes of the PEIR the worst-case scenario will be assessed, which is full removal, refurbishment and re-instalment of the valve.

Cathodic Protection Beds

3.12.74 It is intended to install three horizontal Cathodic Protection ground-beds, adjacent to the Block Valve Stations. The ground-bed consists of a number of sacrificial magnesium anodes laid out in a straight line at 1.5m intervals in a trench that is normally located 100m away and perpendicular to the pipeline.

3.12.75 A positive cable connects the anodes from the transformer rectifier, normally housed in the control kiosk. A negative cable runs to a brazed pin on the pipeline to complete the circuit.

3.12.76 There will also be Cathodic Protection test posts located at some road crossings. A negative cable runs from the test post to a brazed pin on the pipeline. Cathodic Protection levels can be measured manually at each test post but more likely, an Abriox device is inserted in the test post that transmits continuous readings via a sim card, back to the control centre.

Reinstatement

3.12.77 Along the pipeline route, the ground would be reinstated with stored topsoil and subsoil following trenching, within the same year as construction should weather conditions allow. If necessary, the subsoil would be ripped prior to topsoil placement if compaction has occurred. Topsoil would be spread in such a way as to ensure that it does not become compacted. All surplus construction materials would be removed on completion of the work.

3.12.78 Following reinstatement of soil and subsoil, final restoration of the pipeline working width would commence. Restoration activities would include reseeding of pastureland and reinstatement of field boundaries. All sections of hedgerow or other field boundaries would be replanted/reinstated. The pipeline route would be marked with marker posts and aerial markers at field boundaries. These would be visible from the ground and all marker posts would be located to minimise interference with agricultural activities.

3.12.79 Permanent pipeline aerial and ground makers, and Cathodic Protection Test Posts would also be installed along the pipeline route, at agreed locations. The temporary fencing along the working width would be removed. Any temporary tracks and bell mouths would be reinstated to their original land use.

3.12.80 The Applicant is committed to making a positive contribution to biodiversity net gain and additional details will be included within the ES.

Waste Management

3.12.81 A Site Waste Management (SWMP) plan in line with UK/EU current and forthcoming legislation will be prepared. The aim of the SWMP is to reduce, as far as possible, the amount of waste generated, to reuse as much as possible and to limit the amount of waste disposal off-site. This would be based on an outline SWMP which will be submitted with the DCO submission as an appendix to the Draft CEMP.

3.12.82 The SWMP would detail procedures for the collection, segregation, recycling and disposal of all waste from the works. The procedures would detail the routes from the works to the ultimate disposal site. Only licensed waste management companies would be employed.

3.12.83 Details of all carriers and disposers involved in the disposal route would be supplied together with copies of their licences, in accordance with relevant legislation. The Pipeline Contractor would provide details of how the waste disposal Procedures would be audited to ensure compliance. All disposal sites and landfills would comply with UK/EU legislation licensing and standards.

3.12.84 The Pipeline Contractor would prepare and maintain a Waste Tracking system which would enable all waste leaving the works to be tracked to their ultimate disposal location. All waste documentation, consignment notes etc would be maintained on site and available for inspection.

3.12.85 The Pipeline Contractor would ensure the practice of good housekeeping in all work areas. High standards of cleanliness would be maintained, and rubbish would be collected on a regular basis and disposed of according to the waste disposal procedures.

3.12.86 There would be no discharges to the existing drains system without prior and written consent from the appropriate authorities.

3.12.87 The Project aims to achieve:

- at least 90% (by weight) recovery of non-hazardous construction and demolition waste. The target specifically excludes naturally occurring materials with European Waste Catalogue (EWC) Code 17 05 04 (17 05 04 soil and stones other than those mentioned in 17 05 03* (soils and stone containing dangerous substances)). Recovery is deemed to include reuse, recycling and other recovery e.g., energy recovery; and
- at least 25% (by weight) of materials imported to site for use within the Project will comprise alternative (reused, recycled or secondary) content, for those applications

where it is technically and economically feasible to substitute these alternatives to primary materials.

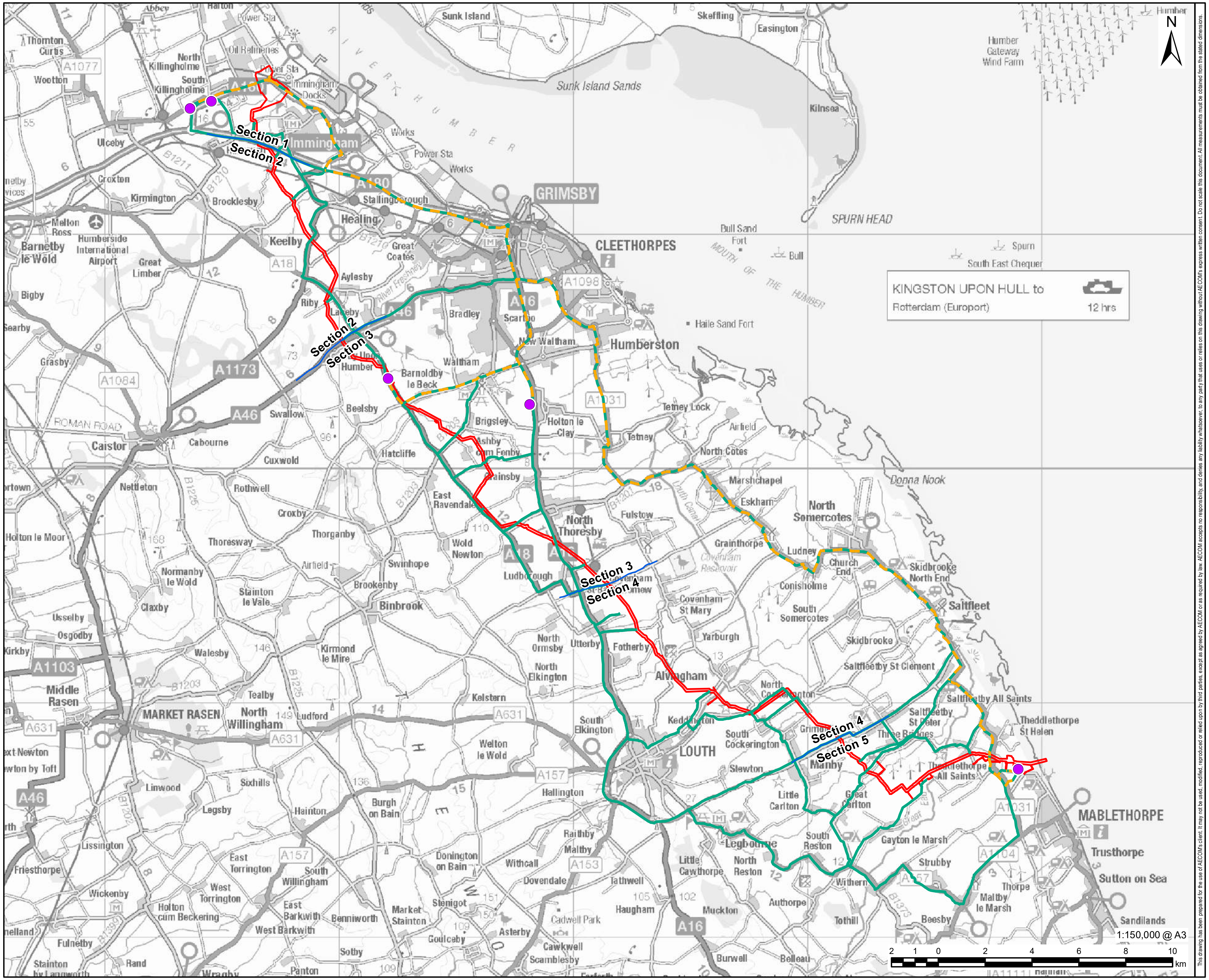
Construction Traffic Access and Management

Initial Pipeline Delivery

3.12.88 It is assumed that pipe may be procured from Europe and be shipped to Immingham Docks. From Immingham Docks, the pipe would be shipped via Heavy Goods Vehicles (HGVs) to the North Compound, Central Compound and Southern Compound via the construction traffic routes identified in **Figure 3-30**. These construction traffic routes have been designed to use major "A" roads and routed away from minor roads where feasible.

3.12.89 A total of 5,000 pipes (24” line pipe of 12m in length) are required. It is estimated that it would take 18 HGVs 15 weeks working concurrently, making daily round trips to haul the pipe to the North Compound, Central Compound and Southern Compound and later to take them out on to the pipeline spread.

Revision: 3 Drawn: AG Checked: LC Approved: HT Date: 2022-11-08



VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- Route Section Break
- Proposed Construction Compound Location
- Proposed Route from Immingham Docks to Construction Compounds
- Proposed Construction Access Route

NOTES:
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FIGURE TITLE

Figure 3-30
Construction Traffic Routes for Initial Pipeline Delivery

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221108_PEIR_3-31

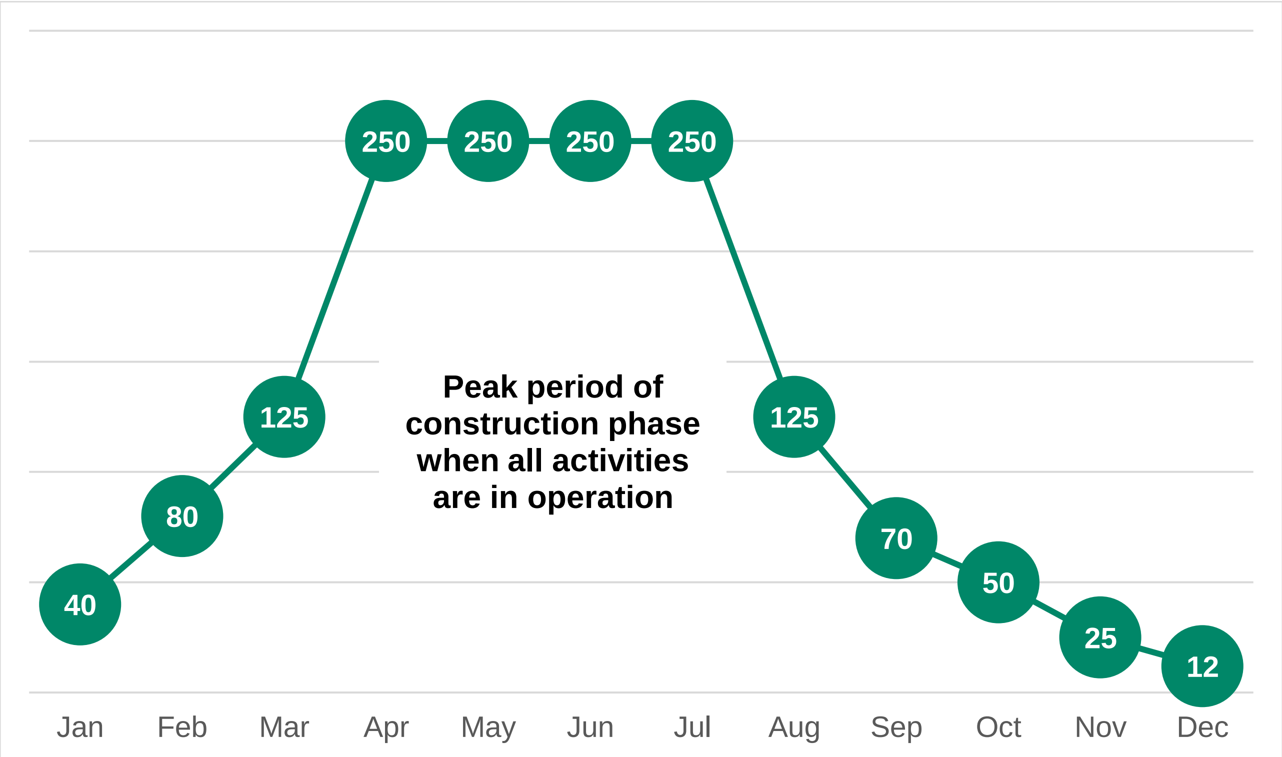
Main Construction Phase

3.12.90 Tipper trucks would be used periodically to deliver aggregate to the North and Southern Compounds; gravel during pre-construction and land drainage installations and sand (if required) for backfill.

3.12.91 Low-loader trucks would be used periodically to move heavy plant initially to the spread at the start of the Works and then to move-around the pipeline spread as required.

3.12.92 The average workforce is anticipated to be approximately 250 during the peak period of construction, and from 12 to 125 during the off-peak, as illustrated in **Figure 3-31**.

Figure 3-31: Estimated Workforce during Construction Phase



3.12.93 Light Goods Vehicles (LGVs) would be used to transport the workforce from accommodation to the site compound and/or a road crossing point, at the start and end of the day using public roads. Further detail on likely traffic movements is provided in *Chapter 12: Traffic and Transport.*

3.12.94 An Outline Traffic Management Plan (TMP) will be prepared and submitted as part of the DCO application. This will provide details of procedures for construction related traffic including:

- Anticipated numbers of construction vehicles;
- Construction traffic routes;
- Frequency and timing and traffic movements;
- Workforce estimations, and
- Parking.

3.13 Preliminary Draft Construction Environmental Management Plan

3.13.1 A Preliminary Draft Construction Environmental Management Plan (CEMP) (*PEIR Volume IV Appendix 3.1*) has been prepared and will be updated prior to the DCO submission to ensure feedback from Statutory Consultation has been adequately addressed as appropriate. It will be submitted with the DCO application as the Draft CEMP.

3.13.2 The Draft CEMP provides the framework of environmental management during the construction phase and comprises of:

- **Project description:** a high-level description of the Project;
- **Construction programme:** a high-level description of the Project;
- **Environmental organisation and responsibilities**; sets out the key Contractor roles and responsibilities of parties involved in the construction of the Project. The Final CEMP(s) will include contact details for key members of staff;
- **Construction mitigation plans**; the plans and procedures that will be developed prior to construction to set out in detail the management systems and approach that will be implemented during construction to comply with the CEMP;
- **Consents and licences**; a schedule of the currently known consents and licences required for the Project. The Contractor(s) will be responsible for identifying any further statutory consents required for the construction, pre-commissioning and re-instatement of the Project;
- **Preliminary Mitigation Register**: identifies the project-specific commitments with reference to any relevant documentation and provides a framework within which all parties are aware of their responsibilities. It also provides a means of establishing a checklist of measures and the requirement for Method Statements and environmental risk assessments to be produced. The Mitigation Register will detail the responsible party for each commitment and mitigation measure to be undertaken;
- **Communications, inductions and training**: identifies how environmental issues will be communicated to all relevant parties, public communication and liaison, communication with other construction sites in the vicinity, inductions and training for construction workers;
- **Environmental monitoring and reporting**: includes details of audits, daily, weekly and monthly site inspections;
- **Record keeping:** describes the required documents and files to be produced; and
- **Design changes:** describes steps to take in the event of the Contractor(s) modifying the Project design.

3.13.3 Other outline management plans would be produced and appended to the Draft CEMP for the DCO submission such as an Outline Site Waste Management Plan.

3.13.4 The Draft CEMP will be developed by the Contractor, once appointed, into the Final CEMP, prior to the start of construction. The Final CEMP would be regularly reviewed throughout construction. The submission, approval and implementation of the Final CEMP will be secured by requirement of the DCO. An Operational Environmental Management Plan (OEMP) would also be developed by the Contractor and Decommissioning Environmental Management Plan (DEMP) produced prior to the decommissioning phase.

3.14 Operational Phase

3.14.1 The new pipeline is being designed in accordance with the requirements of the Pipeline Safety Regulations 1996. The pipeline would be operated continuously 24 hours a day.

3.14.2 The control room at the Immingham Facility would be manned 24 hours a day, seven days a week. Coverage of these manned hours would be provided by personnel on a shift rota that would be defined nearer project completion.

3.14.3 All other facilities (Block Valve Stations and the Theddlethorpe Facility) would be principally unmanned excepting periodic visits for maintenance and inspection. The frequency of such visits is yet to be determined but would be in line with equipment supplier recommendations and risk assessments.

Maintenance and Inspection

3.14.4 The pipeline and associated facilities are designed for minimal maintenance. Maintenance would be restricted to periodic equipment checks and equipment design would facilitate rapid repair or replacement in order to reduce downtime to a minimum. Pipeline inspections would be carried out at regular intervals using aerial surveillance and annual walkover of the route. The performance of the cathodic protection system would also be monitored.

3.14.5 Internal inspection via the use of intelligent PIGs would be undertaken as required.

3.14.6 The pipeline operation would be managed from the control room via connection to all monitoring and metering systems.

3.14.7 The Block Valve Stations would require a weekly inspection by one operative, with routine maintenance carried out by discipline engineers on a pre-planned basis. GRP Control Kiosks installed at each block valve would allow for local intervention/control when personnel are on site. The frequency of maintenance for each item is yet to be defined but would be based on equipment supplier recommendation and risk assessment.

3.14.8 The maintenance of the isolation valve located east of the former TGT site boundary would also be minimal and mainly depend on the choice of motive power for the valve. A bottled gas supply would potentially need to be inspected on a monthly basis, but this would be visual inspection only. There would be a need to change out the gas cylinder periodically. A hydraulic power source may need periodic draining and re-filling of the hydraulic fluids. An electrical operation would likely just need infrequent electrical checks. All of these options would only require a maximum of two workers and the use of hand tools or small powered hand tools.

Table 3-4: Maintenance Regime

Infrastructure	Maintenance / Inspection Activity	Indicative Frequency
Immingham Facility	Maintenance with depressuring venting	Every two years
Pipeline	Aerial surveillance survey	Fortnightly
Pipeline	Walkover of pipeline easement	Annual
Pipeline	In-line inspection (using PIG)	Every five years

Infrastructure	Maintenance / Inspection Activity	Indicative Frequency
Pipeline	Cathodic Protection System - monitored via test posts located on public highway	Every six months
Pipeline	Closed Interval Potential Survey (CIPS) line walk	Every five years
Block Valve Stations	Inspection	Weekly visits
Block Valve Stations	Maintenance visit	Every six months (over one-two days)
Theddlethorpe Facility	Maintenance with depressuring venting	Every two years
Isolation valve to the east of the former TGT site	Visual survey of valve surface works	Monthly

Operational and Maintenance Waste

3.14.9 The operational waste generated by the Project would be minimal due to the minor above ground infrastructure and staffing levels required, reducing daily waste generation.

3.14.10 As only the Immingham Facility would be routinely staffed by control room personnel, waste collection and recycle facilities will be present to manage the daily waste generation of paper, plastics and food.

3.14.11 The unmanned facilities (Block Valves and Theddlethorpe Facility) would be visited periodically, and routine waste will be removed by visiting personnel, so it does not accumulate unnecessarily.

3.14.12 The maintenance of major equipment is likely to require no more than a visit every two years. The waste streams generated from such maintenance may include:

- oils from valve gearboxes;
- hydraulic fluids from any hydraulic systems;
- seals from pig trap doors; and
- batteries from UPS backup systems.

3.14.13 Maintenance would be undertaken by contractors who would be instructed to bring any necessary materials with them and also to remove any waste generated. The contractor selection process will ensure that responsible companies are selected who fully understand any potential waste streams and will recycle and dispose of waste in a legally complaint manner.

Operational Vehicles

3.14.14 The need for, and potential number of, company vehicles is yet to be defined. However, it is likely that any required company vehicle will be of a 4x4 or LGV type. The company vehicles would likely be based at the CCR co-located within the existing control room of VPI Immingham and used by personnel to visit the unmanned facilities (Block Valve Stations and the Theddlethorpe Facility) for routine maintenance or inspections.

3.15 Decommissioning Phase

3.15.1 The Project has a design life of approximately 25 years, thought this could be extended. When appropriate, the pipeline and associated infrastructure would be decommissioned. The decommissioning programme would be developed in line with all applicable legislation and best practice in place at the time and would include engagement with relevant stakeholders and consultees as appropriate, to understand any possible re-use options for the pipeline and associated infrastructure.

3.15.2 The decommissioning strategy would apply to the Immingham Facility, the pipeline between Immingham and Theddlethorpe, including the Block Valve Stations, and associated equipment located at the Theddlethorpe Facility.

3.15.3 The detail of the decommissioning strategy would be developed nearer the time; however the following basic principles would be followed:

- All equipment would be isolated from sources of CO_2;
- All inventories would be removed from equipment and pipelines;
- The pipeline would be pigged, cleaned and subsequently air capped at both the Immingham and Theddlethorpe ends;
- All above ground facilities (Block Valve Stations, Immingham and Theddlethorpe Facilities) would be removed including any connections to local services such as power;
- In order to minimise disruption during the decommissioning phase, the pipeline would likely remain in-situ; and
- Any open ends of the pipeline would be capped and the remaining pipeline marked on all required maps and plans.

3.16 References

Ref 3-1 UK Government Net Zero Strategy: Build Back Greener (October 2021). Available at: https://www.gov.uk/government/publications/net-zero-strategy

Ref 3-2 Element Energy (2020) Humber Industrial Decarbonisation Roadmap. Available at: https://humberindustrialclusterplan.org/site_content/content/HIDR Local Emissions Assessment_final report June 2020.pdf

Ref 3-3 Planning Inspectorate's Advice Note 9: Using the '*Rochdale Envelope*'. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-nine-rochdale-envelope/

Ref 3-4 Planning Act 2008. Available at: https://www.legislation.gov.uk/ukpga/2008/29/contents

Ref 3-5 National Policy Statements for Energy Infrastructure. Available at: https://www.gov.uk/government/publications/national-policy-statements-for-energy-infrastructure

Ref 3-6 PD8010 Code of Practice for Pipelines – Part 1 Steel Pipelines on Land and constructed, operated and maintained in accordance with UK's Pipeline Safety Regulations (1996)

Ref 3-7 The Pipeline Safety Regulations 1996. Available at: https://www.legislation.gov.uk/uksi/1996/825/contents/made

Ref 3-8 The Construction (Design and Management) Regulations 2015. Available at: https://www.hse.gov.uk/construction/cdm/2015/index.htm

Ref 3-9 Health and Safety at Work etc Act 1974. Available at: https://www.hse.gov.uk/legislation/hswa.htm

Ref 3-10 The Management of Health and Safety at Work Regulations 1999. Available at: https://www.legislation.gov.uk/uksi/1999/3242/contents/made

Ref 3-11 Reporting of Injuries, Diseases and Dangerous Occurrences Regulation 2013. Available at: https://www.hse.gov.uk/riddor/#:~:text=RIDDOR%20%2D%20Reporting%20of%20Injuries%2C%20Diseases,dangerous%20occurrences%20(near%20misses).

Ref 3-12 PD8010-1: Pipeline Systems. Steel pipeline on Land, second Edition, March 2015

Ref 3-13 ASME B31.3 Code for Pressure Piping

Ref 3-14 IGEM/TD/13 Pressure regulating installations for Natural Gas, Liquefied Petroleum Gas and Liquefied Petroleum Gas/Air

Ref 3-15 API Specification 5L Specification for Line Pipe

Ref 3-16 ISO 15589-1 Petroleum, petrochemical and natural gas industries – Cathodic protection on pipeline systems, Part 1 On-land pipelines

Ref 3-17 IEC 61508/61511

Ref 3-18 BSI (2015) PD8010 Code of Practice for Pipelines – Part 1 Steel Pipelines on Land.