VikingCCS

Viking CCS Pipeline

Environmental Statement Volume II – Chapter 3: Description of the Proposed Development

Document Reference: EN070008/APP/6.2.3

Applicant: Chrysaor Production (U.K.) Limited,
a Harbour Energy Company
PINS Reference: EN070008
Planning Act 2008 (as amended)
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)
Date: October 2023

Harbour Energy | AECOM

PINS Reference	Document Reference	Document Revision	Date
EN070008	EN070008/APP/6.2.3	Revision 1	October 2023

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3. The Viking CCS Pipeline

3.1 Introduction

3.1.1 This chapter of the Environmental Statement (ES) provides a description of the Viking CCS Pipeline, (hereafter referred to as 'the Proposed Development'), for the purposes of identifying and reporting the potential environmental impacts and likely significant effects.

3.1.2 The description includes the design of the Proposed Development that is the subject of the DCO application. Further detailed design of the Proposed Development will take place during the Front-End Engineering Design (FEED) which will work within the parameters identified within this chapter and shown in the Works Plans (*Application Document 4.2*). The chapter also describes how the Proposed Development would be constructed, operated and decommissioned.

3.1.3 The chapter is split into the following sections:

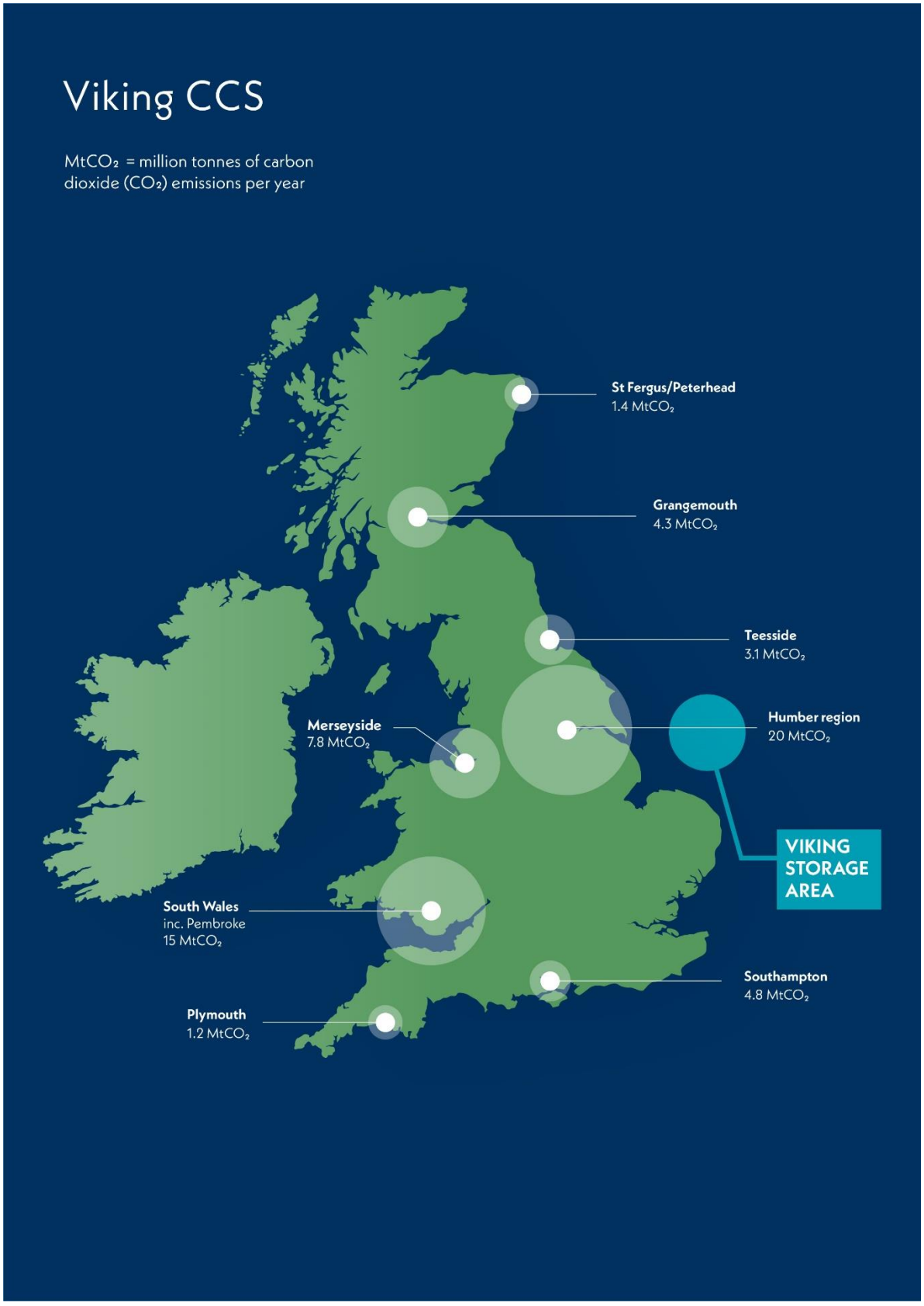
- Section 3.1 is this section, which provides an introduction and sets out the context of the Proposed Development and how it fits into the overall Viking CCS Project and wider U.K. government targets for net zero;
- Section 3.2 identifies some of the key terms that are used in the ES when describing the Proposed Development;
- Section 3.3 provides a description of the wider Viking CCS Project, of which the Proposed Development forms a key element, as well as outlining key design parameters;
- Section 3.4 provides an overview of the key components of the Proposed Development;
- Section 3.5 provides an overview of the key safety considerations relevant to the Proposed Development;
- Sections 3.6 to 3.11 provide more detailed information on each of the key components of the Proposed Development;
- Section 3.12 provides information about the construction of the Proposed Development, including the proposed construction methods and programme;
- Section 3.13 includes information on the Draft Construction Environmental Management Plan (CEMP);
- Section 3.14 includes details on the operational phase of the Proposed Development; and
- Section 3.15 provides an overview of the outline Decommissioning Strategy for the Proposed Development.

General Overview

3.1.4 As part of their commitments to tackling climate change, the UK government via the Climate Change Act (Ref 3-30) has set legally binding targets to achieve net-zero by 2050 for England and Wales. This commitment is further strengthened by the information provided in section 3.5 of the Draft EN-1 (Ref 3-7) which states that There is an urgent need for new carbon capture and storage (CCS) infrastructure to support the transition to a net zero economy.

3.1.5 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 carbon dioxide (CO2) (MtCO2) across the economy, including 6 MtCO2 of industrial emissions, per year, by 2030 (Ref 3-1). Further information is presented within the Planning Statement (*Application Document 7.1*). Key industrial emission hotspots are shown in **Figure 3-1**.

Figure 3-1: Industrial Emission Hotspots in the U.K.



3.1.6 The Humber industrial cluster represents a unique emissions density within the UK, with approximately 20 million tonnes of CO_2 equivalent (CO_2e) emitted each year (Ref 3-2). Decarbonisation of the Humber region 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. Promoting and enabling future regional collaboration, 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 The overall Viking CCS Project intends to transport compressed and conditioned CO_2 received at the Immingham Facility to store in depleted gas reservoirs in the Southern North Sea.

3.1.9 The Crown Estate is responsible for granting leases for offshore pipeline transportation, seabed and subsurface rights to developers for carbon dioxide storage, with the regulation of projects being carried out by the licensing authority, the North Sea Transition Authority (NSTA). NSTA regulates offshore carbon dioxide storage and is the licensing authority. NSTA approve and issue storage permits – and maintains the carbon storage public register. Chrysaor Production (U.K.) Limited (a subsidiary of Harbour Energy, the Applicant) was awarded the Applicant a CO_2 appraisal and storage licence in 2021 (CS005 licence). The Viking CCS Project aims to transport and store up to 10 million tonnes of CO_2 annually by 2030, rising to 15 million tonnes by 2035.

3.1.10 Further information on the wider Viking CCS Project and the wider Humber region is contained within the report entitled "*Viking CCS – Transforming the Humber into a net zero Super Place*" (Ref 3-3).

3.1.11 The CO_2 to be transported in the Viking CCS Pipeline will be captured, conditioned and compressed by emitters, including Phillips 66 and VPI Immingham.

3.1.12 The main elements of the overall Viking CCS Project, into which the captured CO_2 will enter (**Figure 3-2**), comprise:

- The Viking CCS Pipeline (i.e., the Proposed Development to which this ES relates), which consists of the Immingham Facility, an onshore pipeline from Immingham to Theddlethorpe with three Block Valve Stations, the Theddlethorpe Facility, and an offshore pipeline tie-in and outlet up to Mean Low Water Springs (MLWS). This forms the basis of this DCO application;
- Transportation, via the existing and repurposed Lincolnshire Offshore Gas Gathering System (LOGGS) pipeline (the existing offshore pipeline), from the MLWS tide mark, to approximately 120 kilometres (km) offshore, along with the development of an additional 28 km subsea pipeline spur extension;
- Installation of a Not Permanently Attended Installation (NPAI) containing injection facilities, including wellheads; and
- The utilisation of world class storage potential within the depleted gas reservoirs in the Viking area of the southern North Sea for CO_2 injection and storage, with an independently verified storage capacity of 300 million tonnes. The Viking reservoirs are located approximately 140 km offshore in the Southern North Sea (SNS) and 2.7km beneath the seabed. The depth of storage, combined with a regional "Superseal" caprock, makes the reservoirs secure for storing captured CO_2. The caprock is made up

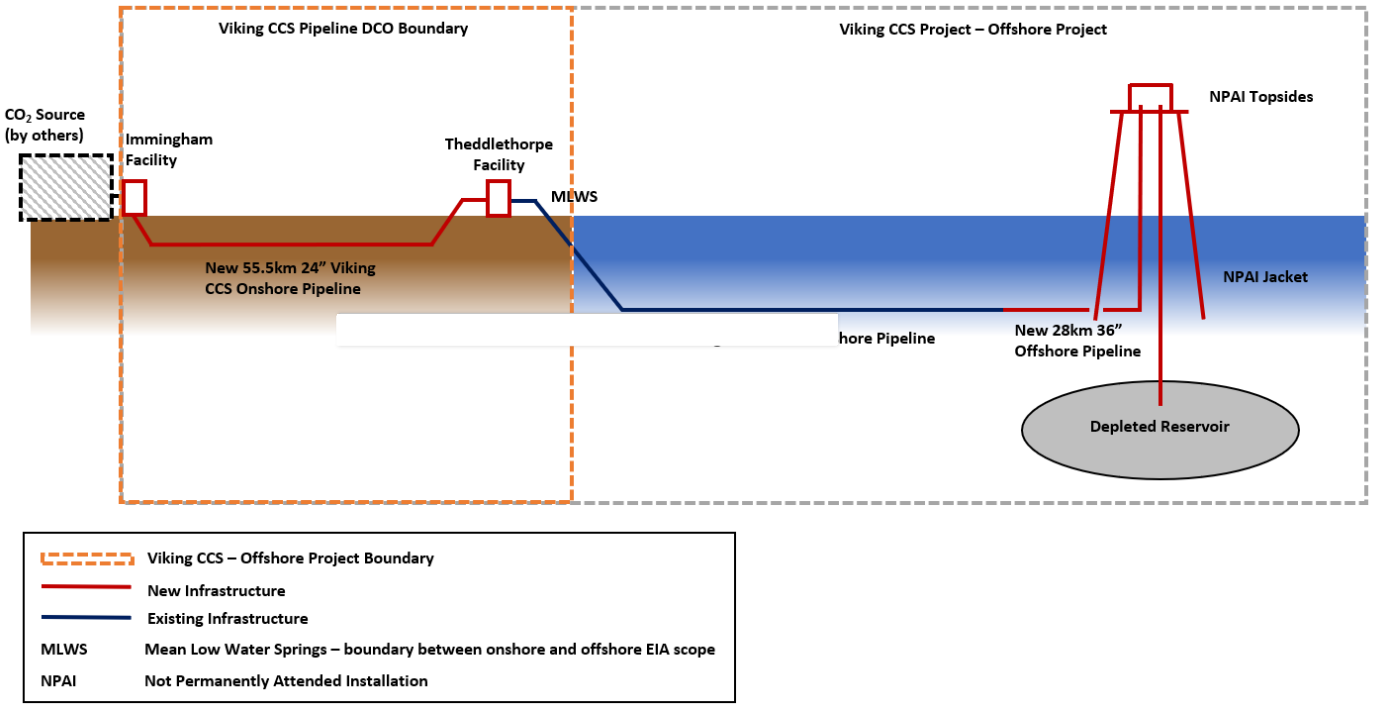
primarily of layers of salt, hundreds of feet thick, which acts as a high-strength barrier through which the CO_2 cannot pass. This caprock gives Harbour a high confidence in the ability of the storage site to keep CO_2 in place. Furthermore, a secondary permeable formation above the primary storage site, known as the Bunter Sandstone, has the capability to act as secondary containment which adds to the security of the site.

3.1.13 The offshore elements of the overall Viking CCS Project are governed by The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 (Ref 3-31), which requires the undertaking of an EIA and the production of an ES for offshore developments, including activities related to the storage of CO_2. Currently, as of summer 2023, a Scoping Report has been prepared and baseline and assessment work is currently underway which will form part of the ES. Following acceptance of the ES, consent may be granted by the Secretary of State via the licencing authority. This lies outside the scope of this ES.

3.1.14 This ES only covers the ***Viking CCS Pipeline*** from the point of receipt of CO_2 at the Immingham Facility, through its onshore transportation in the new onshore pipeline to the Theddlethorpe Facility, and onward transportation through the existing LOGGS pipeline, down to MLWS. Subsequent transmission beyond MLWS would be part of a separate consent application.

3.1.15 The estimated overall cost to construct the Viking CCS Pipeline is approximately £200 million.

Figure 3-2: Schematic of the Viking CCS Project



3.1.16 The Viking CCS Offshore Project and the Viking CCS Pipeline project boundaries overlap in the intertidal zone. The intertidal zone is defined as the area where the ocean meets the land between high and low tides. This is the land between Mean Low Water Spring (MLWS) and Mean High Water Spring (MHWS). The Proposed Development's DCO Site Boundary ends at MLWS, where the Offshore Project commences.

3.1.17 However, it is worth noting that no work is anticipated in this location at all for either the onshore, or offshore projects as the project in this location only consists of the existing buried LOGGS pipeline.

3.2 Key Terms used in this ES

3.2.1 The following key terms are used throughout this ES:

- **The Proposed Development:** The Proposed Development is comprised of the onshore elements of the wider Viking CCS Project (i.e., 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 pipeline to MLWS tide mark. Onward transmission seaward of MLWS and storage offshore will be subject to a separate consent application;
- **DCO Site Boundary:** The DCO Site Boundary comprises the outer limits of both the temporary and permanent land take required for construction and operation of the Proposed Development for which powers are sought through the DCO. For the majority of the pipeline route the DCO Site Boundary is 100m wide. The use of the term 'DCO Site Boundary' is interchangeable with the term 'Order limits' which is used in other DCO documents and figures; and
- **Working Width:** The working width is the construction corridor within which all construction activities would occur. For the majority of the pipeline route, this is set at 30 metres, expanding up to 50 metres at certain crossing points, whilst reducing below 30 metres at other sensitive locations.

3.3 Development Envelope / Design Parameters

3.3.1 The Planning Inspectorate's Advice Note 9: Using the '*Rochdale Envelope*' (Ref 3-4), provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008 (Ref 3-5). 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 3-6) 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 have been considered in preparing the DCO application (Ref 3-32).

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 Development Consent Order (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 metres (m), and the pipeline construction working width would be a maximum of 30 m along the majority of the route, located within the limits of deviation. The only exceptions to this would be at major crossings of roads, railways or watercourses where the working width may be greater than 30 m. In most areas the limits of deviation are contiguous with the DCO Site Boundary/draft Order limits and so are not presented on the majority of figures prepared for this Environmental Statement (ES).

3.3.4 Design parameters have been developed for the ES and are presented in the following sections. Design parameters, including the draft Order limits are also provided within the DCO (*Application Document 2.1*) and Works Plans (*Application Document 4.2*). When presenting the design information for the Proposed Development in the subsequent

sections, the requirements of The Planning Inspectorate's Advice Note 9 has been complied with to ensure that the likely significant effects of the Proposed Development are assessed on a reasonable worst-case basis.

3.3.5 Where feasible however, mitigation measures have been incorporated into the design of the Proposed Development such that they inform its detailed design and/or the approach to its construction. Embedded measures have been defined through an iterative process of assessment and design-development, the aim being to mitigate impacts and effects as much as possible through good design and avoidance of any sensitive areas where practicable.

3.3.6 This approach has accordingly provided opportunities to prevent or reduce adverse effects by designing-in measures from the outset and defining the actions and control that will be applied during construction. Embedded mitigation for example includes routeing and siting work which was undertaken to avoid sensitive areas as well as more practicable measures such as the use soil storage as screening, segregation of soil types (topsoil and subsoil) for reuse, sequential phasing to limit the extent of works at any one time and planting to reinstate sections of hedgerow or trees removed during the construction stage of the Proposed Development.

3.3.7 Throughout the ongoing design process, consideration has been given to a range of design options. Design decisions have, where relevant, been informed by environmental appraisal and assessment work and by consultation with stakeholders, and the design has evolved through a continuous process of environmental assessment, consultation, and development.

3.4 Viking CCS Pipeline – Key Components

3.4.1 Key components of the Viking CCS Pipeline comprise the following:

- Immingham Facility, described in more detail in Section 3.6;
- Approximately 55.5 km buried 24 inch (") onshore steel pipeline (including cathodic protection), described in more detail in Section 3.7;
- Three Block Valve Stations, described in more detail in Section 3.8;
- Theddlethorpe Facility - Option 1 and Option 2 are described in more detail in Section 3.10;
- Existing LOGGS Pipeline to the extent of the DCO Site Boundary and the Dune Isolation Valve, described in more detail in Section 3.11;
- Temporary Works – construction compounds, temporary access points, described in more detail in Section 3.12; and
- Other Works - permanent access, mitigation works, landscaping described in more detail in Sections 3.12 and 3.13.

3.4.2 The location of each of these facilities are shown on **Figure 3-3**. Additionally, a summary list of the key components split by each Local Planning Authority is included in Table 3-1.

3.4.3 It is also worth noting that where appropriate, the pipeline route presented within the ES on a number of figures have shown the pipeline route split into 5 sections. This is solely to assist in describing baseline conditions present across the length of the pipeline route.

Table 3-1: Key Components of the Proposed Development split by Local Authority

Local Authority	Key Component of the Proposed Development	Temporary or Permanent
North Lincolnshire Council	Northern Construction Compound	Temporary
	Immingham Facility	Permanent
	Pipeline – approximately 1km	Permanent
North East Lincolnshire Council	Central Construction Compound	Temporary
	Washingdales Lane Block Valve Station	Permanent
	Thoroughfare Block Valve Station	Permanent
	Pipeline – approximately 22km	Permanent
West Lindsey District Council	Pipeline – approximately 2km	Permanent
East Lindsey District Council	Southern Construction Compound	Temporary
	Louth Road Block Valve Station	Permanent
	Theddlethorpe Facility	Permanent
	LOGGS Pipeline (Existing)	Permanent
	Dune Isolation Valve (to be replaced)	Permanent
	Pipeline – approximately 30km	Permanent

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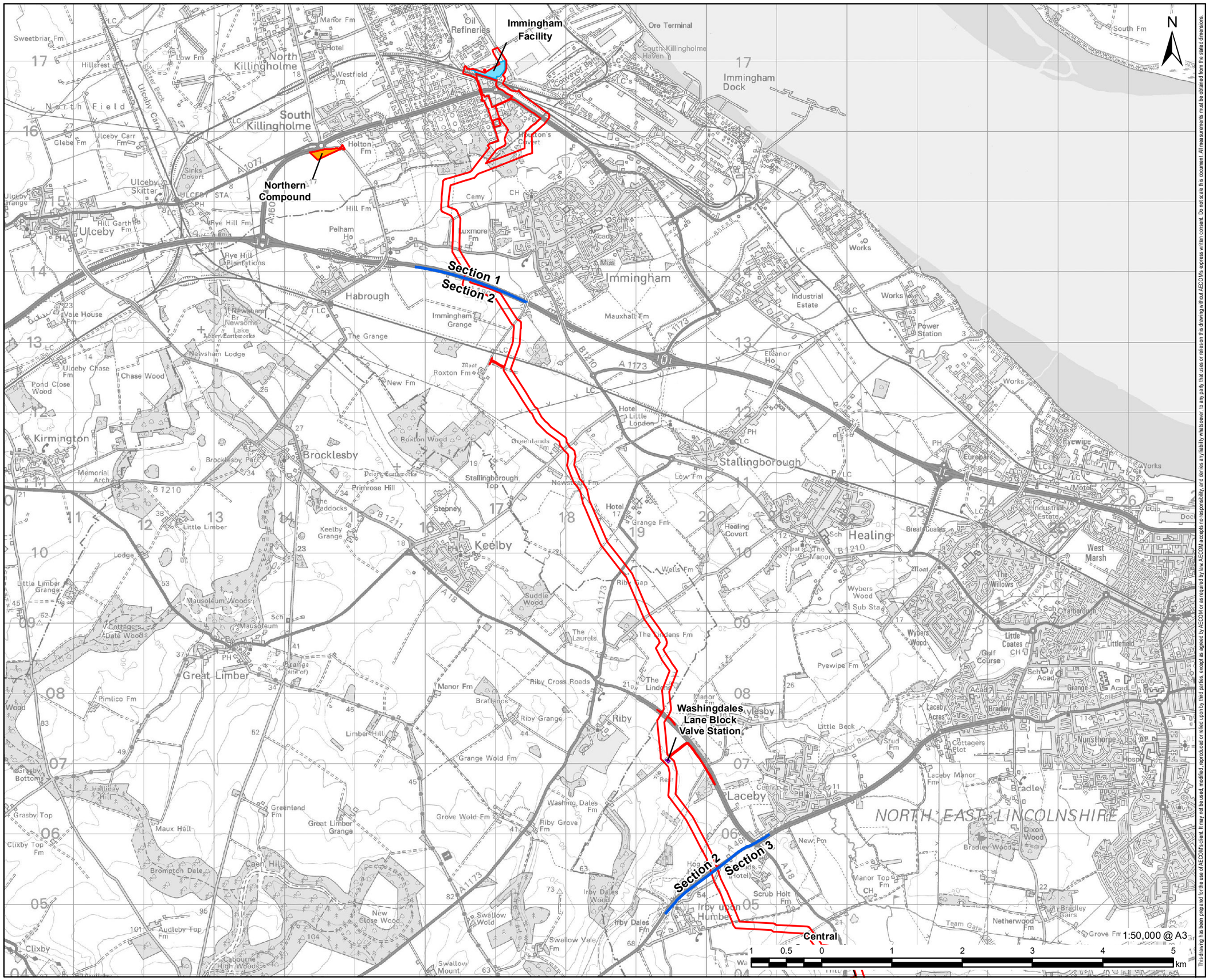

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LEGEND

- DCO Site Boundary
- Route Section Break
- Temporary Construction Compound
- Block Valve Station
- Immingham Facility

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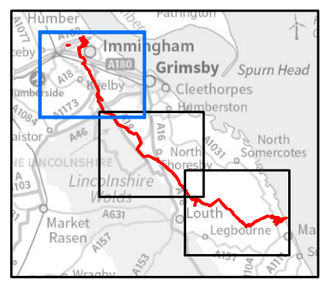

FIGURE TITLE

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

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Central Compound

Thoroughfare Block Valve Station

Section 3

Section 4

1:50,000 @ A3

1 0.5 0 1 2 3 4 5 km

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Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Temporary Construction Compound
- Block Valve Station

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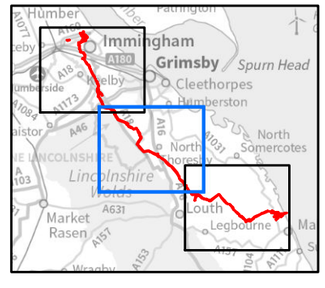

FIGURE TITLE

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

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Louth Road Block Valve Station

Section 4

Section 5

Theddlethorpe Facility Option 2

Theddlethorpe Facility Option 1

Dune Isolation Valve

Southern Compound

1 0.5 0 1 2 3 4 5 km

1:50,000 @ A3

N

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PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Dune Isolation Valve
- Temporary Construction Compound
- Block Valve Station
- Theddlethorpe Facility

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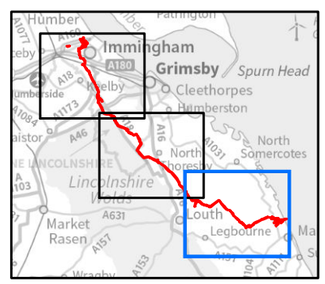

FIGURE TITLE

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

ISSUE PURPOSE

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3.5 Safety

3.5.1 The Applicant, as part of the Harbour Energy Group, will operate in accordance with the Group's well established health and safety policies. Harbour has extensive experience in the construction and operation of similar type infrastructure.

Overview

3.5.2 Safety is the key priority for the Proposed Development throughout the construction, operation, maintenance and decommissioning of the pipeline. The Applicant operates responsibly, securely and in accordance with applicable regulation across all their activities and the pipeline will meet (and in some cases exceed) all current UK safety and operational regulations. The Applicant always 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.

3.5.3 The Applicant will ensure that the pipeline is designed, constructed and operated in accordance with the Pipeline Safety Regulations 1996 and other relevant standards and guidance as outlined in paragraphs 3.7.20.

Responsibility

3.5.4 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, 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 uses 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

3.5.5 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 strives 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.

3.5.6 Harbour Energy has extensive experience of safely managing facilities that have a major accident potential, such as at the former Theddlethorpe Gas Terminal, which has been gained through the operation of its heritage companies in the U.K. 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.

3.5.7 Harbour Energy is 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 promotes robust regulator and public engagement to ensure correct design and planning are demonstrated to all stakeholders throughout the project lifecycle.

3.5.8 Harbour Energy is consulting with the Health and Safety Executive (HSE) as they develop the Viking CCS Pipeline, in particular on the risk management and safety management systems for carbon dioxide transport and storage.

3.5.9 During operation regular inspections will ensure the system is maintained free from defects or damage and in a safe condition to operate. There will be 24-hour monitoring of the pipeline operations and facilities will be provided to enable routine internal inspection of the pipeline and its wall thickness.

3.5.10 The Applicant will ensure that marker posts are installed along the pipeline route for operations/maintenance reasons and, if applicable, for emergency services, in keeping with good practice, 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.

3.5.11 The overall Viking CCS Project has robustly applied the design requirements of PD 8010 for the onshore pipeline. Within the UK there is a robust framework of legislation and good practice for the construction and operation of pipelines. Whilst the Viking CCS Pipeline is not subject to major accident hazard (MAH) regulations or best practice, the decision was taken by Harbour Energy to design the pipeline on the basis that the MAH regulations and guidance did apply.

3.5.12 The Applicant is taking a robust design approach and has chosen to exceed the current UK design requirements (i.e., PD8010) by selecting a higher design factor for the entire length of the pipeline route, further emphasising their commitment to safety. In opting to specify heavy wall pipe in remote locations, a significant benefit will be increased robustness of the pipeline, where potential causes of failure could be instigated by accidental damage by agricultural or third party activities. Additionally, the selection of heavy wall pipe for the entire route will eliminate transition sections between standard/heavy wall pipe, which will facilitate a more efficient welding process with the associated improvement in weld quality, productivity and reliability and thus safety.

3.6 Immingham Facility

Overview

3.6.1 The first component of the Proposed Development will consist of the Immingham Facility to be located on vacant brownfield land to the south of the VPI Immingham site, formerly used as a construction laydown area for the Immingham power station. This facility would require a relatively small area, consisting of approximately 1.0 hectares (10,000 m^2). The photograph in **Figure 3-4** shows the current nature of the site, looking south away from the existing VPI facilities, whilst the area within which the Immingham Facility would be located, is shown on **Figure 3-5**.

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 and connection to the Proposed Development would be performed by the emitters themselves, such as at the Humber refinery operated 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 under the Town and Country Planning Act 1990 which are currently being determined by the LPA (North Lincolnshire Council) and, as such, these works do not form part of the Proposed Development. Each emitter would also undertake flow metering and compositional analysis to an agreed specification.

3.6.3 The final layout of the Immingham Facility will not be defined until the FEED is undertaken. One potential configuration of the Immingham Facility is shown on **Figure 3-6**, whilst **Figure 3-7** provides an illustration. Although the exact location has yet to be finalised, the Immingham Facility will be to the south of the VPI CO_2 capture facilities, somewhere within the area shown on **Figure 3-5**.

Figure 3-4: Existing site photograph of the proposed Immingham Facility location

3.6.4 The Immingham Facility would include the following key components:

- Inlet manifold with valve access platform;
- Permanent pig launcher and receiver 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, which includes a projectile blast wall;
- High-integrity pressure protection system (HIPPS);
- Emergency Shutdown Valve (ESDV) for each pipeline and Isolation valves;
- Venting system including vent pipework, valves and vent stack. Permanent vent stack to be a maximum of 24” diameter and up to 25 metres high;
- Various instruments installed on the pipework, including temperature, pressure and flow measurement;
- Central control room (CCR);
- Local equipment room (LER);
- Analyser house; and
- Supporting utilities.

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

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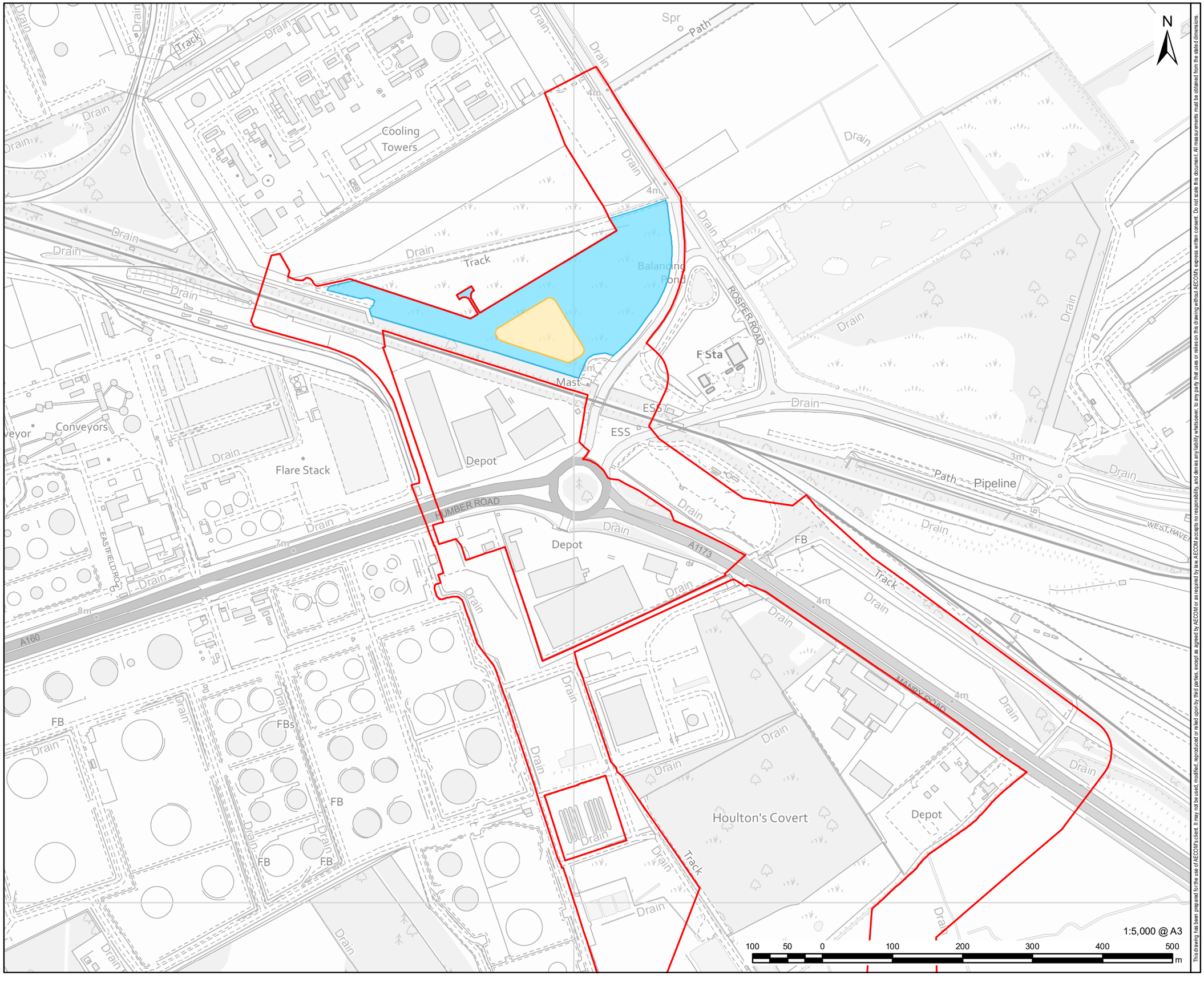

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LEGEND

- DCO Site Boundary
- Indicative Immingham Facility Footprint
- Area in which the Immingham Facility will be located

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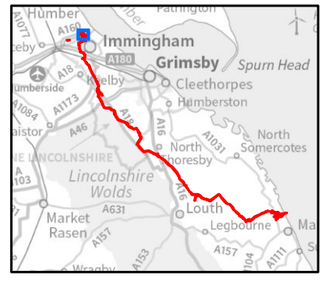

FIGURE TITLE

Figure 3-5
Indicative Location of the Immingham Facility

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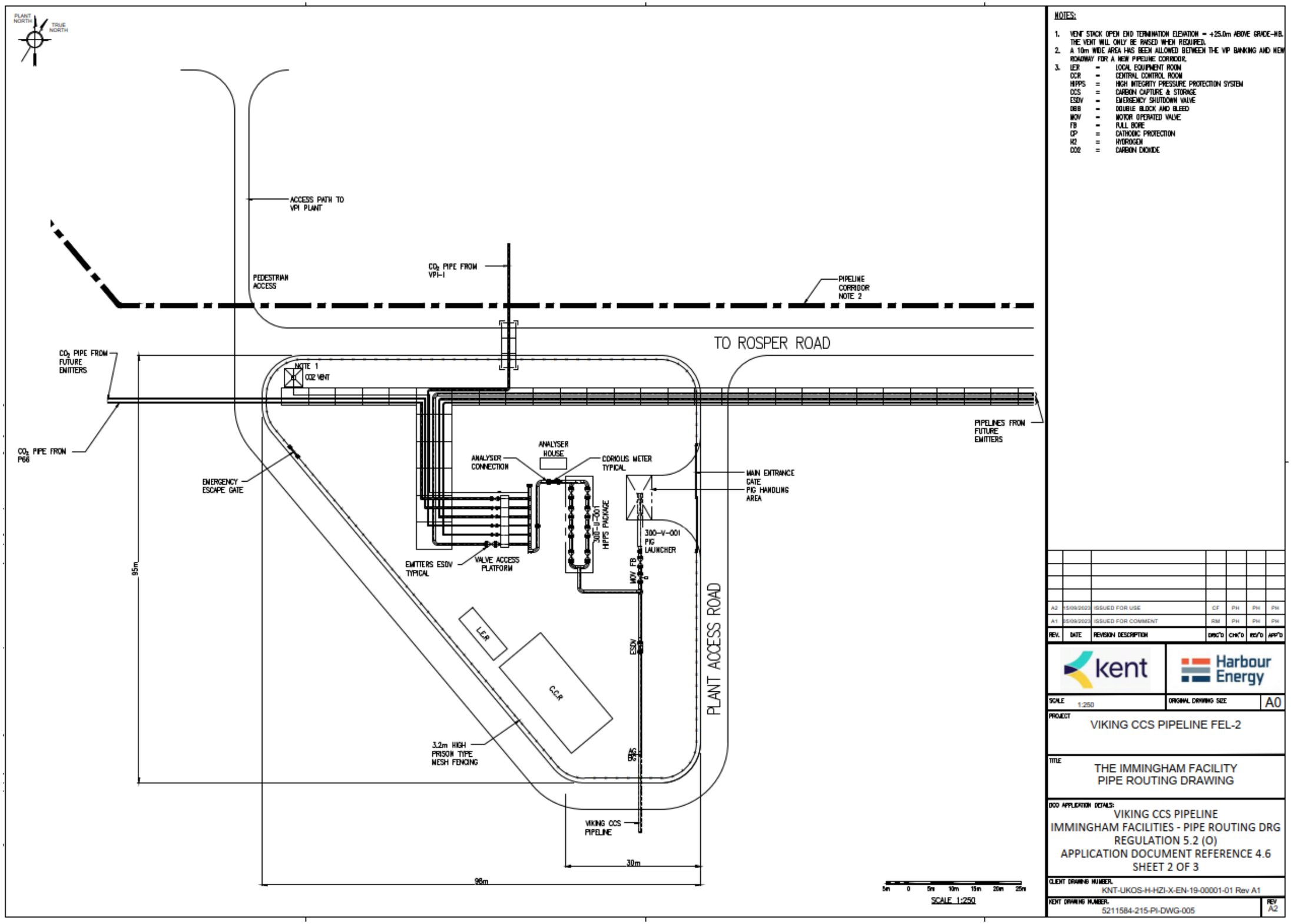
Figure 3-6: Indicative Layout of the Immingham Facility



NOTES:

1. VENT STACK OPEN END TERMINATION ELEVATION = +25.0m ABOVE GRADE-NB. THE VENT WILL ONLY BE RAISED WHEN REQUIRED.
2. A 10m WIDE AREA HAS BEEN ALLOWED BETWEEN THE VP BANKING AND NEW ROADWAY FOR A NEW PIPELINE CORRIDOR.
3. LER = LOCAL EQUIPMENT ROOM
   CCR = CENTRAL CONTROL ROOM
   HIPPS = HIGH INTEGRITY PRESSURE PROTECTION SYSTEM
   CCS = CARBON CAPTURE & STORAGE
   ESDV = EMERGENCY SHUTDOWN VALVE
   DBB = DOUBLE BLOCK AND BLEED
   MOV = MOTOR OPERATED VALVE
   FB = FULL BORE
   CP = CATHODIC PROTECTION
   H2 = HYDROGEN
   CO2 = CARBON DIOXIDE

REV.	DATE	REVISION DESCRIPTION	DRG'D	CHK'D	REV'D	APP'D
A2	15/09/2023	ISSUED FOR USE	CF	PH	PH	PH
A1	05/09/2023	ISSUED FOR COMMENT	RM	PH	PH	PH

kent | Harbour Energy

SCALE 1:250 | ORIGINAL DRAWING SIZE A0

PROJECT
VIKING CCS PIPELINE FEL-2

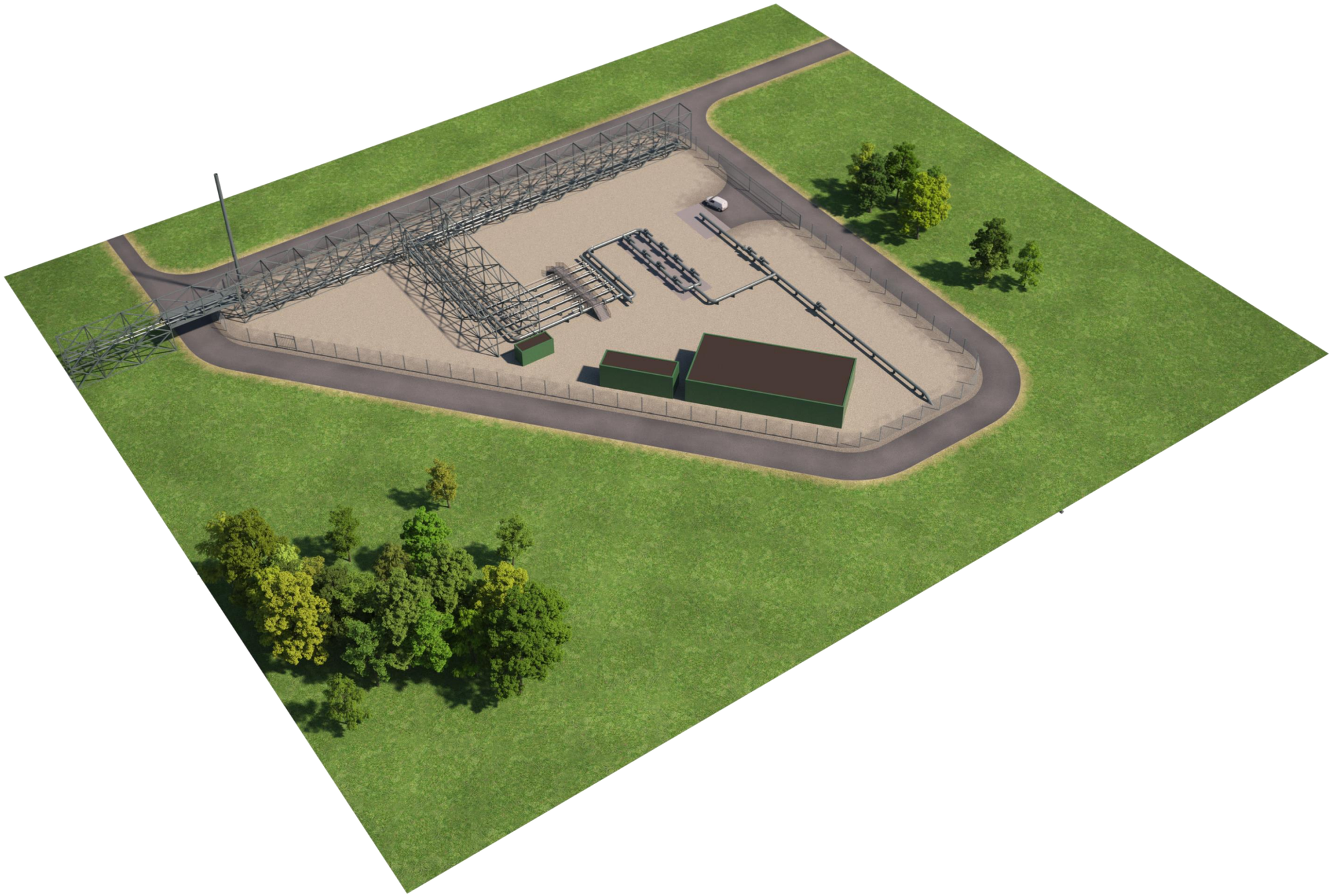
TITLE
THE IMMINGHAM FACILITY
PIPE ROUTING DRAWING

DCO APPLICATION DETAILS:
VIKING CCS PIPELINE
IMMINGHAM FACILITIES - PIPE ROUTING DRG
REGULATION 5.2 (O)
APPLICATION DOCUMENT REFERENCE 4.6
SHEET 2 OF 3

CLIENT DRAWING NUMBER.
KNT-UKOS-H-HZI-X-EN-19-00001-01 Rev A1

KENT DRAWING NUMBER.
5211584-215-PI-DWG-005 | REV A2

Figure 3-7: CGI Illustration of an indicative configuration for the Immingham Facility



3.6.6 The ground surface within the boundary of the Immingham Facility will be predominantly stone with a minimal number of internal tarmac/concrete access roads. Temporary construction access to the site will be via one of two potential access points from Rosper Road, whilst permanent access would be from a location as agreed with Phillips 66 and VPI Immingham, also off Rosper Road.

3.6.7 A brief description of each of the key components at the Immingham Facility is included in the following sections.

Inlet Manifold

3.6.8 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 (circa 14 m x 2 m) is provided to allow maintenance on the valve actuators installed on each incoming pipeline. Future proofing of the Proposed Development is important, which is why lines from other potential emitters are shown on **Figure 3-6** which may seek to feed into the system in the future.

Pig Launcher/Receiver

3.6.9 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 launcher/receivers are used for inserting pigs into a pipeline then launching, receiving at the other end, and finally removing them without flow interruption.

3.6.10 The Immingham Facility would have a pig launcher associated with the pipeline to the Theddlethorpe Facility. When required a pig is loaded into the launcher and the door sealed closed. The CO_2 in the pipeline will be used to convey the pig along the length of the pipeline from Immingham to Theddlethorpe. The isolation valves allow this process to be completed whilst the pipeline remains operational. The valves on the bypass pipework are opened to pressurise the launcher, and once the launcher has equalised the pig trap isolation valve is opened and main pipework isolation valve closed to direct all flow through the launcher and therefore propel the pig into the pipeline.

3.6.11 A pig receiver may also be installed at the Immingham Facility for potential future expansion that is not part of this DCO.

3.6.12 There will be a common pig handling area where pigs can be safely loaded or unloaded. The pig receiver and launcher will be equipped with safety interlocks to ensure that the doors cannot be opened whilst there is residual pressure present. However, for safety reasons, in the extremely unlikely scenario that these systems do not operate correctly a blast wall will be provided. The blast wall is designed as a 20m long and 5m high structure made of concrete or steel.

Emergency Shutdown Valves (ESDV)

3.6.13 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

3.6.14 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

3.6.15 A high-integrity pressure protection system (HIPPS) consists of a series of ESDVs. The ESDVs would automatically close in response to a high pressure being detected. Additionally, 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

3.6.16 A new stand-alone vent stack will be required to be used to de-pressure facilities for maintenance and pigging operations or for wider pipeline de-pressurisation requirements; all such venting requirements are expected to be infrequent. The height of the required vent stack is elevated at up to 25 m above ground level. The diameter of the vent stack is expected to be 24”. For more information on the venting systems, refer to section 3.9.

Local Equipment Room

3.6.17 The local equipment room (LER) is proposed 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 ensure that there is an uninterrupted power supply (UPS). The instrument equipment room would house a series of cabinets which marshal all local Input/Output (I/O) cables into a single point to allow data cables to be routed back to the Central Control Room. There would also be a desk with workstation available in the instrument room.

Analyser House

3.6.18 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

3.6.19 The system will be operated from a permanently attended Central Control Room (CCR). This is expected to be co-located within the existing control room of VPI Immingham and so is not part of the DCO application. However, if required it could alternatively be housed within the LER, within the Immingham Facility.

3.6.20 The CCR would receive all necessary data to enable key parameters to be monitored such that the plant remains within operational limits.

Supporting Utilities

3.6.21 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 will be supplied by VPI;
- Water for emergency shower will be supplied by VPI;
- Nitrogen, to purge the analysers and sample points, as well as purging the pig launcher/receiver prior to opening, will be supplied by Nitrogen gas bottles; and
- Local venting / draining for the pig launcher and analysers.

3.6.22 The power requirement is estimated to be 70 kilowatts (kW) and will likely be supplied by Immingham combined heat and power plant operated by VPI (Vitol). An alternative electrical connection is included off the eastern side of Rosper Road.

3.6.23 Switchboard and protection devices shall be rated to supply the entire load required on the site, as determined in load assessment calculations.

3.6.24 In order to either limit or avoid interruption to electricity supplies, a back-up uninterruptable power supply (UPS) system arrangement will be housed in the LER in order to maintain the operability and functionality of the site. The back up power supply will cover the continued operation of key equipment, control systems, lighting and other apparatus, following a failure of the normal supply and in order to ensure the safe, satisfactory shutdown of the plant and allow restarting in the shortest time.

Lighting

3.6.25 The Immingham Facility would be lit outside of daylight hours, similar to the existing VPI Immingham and Phillips 66 site in the immediate vicinity.

3.7 Onshore Pipeline

Route Refinement

3.7.1 Further safety, engineering design and environmental work has been undertaken since the original EIA Scoping Report was prepared in spring of 2022. In particular, the design has been further developed as a result of feedback received during the Non-Statutory Consultation undertaken between April and June, and September and October 2022, and from the Statutory Consultation which ran from 22 November 2022 to 24 January 2023. Further details on how the route evolved is included in *ES Volume II Chapter 2: Design Evolution and Alternatives* (*Application Document 6.2.2*) and feedback to the consultation is summarised in *ES Volume II Chapter 4: Consultation (Application Document 6.2.4)*, with further details provided in the Consultation Report (*Application Document 5.1*).

DCO Site Boundary

3.7.2 The onshore pipeline will be designed in accordance with PD8010 Code of Practice for Pipelines – Part 1 Steel Pipelines on Land (Ref 3-7) and constructed, operated and maintained in accordance with Pipeline Safety Regulations 1996 (Ref 3-9). The key design standards, codes and regulations relevant to the design of the Proposed Development are listed in paragraph 3.7.20.

3.7.3 The DCO Site Boundary for the application has been developed around an indicative pipeline route. The length of the indicative route within the DCO Site Boundary is approximately 55.5 km and is shown in **Figure 3-8**.

3.7.4 To aid in the presentation of baseline information along the pipeline route, the DCO Site Boundary has been arbitrarily separated into five sections (Sections 1-5), split by road junctions. A summary of the key features of each section are described in **Table 3-2**.

Table 3-2: Key Features of the DCO Site Boundary

Section	Description
Section 1 – Immingham Facility to A180	*Option 1:* The pipeline leaves the tie-in at the Immingham Facility, crosses Humber Road (twice) and the railway line, and then runs parallel to Manby Road before crossing it south of the Immingham Calor Cylinder Distribution site, heading in a south westerly direction north of Immingham towards the former Immingham Golf Club (closed in 2018), which would be crossed in a more westerly direction using a trenchless technique. The pipeline then continues to travel westwards before changing direction southwards towards Mill Lane which it then crosses, before crossing Harborough Road between the Old School House and Luxmore Farm. Finally, the route then continues southwards and crosses the A180.

Section	Description
	Option 2: If, via discussions with Philips 66, it is viable to route the pipeline through the Humber Refinery site, the pipe would exit between Houlton's Covert and Children's Avenue (which would be crossed using a trenchless technique) towards the south east. The route would then continue until it reached the alignment of the route as detailed in option 1 above.
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 Stallingborough 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/south west to cross the A18 to the west of Aylesby. 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 for a distance of approximately 2.34 km. It exits the AONB by crossing the A18 for a second time. From here, it continues in a south-easterly direction paralleling the AONB boundary to the west of Barnoldby le Beck, crossing Beelsby 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 the Theddlethorpe Facility (Option 1 or Option 2). On exiting the Theddlethorpe Facility 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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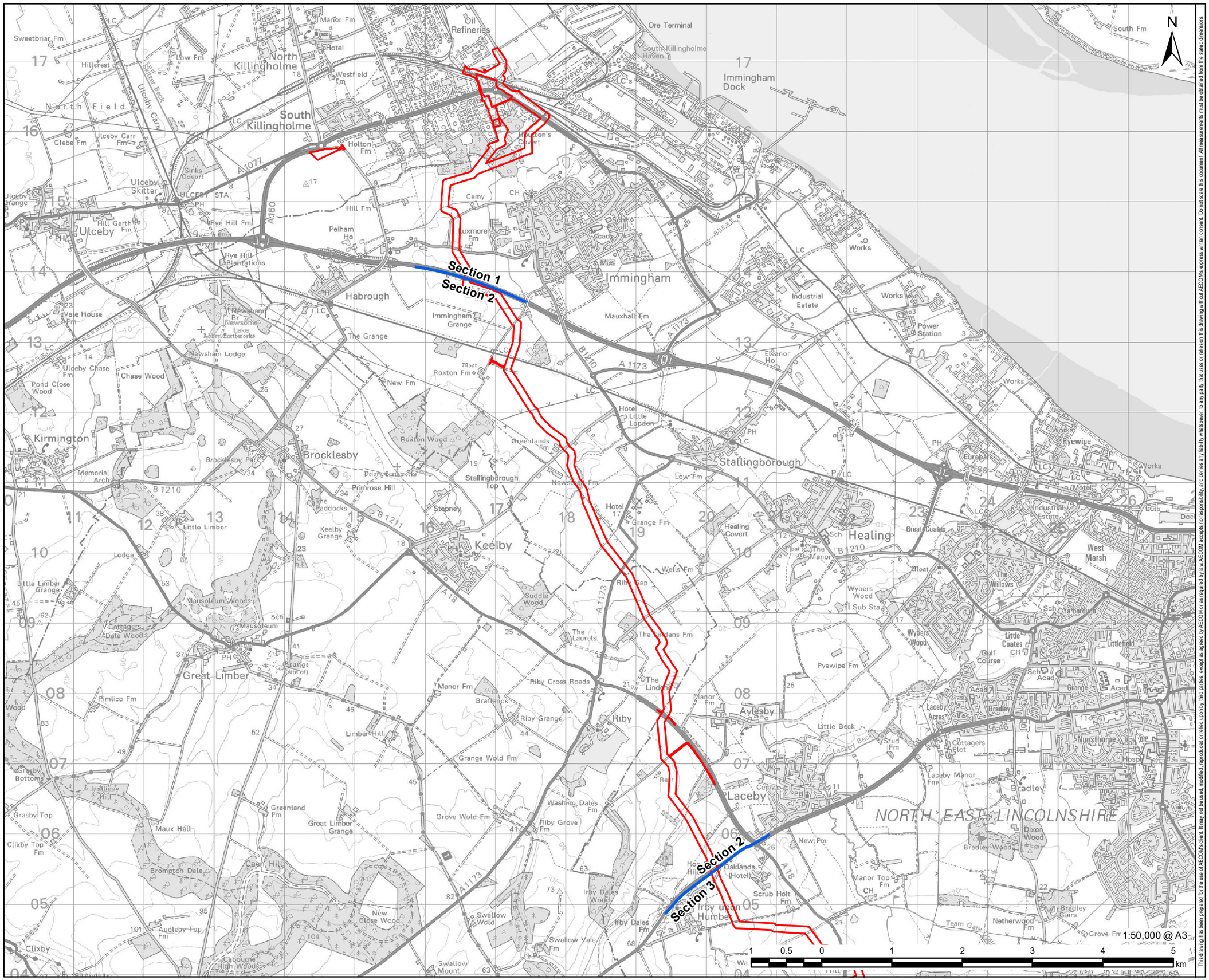

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Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break

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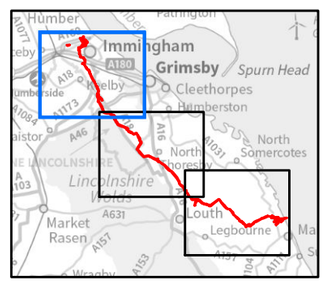

FIGURE TITLE

Figure 3-8 (1 of 3)
DCO Site Boundary

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

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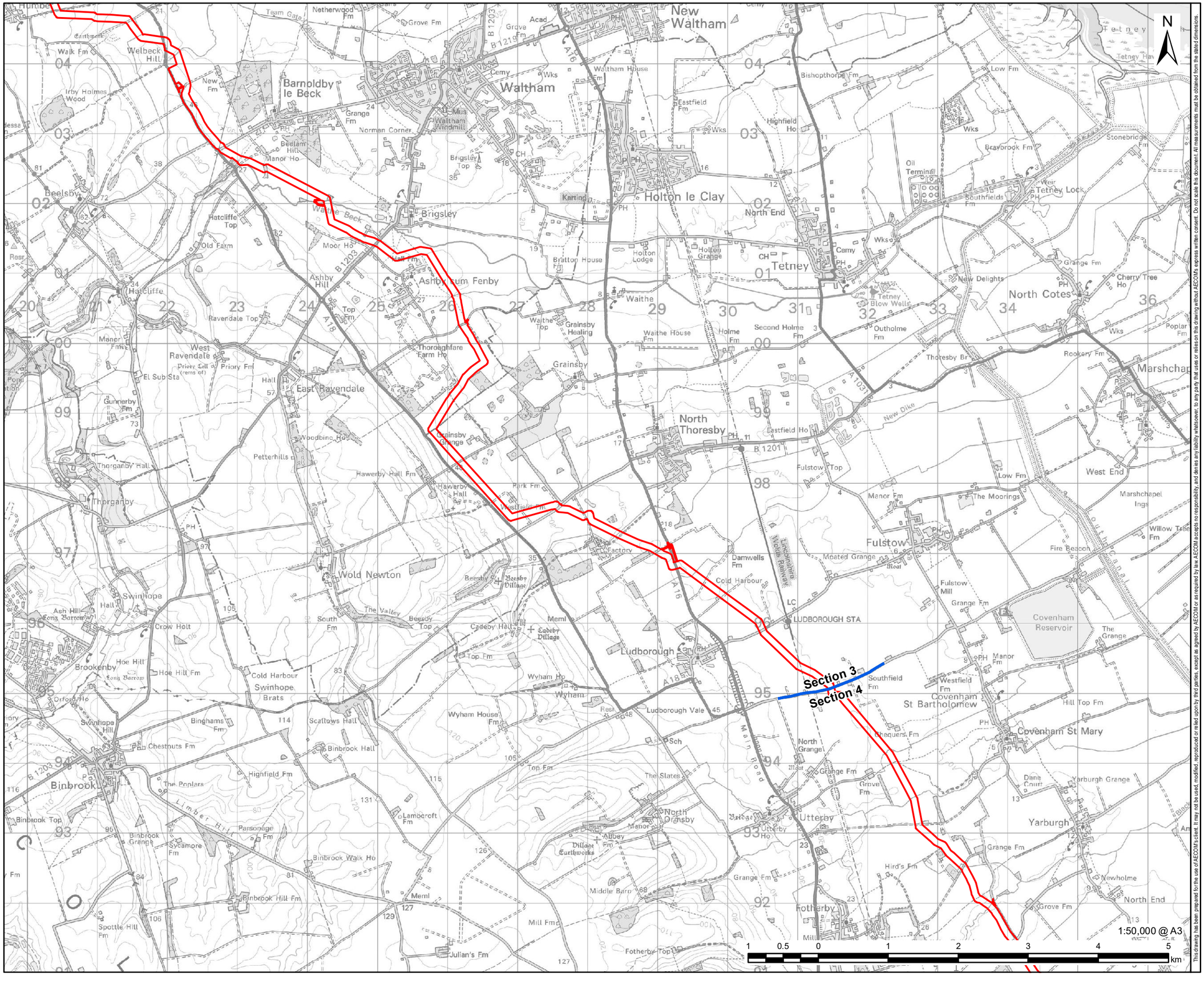

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LEGEND

- DCO Site Boundary
- Route Section Break

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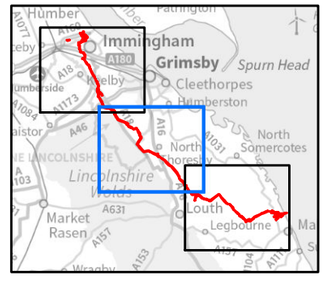

FIGURE TITLE

Figure 3-8 (2 of 3)
DCO Site Boundary

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

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Section 4

Section 5

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PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break

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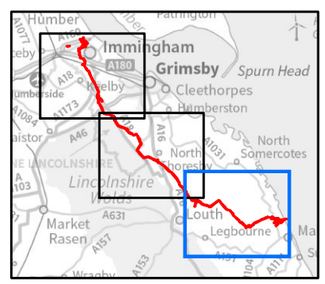

FIGURE TITLE

Figure 3-8 (3 of 3)
DCO Site Boundary

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230914_ES_3-8

Pipeline design

3.7.5 As stated in section 19.4.5, HSE guidance on Conveying Carbon Dioxide in Pipelines (Ref 19-28) in connection with carbon capture and storage projects, the application of good practice at the design stage is an essential part of any ALARP demonstration. The Proposed Development will be designed, constructed, operated and maintained in line with the Pipeline Safety Regulations (1996) (Ref 19-9), PD8010 Code of Practice for pipelines – part 1 steel pipelines on land (Ref 19-38) and with current best practise standards.

3.7.6 PD8010 is published by the British Standards Institute, which is the recognised UK National standards body. PD8010 provides recommendations for the design, selection, specification and use of materials, routeing, construction, installation, testing, operation, maintenance and abandonment of land pipeline systems constructed from steel, including carbon dioxide pipelines.

3.7.7 *ES Volume II: Chapter 2 Design Evolution and Alternatives* (*Application Document 6.2.2*) outlines some of the key design decisions that were made as the Proposed Development evolved, many which were focussed on impact avoidance measures. Particular examples included the drive to avoid more densely populated areas as well as routeing to avoid sensitive ecological and statutory designated sites.

3.7.8 Safety has been key to the design of the Proposed Development. The engineering team has undertaken a number of initial technical studies which have helped to influence the pipeline routeing and the location of key Above Ground Installations including the block valves (which act as emergency shutdown valves).

Pipeline Characteristics

3.7.9 The pipeline will be designed for a minimum operational life of 25 years. 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 design life of 25 years to align with the manufacturers recommended lifespan for equipment. However, through regular maintenance and refurbishment the operational lifespan of the Proposed Development is likely to be well in excess of 25 years, if it were required.

3.7.10 The pipeline is expected to have an external diameter of 24” (609 mm) 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.

3.7.11 The pipeline will be constructed in its entirety using thick wall steel pipe. This would consist of either API 5L X70, 24” (DN 600) line pipe with a wall thickness of 29.98mm, or API 5L X80, 24" (DN600) line pipe with a wall thickness of 24.89mm or an equivalent pipeline material.

3.7.12 The external coating for the pipeline will be either three-layer polyethylene (3PLE) or Fusion Bonded Epoxy (FBE) with a simple multi-component liquid or three-layer polypropylene (3LLP) coating applied to protect field joints and tie-ins.

3.7.13 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 where both gas and dense phase flow occur simultaneously 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.

3.7.14 Dense phase CO_2 transport enables a more efficient transport of mass of CO_2 per pipeline size. The Viking CCS pipeline has been sized to materially decarbonise the Humber and Lincolnshire area. The maximum capacity of the pipeline when operating at the maximum allowable operating pressure is 17mtpa. The development of the CO_2 capture industry in the Humber and Lincolnshire region is foreseen to increase over the decade from 2027 to the late 2030s as UK-based industries seek to decarbonise. The base case for the Viking CCS pipeline is to reach 10-to-11mtpa flow rate by 2030 and then gradually increase in flow rate through the 2030s.

3.7.15 Gas phase CO_2 transport limits the mass of CO_2 that can be transported for a similar pipeline size. Analysis of the Viking CCS pipeline indicates that for the same 24” diameter pipeline (6 m) which could transport 17mtpa in the dense phase, would be limited to less than 4mtpa in the gas phase. Transport in the gas phase only would therefore potentially require multiple gas phase pipelines to reach the same target flowrate, needed for the decarbonisation of the Humber region, compared to a single dense phase pipeline for an equivalent capacity.

3.7.16 The quantity of CO_2 transported through the pipeline has the potential to increase as more emitters bring their capture plants online. The CO_2 transportation profiles have been estimated for low, medium and high ramp up scenarios giving an estimated 6, 10 and 18 million tonnes of CO_2 transported per year respectively.

Pipeline Crossings

3.7.17 A summary of the anticipated crossing numbers and types are provided in **Table 3-3**. Details of the construction techniques expected to be used, whether open cut or trenchless, are identified with a written description of the different types of trenchless or open cut crossings provided in section 3.12.146 onwards.

3.7.18 **Table 3-4** provides an overview of the total number of different crossing types. It is important to note that some of these crossings incorporate more than one crossing (e.g., a Drain, road, cable can all be crossed with one crossing method), hence why the total number provided is lower than that shown in **Table 3-4**.

Table 3-3: Preliminary Crossing Types and Numbers

Crossing type	Trenchless crossings	Open Cut crossings	Total
Buried powerlines	5	7	12
Overhead powerlines	1	23	24
Buried pipelines including: Water pipelines; Wastewater pipelines; Gas pipelines; and Condensate pipelines	8	19	27
Telecoms cables	1	3	4
Hornsea No1 cable and Hornsea No2 cable	0	2	2
Roads	40	6	46
Tracks	0	8	8
Railways	2	0	2
Drains	39	90	129
Rivers	10	2	12
Canal	1	0	1
Total number of crossings			**267**

Table 3-4: Proposed Crossing Methods

Crossing Method	Quantity of crossings
Horizontal Directional Drilling (HDD)	**4**
Guided Auger Bore	**6**
Traditional Auger Bore	**48**
Open Cut	**136**
Open cut (Overhead Powerlines)	**23***
Total	**217**
* Note, 24 are included in crossing schedule, but one of the O/H power lines is included as part of an HDD crossing	

3.7.19 **Figure 3-9** identifies the key crossings along the DCO Site Boundary. A higher resolution version of the same Figure is provided in *ES Volume III: Figures (Application Document 6.3*).

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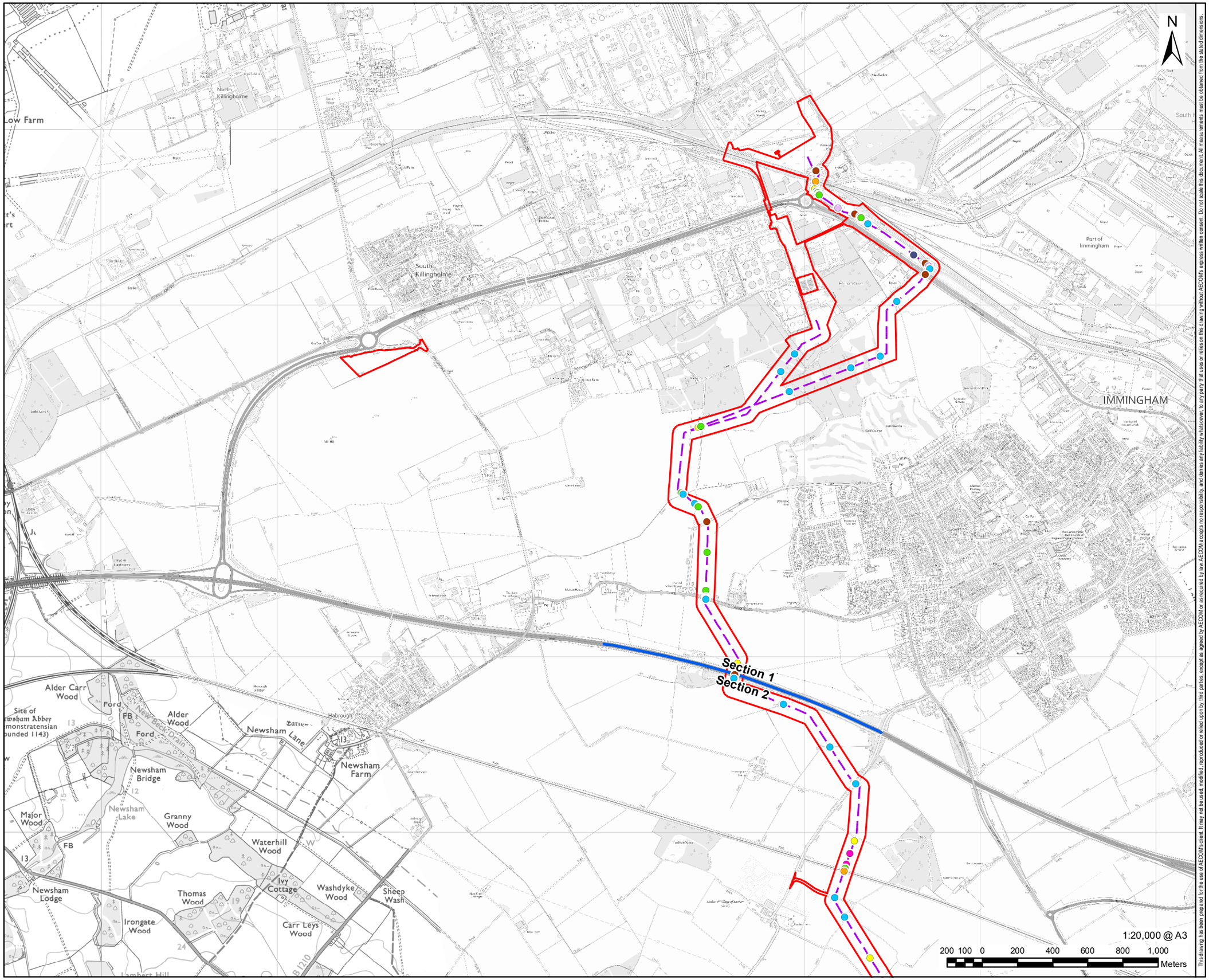

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PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

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

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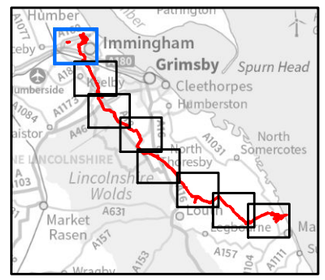

FIGURE TITLE

Figure 3-9 (1 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

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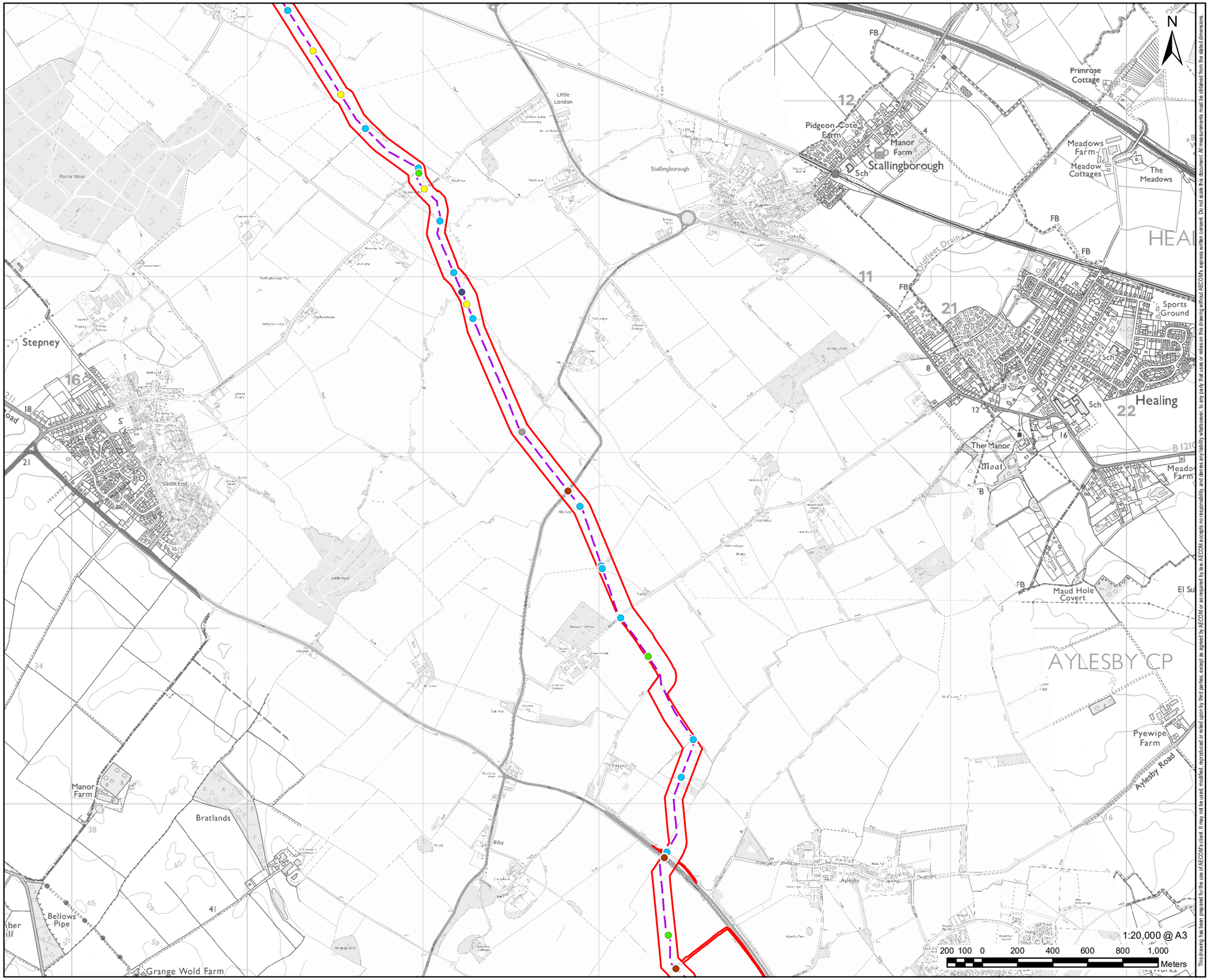

VikingCCS

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PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

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

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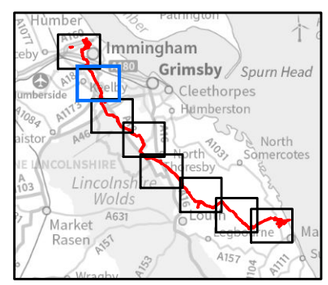

FIGURE TITLE

Figure 3-9 (2 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

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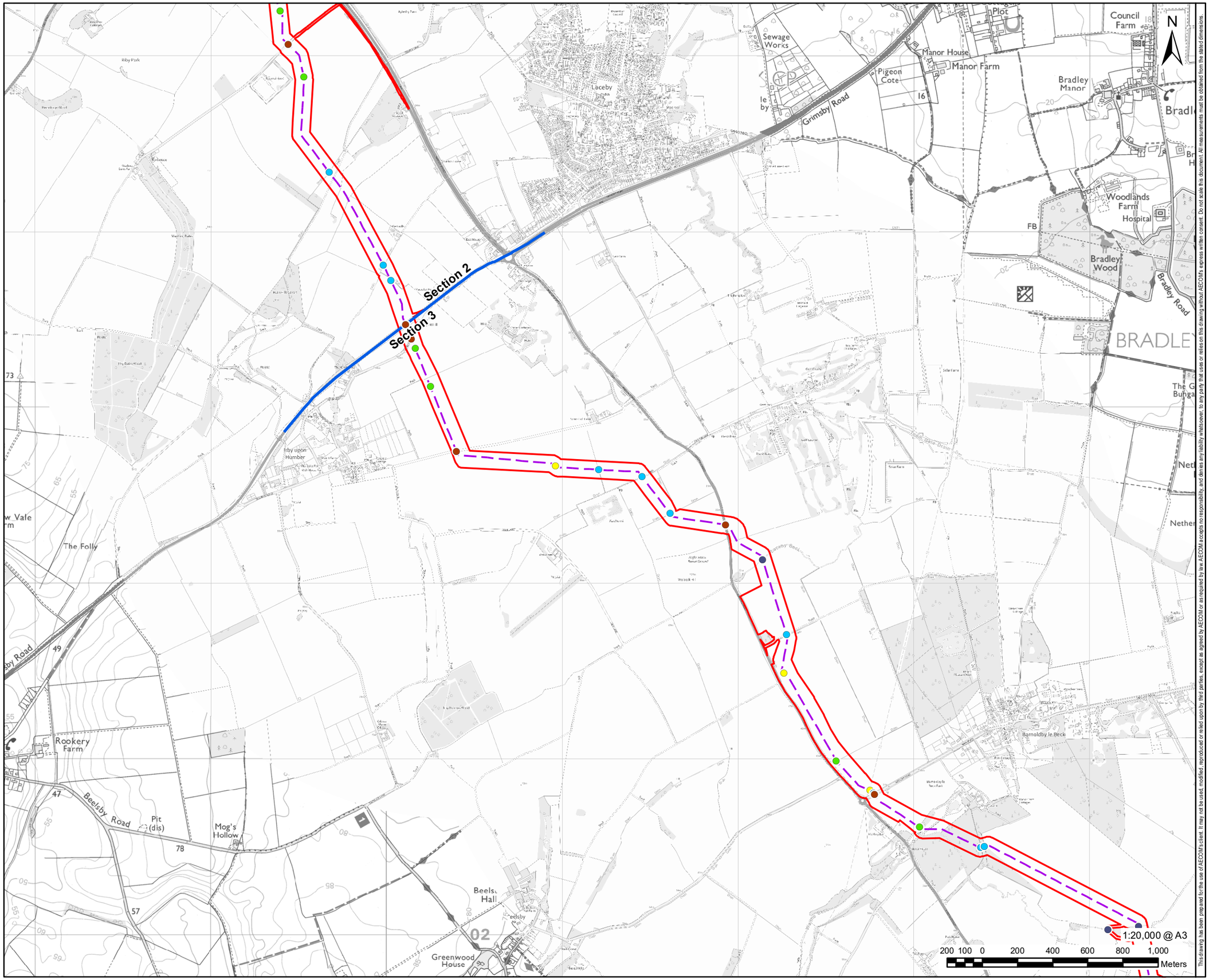

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

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

NOTES:
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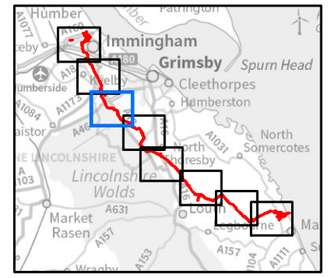

FIGURE TITLE

Figure 3-9 (3 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-9

Revision: 3 Drawn: LC Checked: HT Approved: MW Date: 2023-10-23

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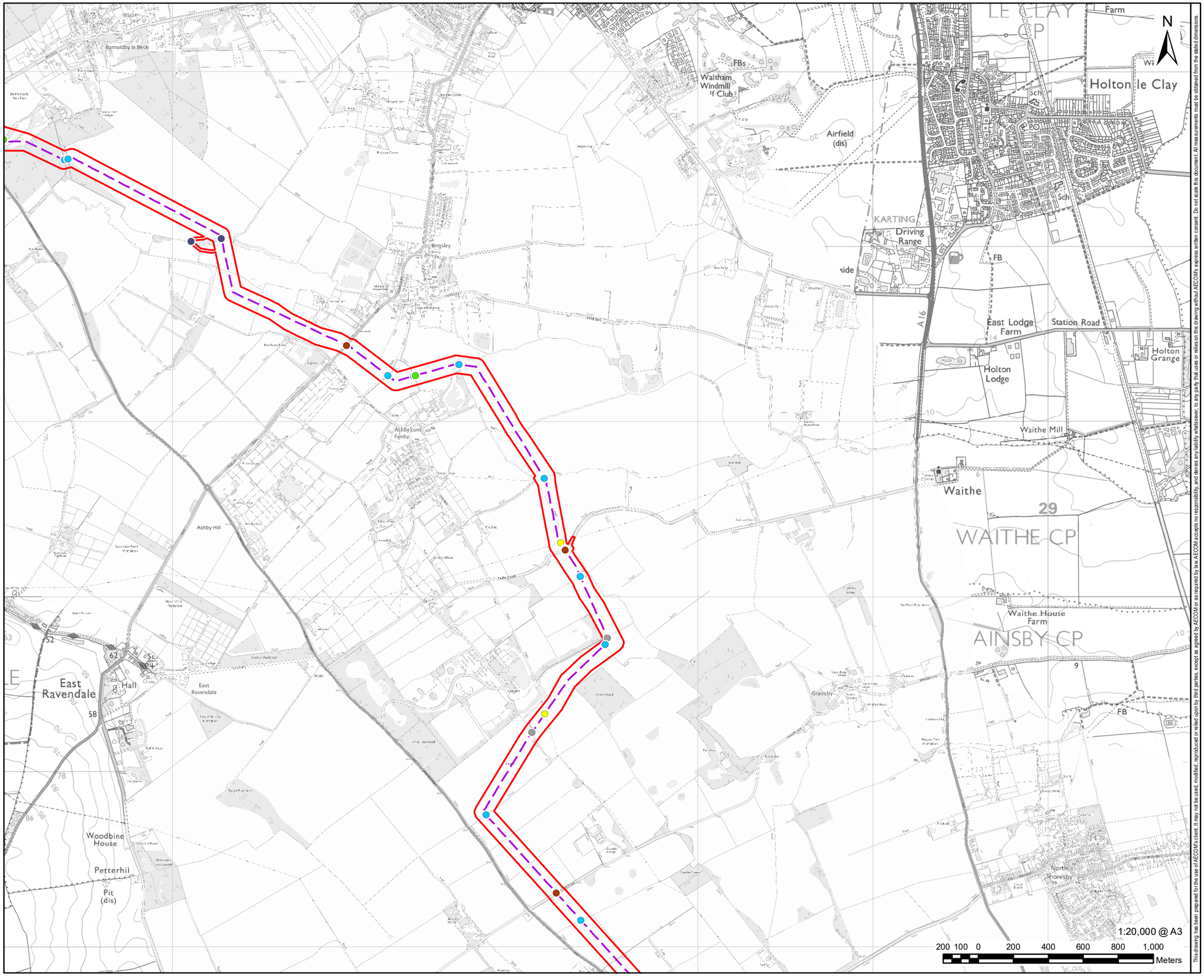

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

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

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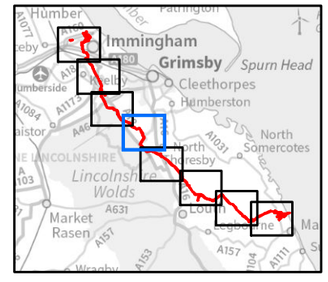

FIGURE TITLE

Figure 3-9 (4 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-9

Revision: 3 Drawn: LC Checked: HT Approved: MW Date: 2023-10-23

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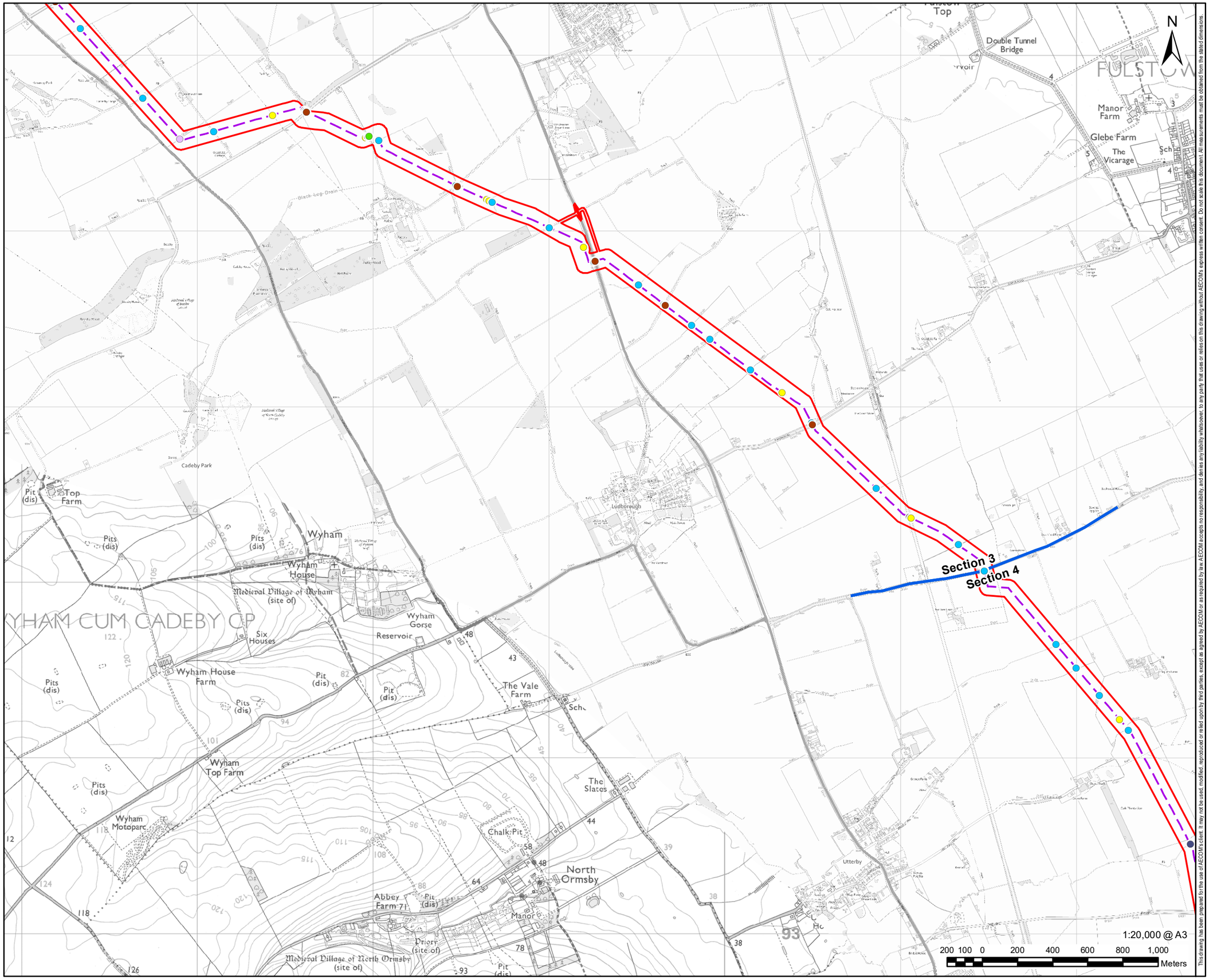

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

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

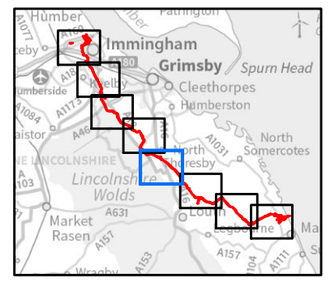

FIGURE TITLE

Figure 3-9 (5 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-9

Revision: 3 Drawn: LC Checked: HT Approved: MW Date: 2023-10-23

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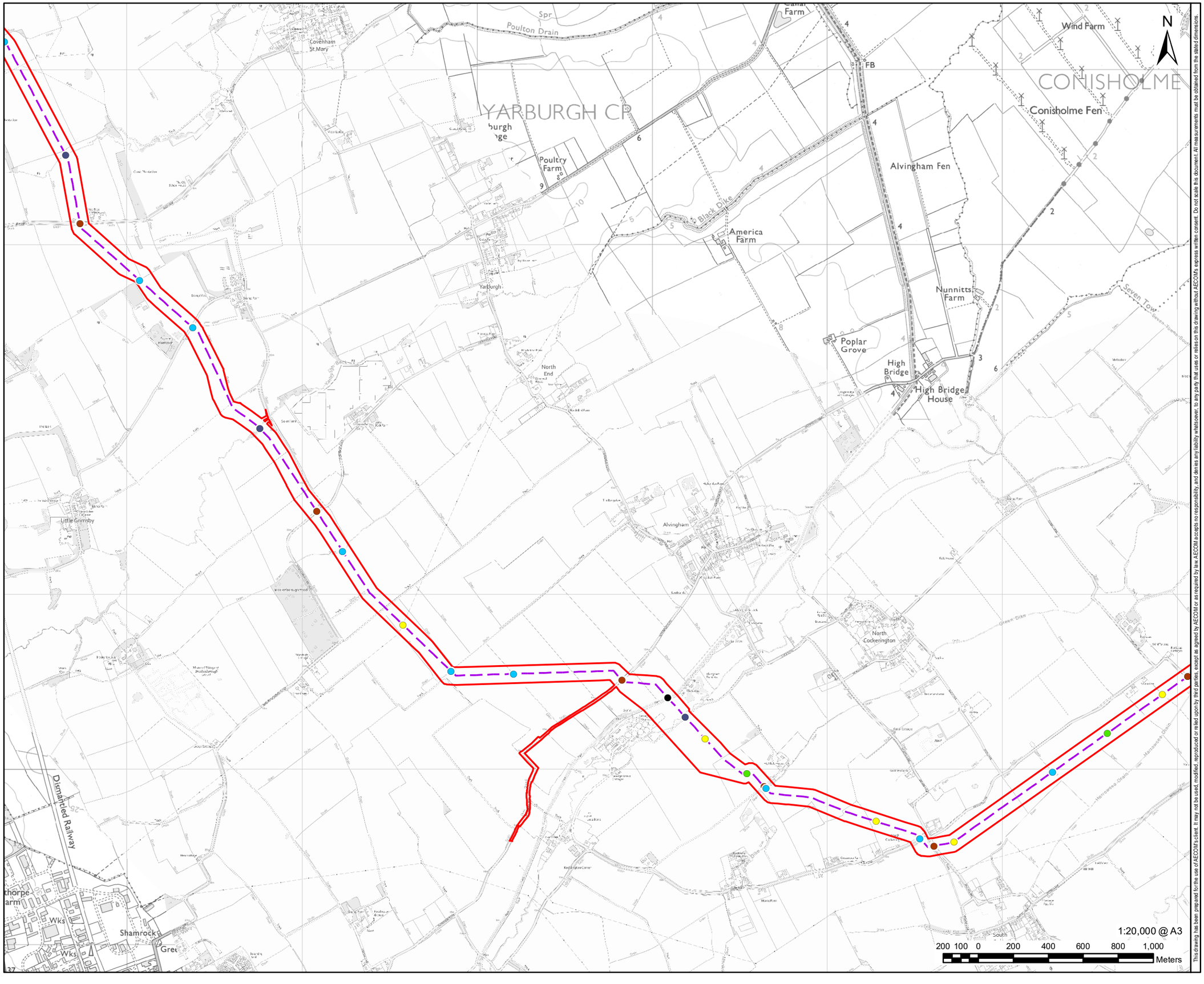

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

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

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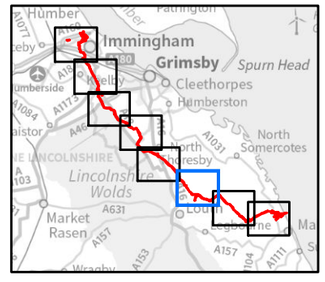

FIGURE TITLE

Figure 3-9 (6 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

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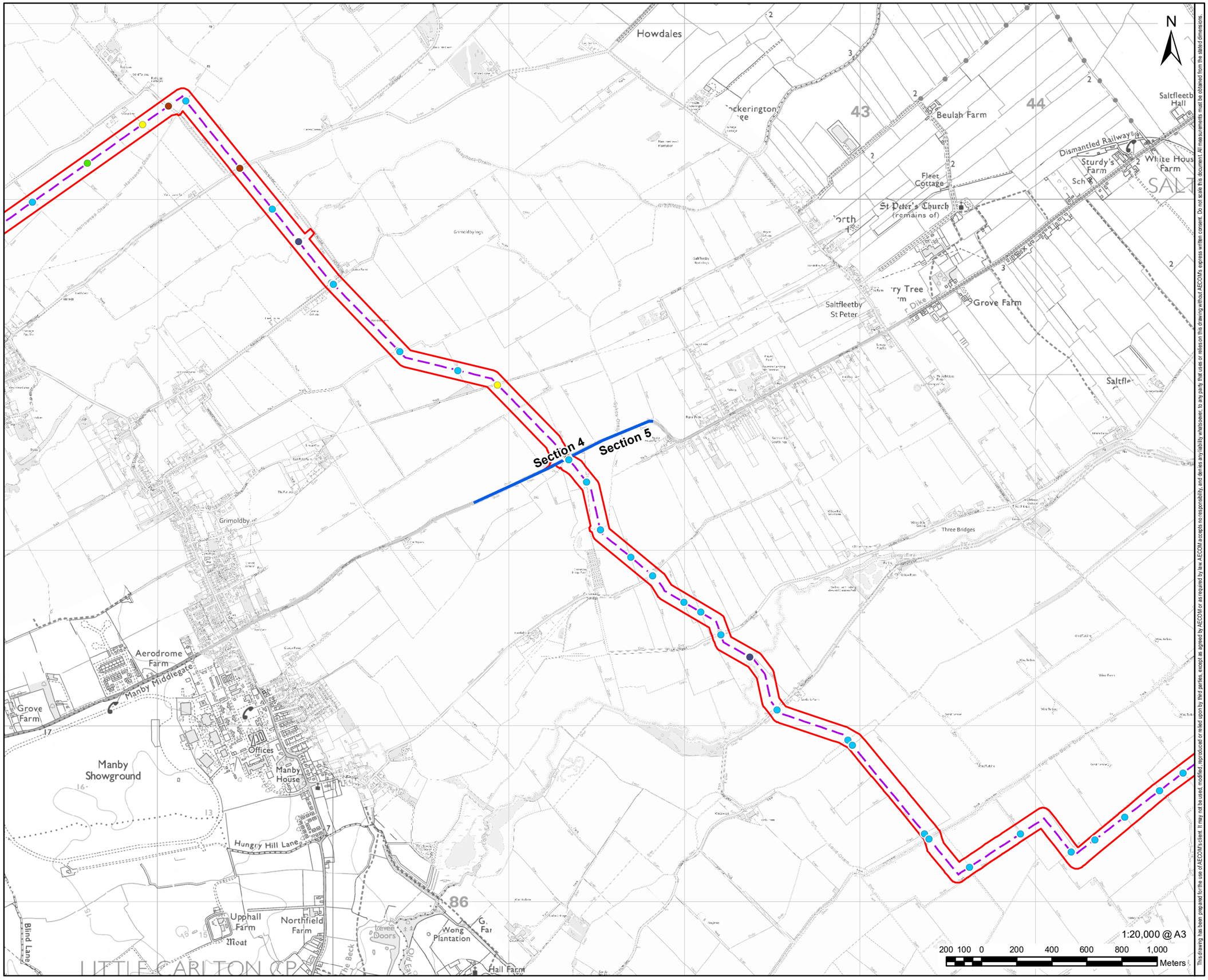

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

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

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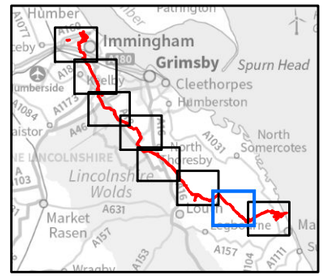

FIGURE TITLE

Figure 3-9 (7 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-9

Revision: 3 Drawn: LC Checked: HT Approved: MW Date: 2023-10-23

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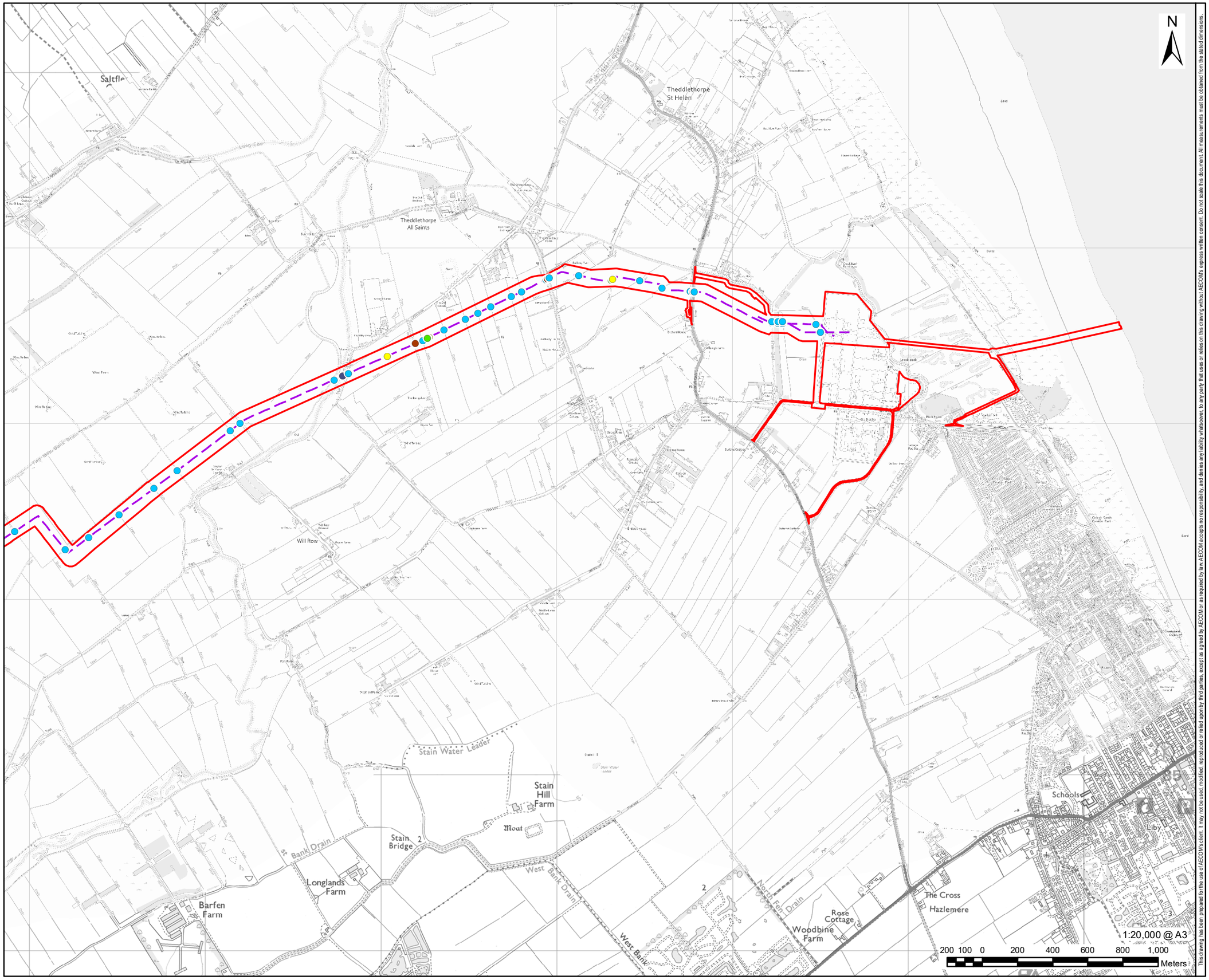

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Preferred Pipeline Route (Indicative)

Crossing Location - Type

- Drain
- Buried Powerline
- Pipeline
- Road
- River

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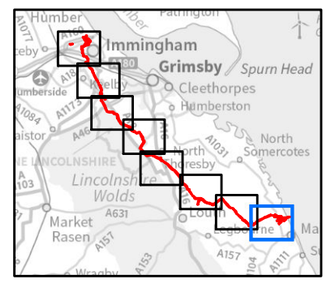

FIGURE TITLE

Figure 3-9 (8 of 8)
Key Crossings Locations and Proposed Crossing Technique

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-9

Pipeline Design Standards, Codes and Regulations

3.7.20 Key design standards, codes and regulations relevant to the Proposed Development include:

- Pipeline Safety Regulations 1996 (Ref 3-9);
- Construction (Design and Management) Regulations 2015 (Ref 3-10);
- Health and Safety at Work Act 1974 (Ref 3-11);
- Management of Health and Safety at Work Regulations 1999 (Ref 3-12);
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulation 2013 (Ref 3-13);
- PD8010-1: Pipeline Systems. Steel pipeline on Land, 2015 (Ref 3-7);
- 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); and
- API Specification 5L Specification for Line Pipe (Ref 3-16).

Pipeline Cathodic Protection

3.7.21 In order to prevent external corrosion of the pipeline, a combination of external coatings and permanent cathodic protection (CP) will be installed. 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 3-17).

3.7.22 Groundbeds would be installed either horizontally comprising a single or a combination of anodes laid end to end in a trench or vertically where space is limited and/or in locations of low resistivity soil. The groundbed requires the availability of electrical power and ready access for maintenance and monitoring. The groundbeds would be installed approximately 100 m from the buried connection point and be approximately 30 m in length. These ground beds would be located at the Immingham and Theddlethorpe Facilities.

3.7.23 The majority of the CP system is buried below ground and installed as part of the pipeline construction. Above ground features would comprise:

- CP test posts would be installed at regular intervals along the length of the pipeline to allow monitoring of the system during its operational life. Such CP test posts will typically be installed approximately 1km apart along the pipeline route in positions accessible from the public highway, however where this is not practical (i.e., the middle of a field), then the nearest accessible public location will be selected;
- Transformer Rectifiers will be installed at Immingham and Theddlethorpe Facilities; and
- Mains power cabinets close to each end of the pipeline.

3.7.24 As part of the pipeline construction, a temporary cathodic protection system will be provided to protect the pipeline until the permanent system is commissioned. Sacrificial anodes will be installed in areas where the soil resistivity is very low, within the DCO Site Boundary. These areas will be identified from the pipeline route resistivity survey. Where possible, the resistivity surveys will be carried out at the same time as the route site investigation to minimise the requirement for pre-construction access to land.

3.7.25 Sacrificial anodes will be installed within the working width following installation of the pipeline and provide protection until the permanent cathodic protection system is commissioned.

3.7.26 In addition, a full Direct Current Voltage Gradient (DCVG) survey will be carried out after the completion of all reinstatement works and removal of plant off site, but prior to the commissioning of the pipeline. All defects identified by the DCVG survey will be repaired prior to commissioning of the pipeline. Following repair and reinstatement, a further DCVG survey will be carried out, extending 15 m either side of the repair area to verify the defect has been cleared.

Telecommunication and VSAT

3.7.27 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 Internet Protocol (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.

Pipeline Leak Detection System

3.7.28 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. 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 Front-End Engineering Design (FEED) stage and would be influenced by the results of a detailed Quantitative Risk Assessment (QRA).

Permanent Pipeline Easement

3.7.29 During its operational life the pipeline may need to be accessed for routine activities required by the owner or operator of the pipeline and its maintenance/repair teams such as:

- Inspection of third-party activity;
- Cathodic protection and other corrosion inspections;
- Assessment of crop loss and indications of leakage;
- Coating repair; and
- Inspection of pipeline cover & soil erosion.

3.7.30 The majority of these activities are considered routine monitoring activities and are carried out on foot or with a small vehicle. Activities such as repair will cause a greater level of disturbance but only for a short period. In the case of emergencies, a statutory right of entry exists, for example to repair major leaks.

3.7.31 A permanent pipeline easement will therefore be established to allow adequate access to the pipeline for the purposes of inspection, maintenance and repair. Harbour Energy in their Design Construction and Operation of Steel Pipelines Standard (HBR-GBR-SBS-STD-0001) (Ref 3-18) specifies that a minimum easement width of 8 m should be established for 24” pipelines for the lifespan of the pipeline.

3.7.32 Once the pipeline has been installed, normal agricultural practices will be able to resume above the pipeline. Restrictions will be imposed on other activities over or in close proximity through the pipeline. Landowners and occupiers will need to seek consent from the undertaker to carry out activities that might interfere with the authorised development.

3.8 Block Valve Stations

3.8.1 Three Block Valves Stations (BVS) are proposed along the pipeline route to enable pipeline sections to be isolated for operational and maintenance reasons.

3.8.2 The spacing of BVS's was initially recommended using results from Quantitative Risk Assessment which was undertaken using proprietary software. Different spacing lengths and differing numbers of BVS were analysed to determine the effect on societal risk along the pipeline route.

3.8.3 Further engineering design work has been undertaken to refine and optimise the specific location for the Block Valve Stations along the preferred pipeline route based on the safety case as described in *ES Volume II Chapter 2: Design Evolution and Alternatives (Application Document 6.2.3)*. This work identified locations at approximately 13 km, 24 km and 39 km along the pipeline route moving away from the Immingham Facility, as shown on **Figure 3-10**. The three Block Valve Stations are known as:

- Block Valve Station 1, hereafter called Washingdales Lane BVS;
- Block Valve Station 2, hereafter called Thoroughfare BVS; and
- Block Valve Station 3, hereafter called Louth Road BVS.

3.8.4 The Block Valve Stations will be remotely monitored from the main control centre, with local control monitoring/control capable when maintenance personnel are physically on site.

3.8.5 The valve itself would be buried with a valve actuator extended above ground (circa 1.5 m), with bypass valves and pipework potentially located above ground subject to operational/maintenance requirements. The valves may be operated remotely for which the necessary equipment on site will be housed in a kiosk, which would be typically between 2-3 m in height, subject to final design. The Block Valve Stations would include a local vent (up to 4 m high) to ensure that bypass pipework maintenance activities can be performed safely, however it is not the intention for routine pipeline venting to be undertaken at these locations.

3.8.6 The Block Valve Stations would require mesh type security fencing, typically 3.2 m high with double-leaf access gates for vehicles with access from the adjacent road network, access tracks or similar. The ground surface within this fenced area will predominantly comprise stone with minimal tarmac/concrete internal access roads. Provision will be provided for maintenance operatives to safely park their vehicle(s) off the highway and open the gates.

3.8.7 The Block Valve Stations would include a 10m wide planting strip to provide screening, as outlined in the Outline Landscape and Ecological Management Plan included in *Application Document 6.8*. Outside this visual landscaping, the Block Valve Station will have a smaller 1.5m high three bar, post and rail perimeter fence and access gate. Block Valve Stations would be unlit except during maintenance or potential breakdown/emergency requirements, when task lighting columns (approximately 4 m high) would be employed.

3.8.8 Each Block Valve Station would be electrically connected to the National Grid system. The nearest connection points have been identified with the Local Distribution Network Operator (Northern Powergrid) and have been included in the DCO Site Boundary.

3.8.9 The electrical system will have the ability to connect a portable generator for maintenance purposes. The Low Voltage (LV) switchgear will supply all process and utility consumers, lighting, socket outlets, UPS, cathodic protection, etc. at the station.

3.8.10 In order to either limit or avoid interruption to electricity supplies, a UPS system arrangement will be provided and housed in the Kiosk in order to maintain the operability and functionality of the equipment.

3.8.11 The back up power supply will cover the continued operation of certain equipment, control system, lighting and other apparatus, following a failure of the normal supply and in order to ensure the safe, satisfactory shutdown of the plant and allow restarting in the shortest time.

3.8.12 The UPS systems will be specified with a battery capacity providing an autonomy time of no less than eight hours.

3.8.13 The indicative layout of each of the three Block Valve Station are shown in the schematic drawings provided within **Figure 3-11**, **Figure 3-12** and **Figure 3-13** whilst an indicative computer generated image (CGI) illustrating what the Block Valve Stations will look like is included in **Figure 3-14**.

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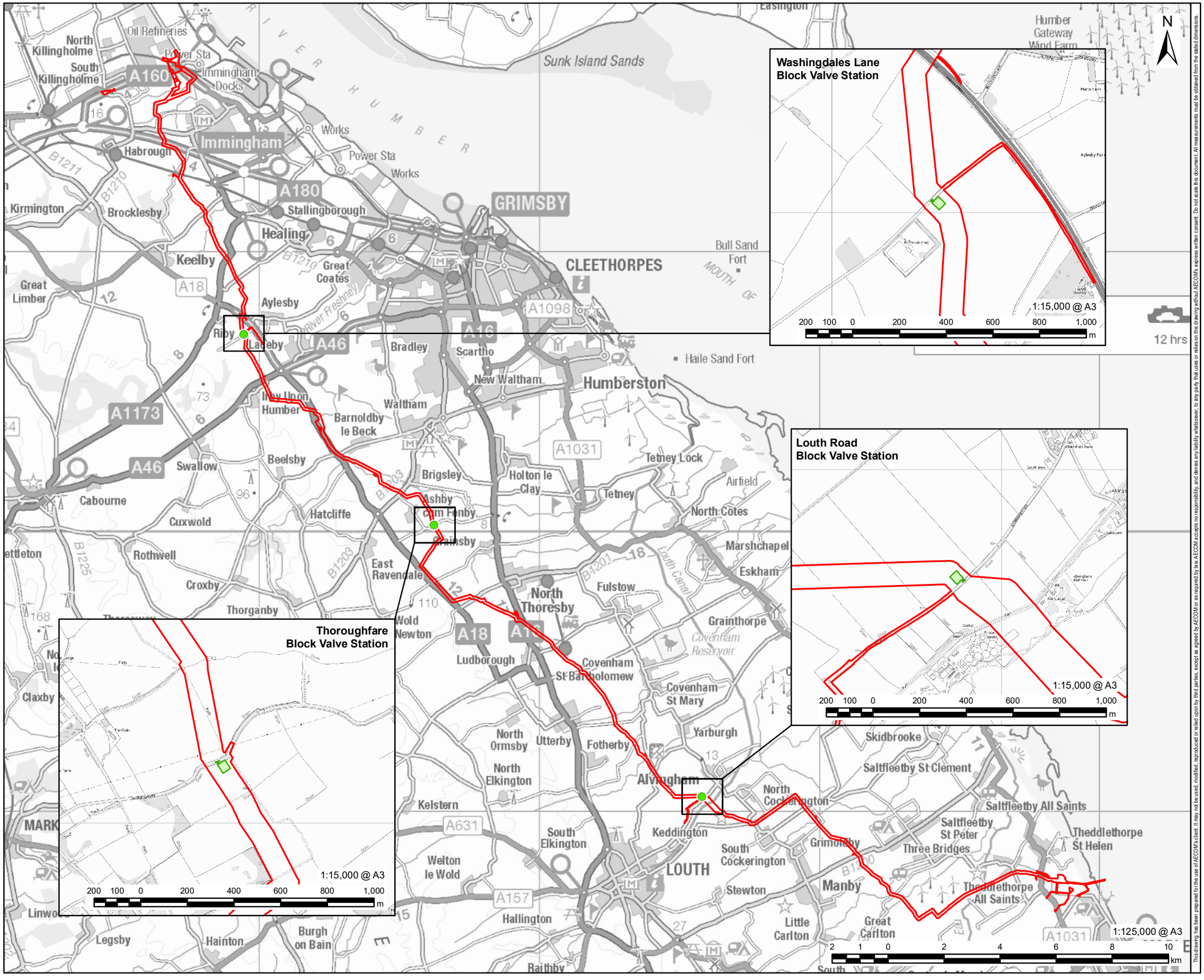

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Block Valve Station Location
- Block Valve Station Location

NOTES:

FIGURE TITLE

Figure 3-10
Location of Block Valve Stations

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_230914_ES_3-10

Figure 3-11: Indicative Washingdales Lane Block Valve Station Layout

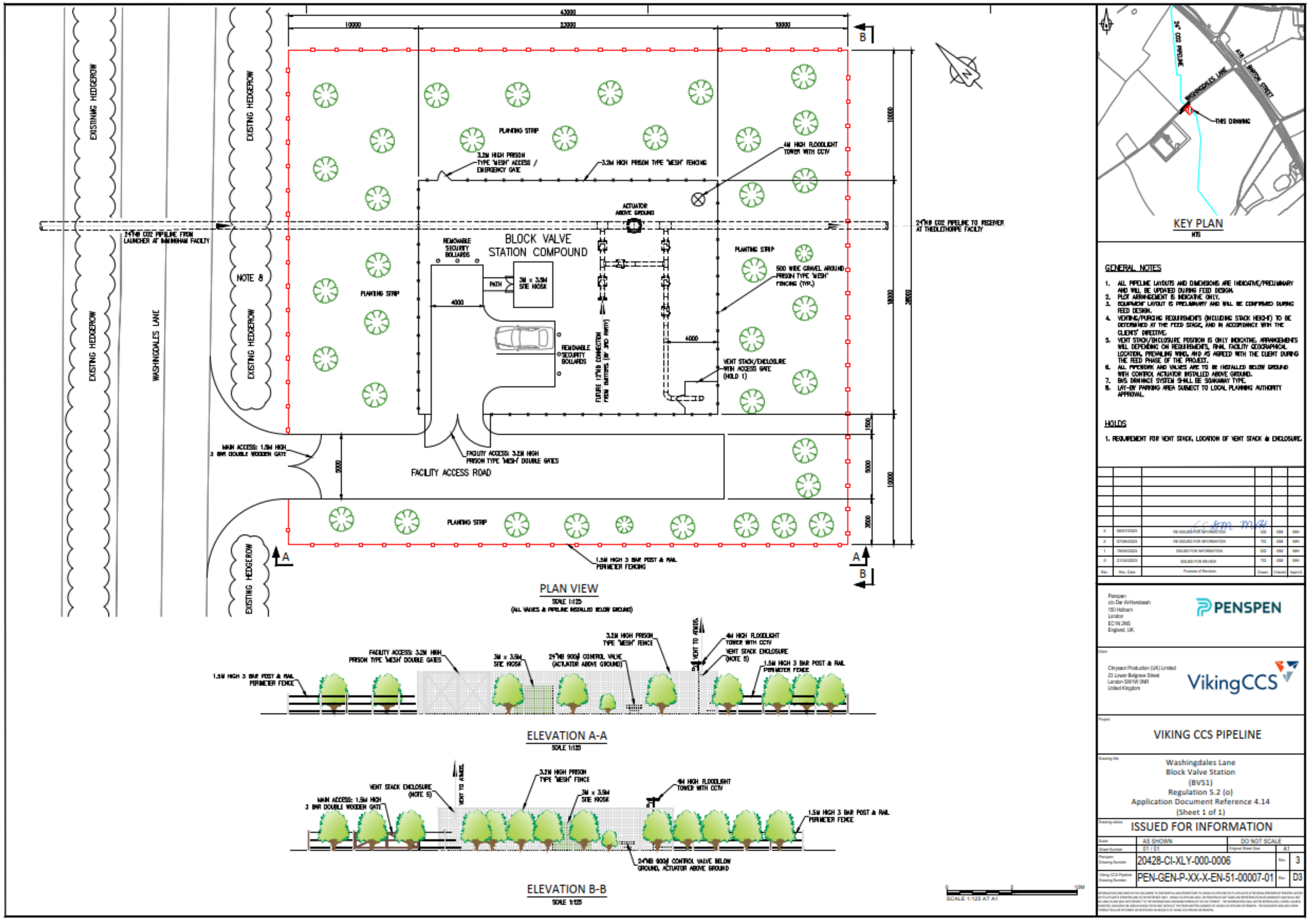

Figure 3-12: Indicative Thoroughfare Block Valve Station Layout

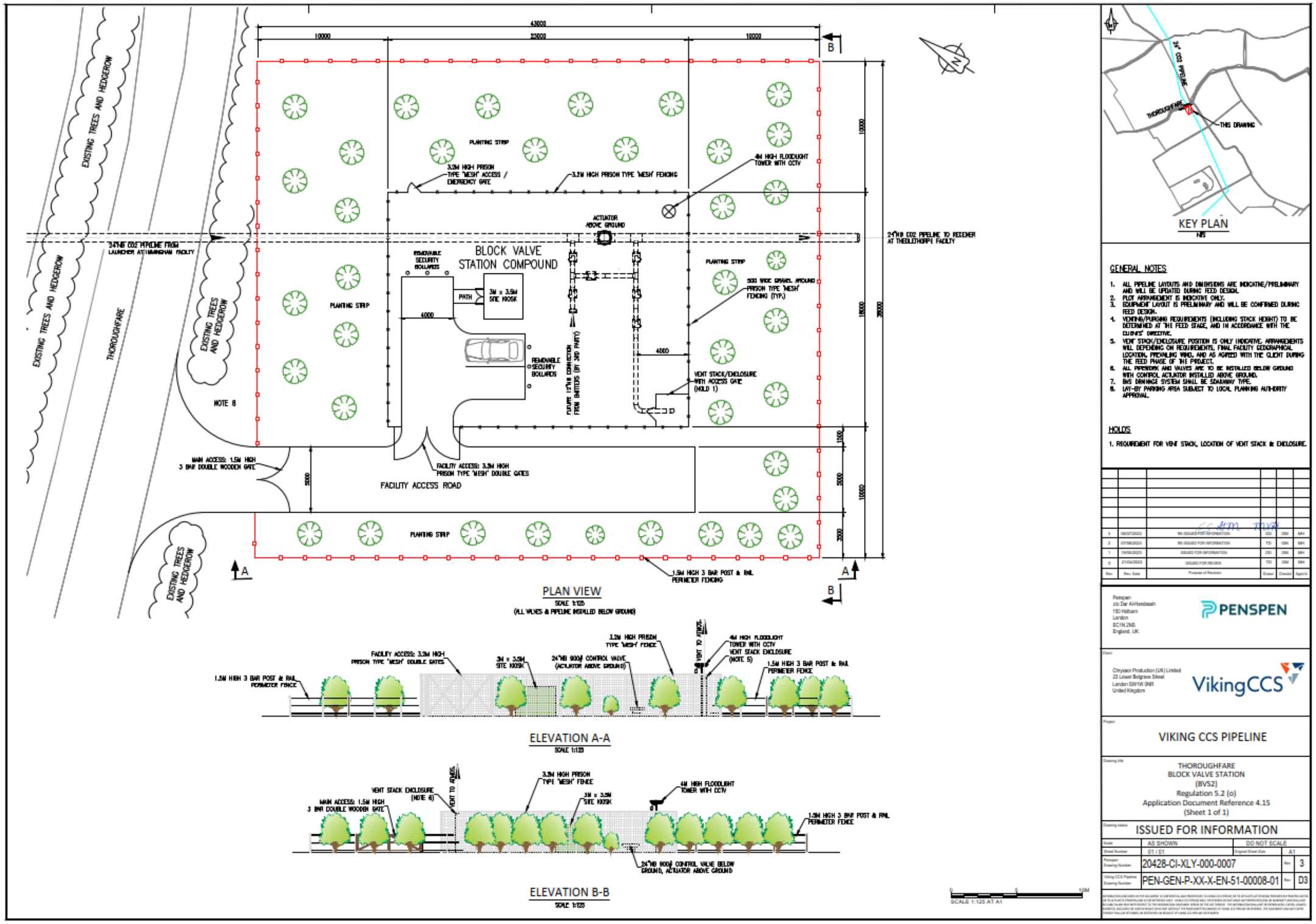

Figure 3-13: Indicative Louth Road Block Valve Station Layout

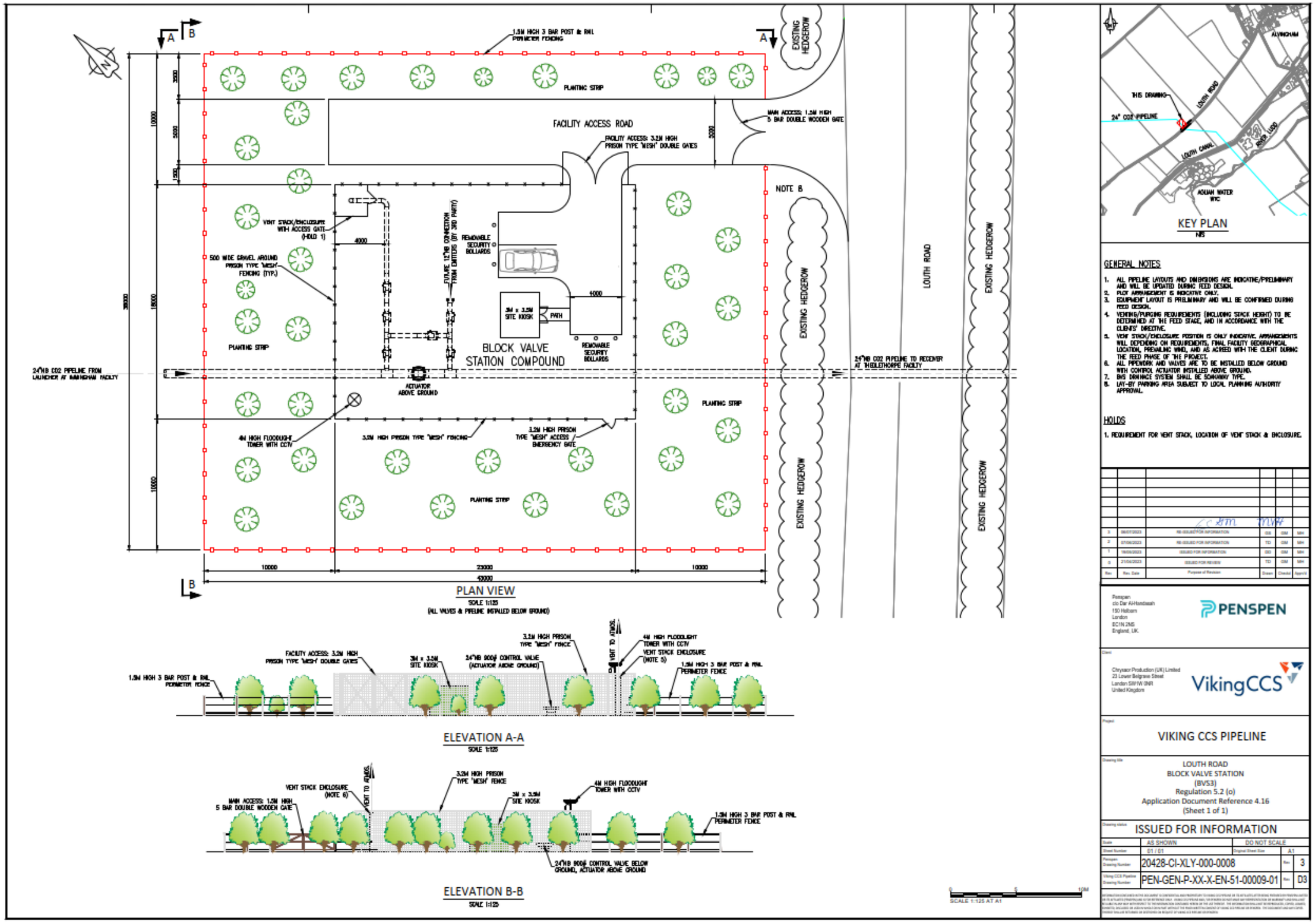

Figure 3-14: Indicative CGI Illustration of a typical Block Valve Station

3.8.14 ***Washingdales Lane Block Valve Station -*** is located on arable land off Washingdales Lane accessed from the A18 Barton Street, approximately 900 m south west of Aylesby and 1.2 km east of village of Laceby. The nearest residential receptor is approximately 700 m to the south east on Barton Street (A18). The permanent land acquisition would be approximately 43 m x 38 m with a new 15 m x 15 m entrance created on the south side of Washingdales Lane.

Figure 3-15: Photograph of the Proposed Washingdales Lane Block Valve Station Location

Figure 3-16: Indicative Entrance Location to Proposed Washingdales Lane Block Valve Station

3.8.15 ***Thoroughfare Block Valve Station*** **-** is located on arable land and is approximately 750 m southeast of the village of Ashby cum Fenby. The nearest residential receptor is approximately 470 m northwest of the station on Main Road in Ashby cum Fenby. The permanent land acquisition would be approximately 50 m x 40 m with a 15 m x 15 m entrance created on the south side of Thoroughfare, west of an existing farm track immediately off a public road called Thoroughfare.

Figure 3-17: Photograph of Proposed Thoroughfare Block Valve Station Location

Figure 3-18: Indicative Entrance Location to Proposed Thoroughfare Block Valve Station

3.8.16 ***Louth Road Block Valve Station -*** is located on arable land to the south east of the village of Alvingham and is accessed off Louth Road. The nearest residential receptor is approximately 370 m to the east of the station on Lock Road, Alvingham. The permanent land acquisition would be 50 m x 40 m with an entrance of 24 m x 15 m. An entrance will be created on the north side of Louth Road, east of the existing field entrance.

Figure 3-19: Photograph of the Proposed Louth Road Block Valve Station Location

Figure 3-20: Indicative Entrance Location to Proposed Louth Road Block Valve Station

3.9 Venting Systems

3.9.1 Venting of CO_2 may occasionally be required for safety, process, operating or maintenance reasons. Venting systems may be called upon in several contexts:

- To support start-up, shutdown and initial commissioning of the system;
- To depressurise parts of the system to facilitate maintenance activities. This is expected to be required approximately bi-annually (every two years); and
- To support depressurisation of the Immingham facilities, Theddlethorpe facilities or the onshore pipeline in the unlikely event of an incident to enable repair work.

3.9.2 The above venting would be undertaken during the daytime. Maintenance venting will be undertaken approximately every two years at the Immingham and Theddlethorpe Facilities. In advance of maintenance, valves and sections of the pipe will be vented down to release CO2. The venting of CO2 will be undertaken at a rate whereby the noise at the nearest Noise Sensitive Receptor will be no greater than 10db above daytime background levels. These levels will be back calculated to the perimeter of each facility and monitored as necessary.

3.9.3 It is anticipated that a permanent vent stack, up to 25 metres tall and up to 24-inch diameter will be required at both the Immingham Facility and at the Theddlethorpe Facility.

3.9.4 In the highly unlikely event that larger volumes of CO_2 are required to be discharged (e.g., to allow for pipeline repairs due to corrosion), a taller temporary vent may be installed and used and then removed again, at either the Immingham Facility or Theddlethorpe Facility. In this unlikely scenario, these temporary stacks would be expected to be in position up to a period of approximately two weeks. The exact height of this temporary vent stack will be determined by detailed atmospheric dispersion modelling, but initial design work indicates that these could be up to a maximum of 50 metres.

3.9.5 Based on feedback from the current potential emitters, it is not anticipated that the CO_2 entering the Viking CCS Pipeline will contain any Hydrogen Sulphide (H_2S).

3.10 Theddlethorpe Facility

Overview

3.10.1 The Theddlethorpe Facility is required to enable the CO_2 to flow from the new 24” pipeline into the existing LOGGS (36”) pipeline, and then onwards to be stored in the depleted gas fields within the southern North Sea. The dimensions of the Theddlethorpe Facility are approximately 100m x 200m.

Location

3.10.2 There are currently two options for locating the Theddlethorpe Facility, as discussed below.

3.10.3 **Theddlethorpe Facility Option 1:** new facility at the former Theddlethorpe Gas Terminal (TGT) site. Demolition of the former TGT was completed in 2021 but as the site was previously an operational facility, existing security fencing and road infrastructure remain in place. The site is currently clear with a mixture of hard standing, stoned areas and has current access to the existing LOGGS pipeline, as shown in **Figure 3-21**. Access to the site would be via an existing gate at the south west corner of the site.

3.10.4 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 from the west and would be routed into the 36” LOGGS pipeline via a cross over connection. An additional

connection would be provided to allow for future projects to connect to the Theddlethorpe Facility.

Figure 3-21: Former TGT Site and Option 1 for Theddlethorpe Facility

3.10.5 **Theddlethorpe Facility Option 2:** Would be a 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 north off the A1031 Mablethorpe Road (**Figure 3-22**).

3.10.6 For Option 2 the existing LOGGS pipeline would be extended to the west using sections of 36" pipeline, tying in the existing LOGGS pipeline to the new Theddlethorpe Facility to the west of the former TGT site. The total length of new 36" pipe is approximately 0.54 km in length.

Figure 3-22: Option 2 for Theddlethorpe Facility

3.10.7 The location of both options is shown on **Figure 3-23**.

3.10.8 An indicative layout of the Theddlethorpe Facility is located in **Figure 3-24** (Option 1) and **Figure 3-25** (Option 2).

3.10.9 The Theddlethorpe Facilities would comprise the following key components:

- LOGGS pipeline tie-in;
- Emergency Shutdown Valves;
- Pig receiver and launcher;
- High-integrity Pressure Protection System;
- Venting system including vent pipework, valves, and vent stack;
- Local equipment room (LER); and
- Supporting Utilities.

3.10.10 The Theddlethorpe Facility would be secured by a single mesh (e.g., weldmesh fencing), security fence 3.2 m high.

3.10.11 The ground surface within the boundary of the Theddlethorpe Facility will be predominantly stone with a minimal number of internal tarmac/concrete access roads.

LOGGS pipeline tie-in

3.10.12 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 facilities at Theddlethorpe.

High-integrity Pressure Protection System

3.10.13 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 emergency shutdown valves (ESDVs). The ESDVs valves would automatically close in response to a high pressure being detected. In addition, manual valves are provided for maintenance of the automatic valves. To allow for full testing in service, a duty/standby flow path arrangement. More information is included within paragraph 3.10.14 below.

Revision: 4 Drawn: LC Checked: HT Approved: MW Date: 2023-10-23

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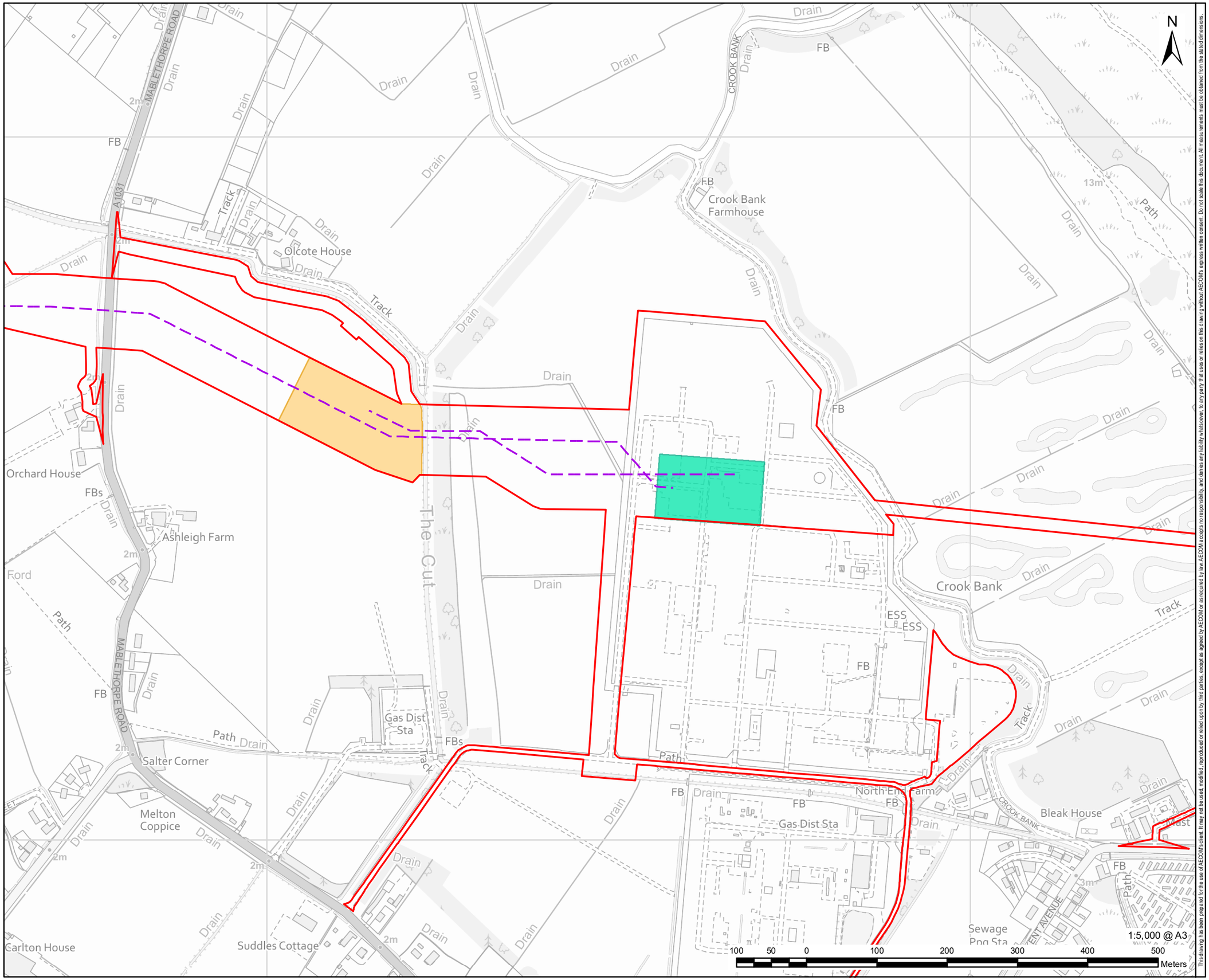

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Preferred Pipeline Route (Indicative)
- Theddlethorpe Facility - Option 1
- Theddlethorpe Facility - Option 2

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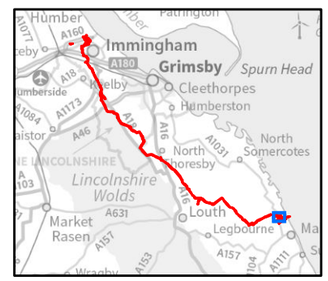


FIGURE TITLE

Figure 3-23
Indicative Location of Theddlethorpe Facility (Option1) and Theddlethorpe Facility (Option 2)

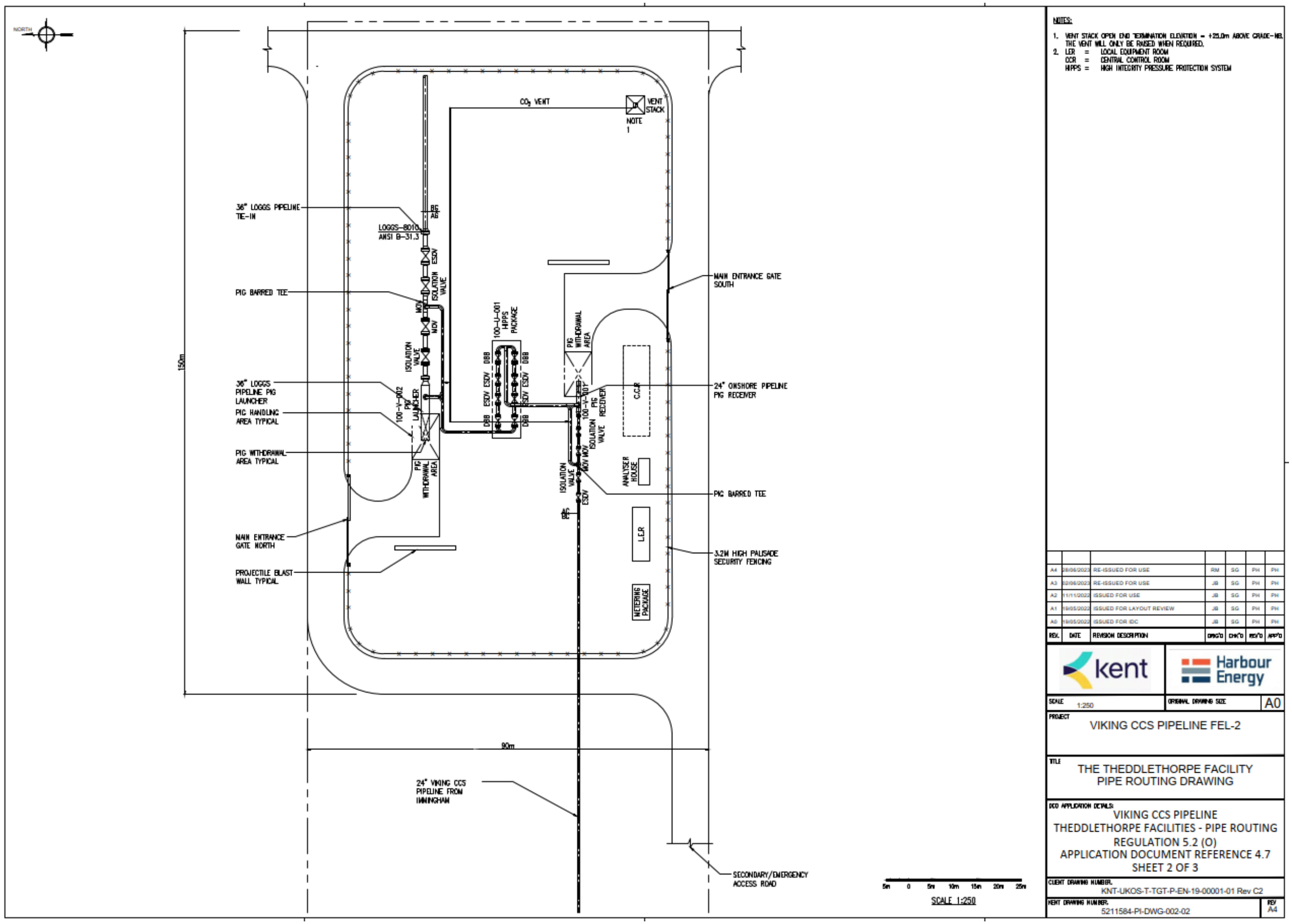
ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-23

Figure 3-24: Indicative Site Layout of Theddlethorpe Facility (Option 1)



NOTES:

1. VENT STACK OPEN END TERMINATION ELEVATION = +25.0m ABOVE GRADE-NB, THE VENT WILL ONLY BE RAISED WHEN REQUIRED.
2. LER = LOCAL EQUIPMENT ROOM
   CCR = CENTRAL CONTROL ROOM
   HIPPS = HIGH INTEGRITY PRESSURE PROTECTION SYSTEM

REV.	DATE	REVISION DESCRIPTION	DRG'D	CHK'D	RSV'D	APP'D
A4	08/06/2023	RE-ISSUED FOR USE	RM	SG	PH	PH
A3	02/06/2023	RE-ISSUED FOR USE	JB	SG	PH	PH
A2	11/11/2022	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

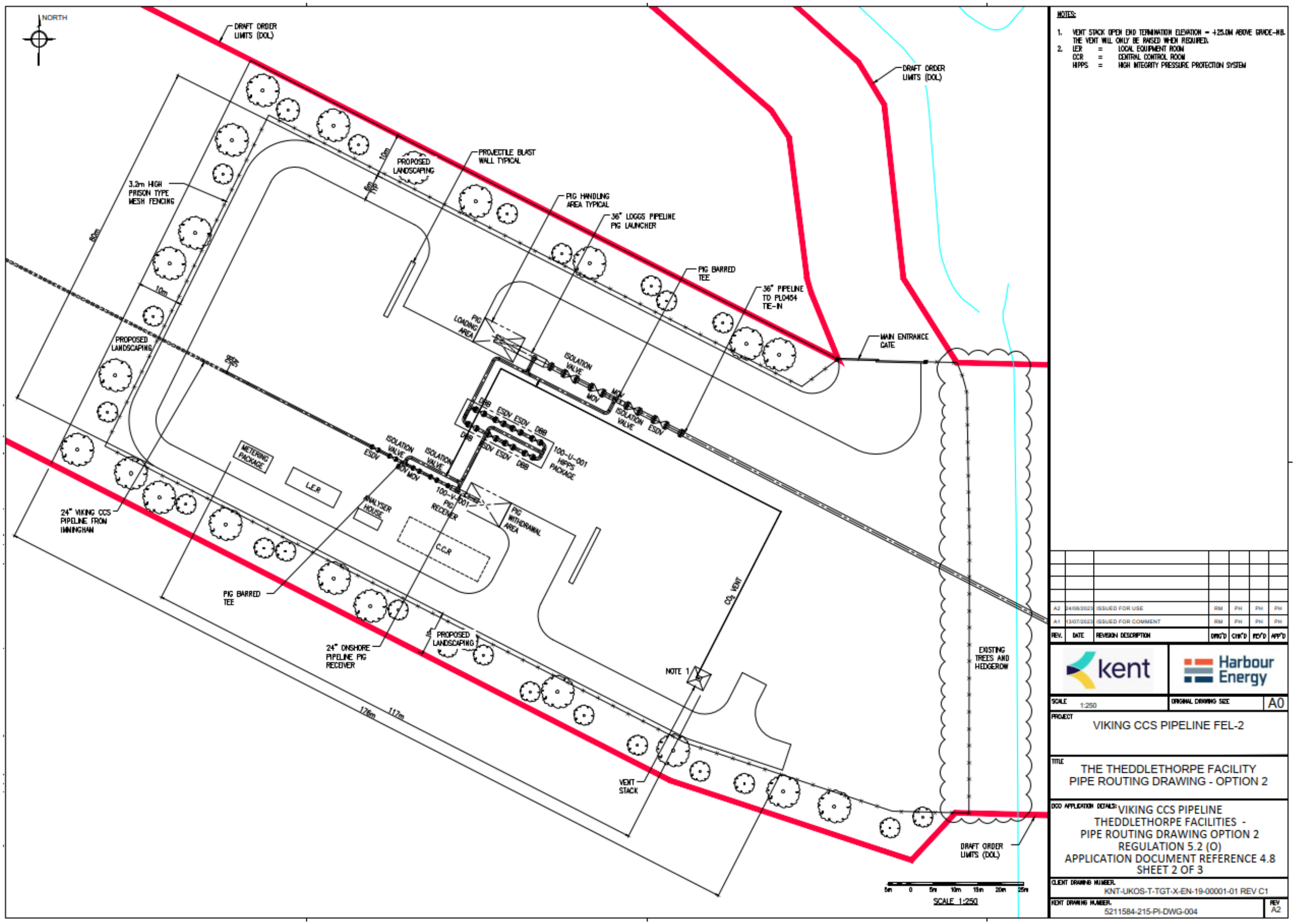
TITLE
THE THEDDLETHORPE FACILITY
PIPE ROUTING DRAWING

DCO APPLICATION DETAILS:
VIKING CCS PIPELINE
THEDDLETHORPE FACILITIES - PIPE ROUTING
REGULATION 5.2 (O)
APPLICATION DOCUMENT REFERENCE 4.7
SHEET 2 OF 3

CLIENT DRAWING NUMBER.
KNT-UKOS-T-TGT-P-EN-19-00001-01 Rev C2

KENT DRAWING NUMBER.
5211584-PI-DWG-002-02 | REV A4

Figure 3-25: Indicative Site Layout of Theddlethorpe Facility (Option 2)



Emergency Shutdown Valves

3.10.14 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

3.10.15 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. Pigs will be launched in the direction of product flow only (i.e., no bi-directional pigging capability).

3.10.16 Therefore, pigs launched from the Immingham facility will be received at the Theddlethorpe facility for the 24" onshore pipeline, and pigs launched from the Theddlethorpe facility will be received at the offshore NPAI for the 36" offshore pipeline. When a pig arrives at the facilities the isolation valves to the receiver will be closed and the receiver body vented. Once vented the door will be opened and the pig retrieved. The isolation valves allow this process to be completed whilst the pipeline remains operational.

3.10.17 The pig receiver and launcher will be suitable for intelligent pigging. The pig receiver and pig launcher will be oriented opposite of each other in line with their respective pipeline directions. They have a pig handling area with associated projectile blast wall. Pigging operations will be carried out in accordance with strict procedures to ensure safe operation, however, the blast wall is provided in the unlikely event that 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 20 m long, and 5 m high structure made of steel or concrete.

Venting System

3.10.18 A new vent stack will be provided to depressurise the Theddlethorpe facilities if required, which will be made of steel construction. The height of the required vent stack is elevated at 25 m above ground level. For more information on venting systems please refer to section 3.9.

Local equipment room

3.10.19 The local equipment room (LER) is proposed to be a 12 m x 5 m containerised steel structure similar to that proposed at the Immingham Facility. 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 would also be a desk with workstation available in the instrument room.

Supporting Utilities

3.10.20 The utilities required for the Theddlethorpe Facility will comprise:

- Electrical power for the motorised valves, local equipment room, field instruments and for electric lighting;
- Hydraulic fluid for the pipeline ESDVs;
- Nitrogen for purging the pig launcher/ receiver prior to opening will be supplied from a local bottled nitrogen supplier; and
- Local venting / draining for the pig launcher and analysers.

3.10.21 The power requirement is estimated to be 80 kW and will be supplied via a local connection to the National Grid supply. The nearest connection points have been identified with the Local Distribution Network Operator (Northern Powergrid) and have been included in the DCO Site Boundary.

Lighting

3.10.22 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.

3.10.23 Further information on operational lighting is included in paragraphs 3.14.27 to 3.14.33.

3.11 Existing LOGGS pipeline and Dune Isolation Valve

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 review of operational records, previous intelligent pigging results, 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.

3.11.2 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.

3.11.3 A total of approximately 1.6 km of the existing LOGGS pipeline is located within the DCO Site Boundary and which will be utilised for the Proposed Development. This may need to be extended if Theddlethorpe Option 2 is selected, as discussed below. Extension of LOGGS pipeline (for Theddlethorpe Facility Option 2 scenario only)

3.11.4 As discussed in section 3.10 above, two options currently exist for the location of the Theddlethorpe Facility, both of which have been assessed within this ES. If Option 2 is built (i.e., the site located to the west of the former TGT site), it will be necessary to extend the current LOGGS 36” pipeline by approximately 540 M, to enable it to connect into the Theddlethorpe Facility (option 2) and ultimately connect to the new 24” pipeline. The indicative route of the extended 36” pipeline between the current LOGGS Pipeline shutdown valve on the former TGT site and the new tie in at the Theddlethorpe Facility Option 2 is shown on **Figure 3-27**.

Dune Isolation Valve

3.11.5 There is an existing isolation valve (Dune Isolation Valve) on the onshore section of the LOGGS pipeline, located close to the sand dunes to the east of the former TGT site, which was used as an isolation valve for Theddlethorpe when importing gas from offshore. A new replacement valve will be provided in the same location.

3.11.6 Replacement of the existing LOGGS pipeline Dune Isolation Valve will be undertaken during installation of the new facilities and will require crane and specialist cutting and welding equipment. The Dune Isolation Valve will be replaced using the following steps:

- The pipeline will be safely isolated either side of the valve;
- The access hatches will be removed to allow access to the pit;

- Actuator will likely be unbolted and removed to gain better access to the valve;
- The current valve is welded into the pipeline so specialist cutting equipment will be utilised to remove the valve;
- A crane will be used to support the valve and lift it out of position once separated; and
- The new valve will be installed by reversing the above steps and then welding the new valve into position.

3.11.7 Access to the Dune Isolation Valve during replacement and maintenance will be via the existing track that runs along the south eastern edge of the field to the east of the existing TGT site.

Figure 3-26: Photograph of Existing Dune Isolation Valve

Replacement Electrical Connection

3.11.8 There is currently both electrical and instrument cabling in place between the existing Dune Isolation Valve and the former TGT site and the preferred option is to re-use this cabling for the Proposed Development. However, further technical and engineering analysis is required to determine if the existing connections are still fit for purpose.

3.11.9 In the event that the pre-existing cables are unsuitable for use, then the alternative option is to replace them. Key work activities would include:

- Survey and mark out route of the proposed cable duct installation;
- Using mole plough equipment, the cable duct would be installed in one pass, with this activity taking a maximum of a week;
- Ducting would be used to both protect the cables and allow for future replacement, if required, without further excavation; and
- Cables will then be pulled through the ducting ready for connection to the Dune Isolation Valve and the LER at the Theddlethorpe Facility, when required.

3.11.10 This work, including cable pull and testing, is expected to last no longer than two months.

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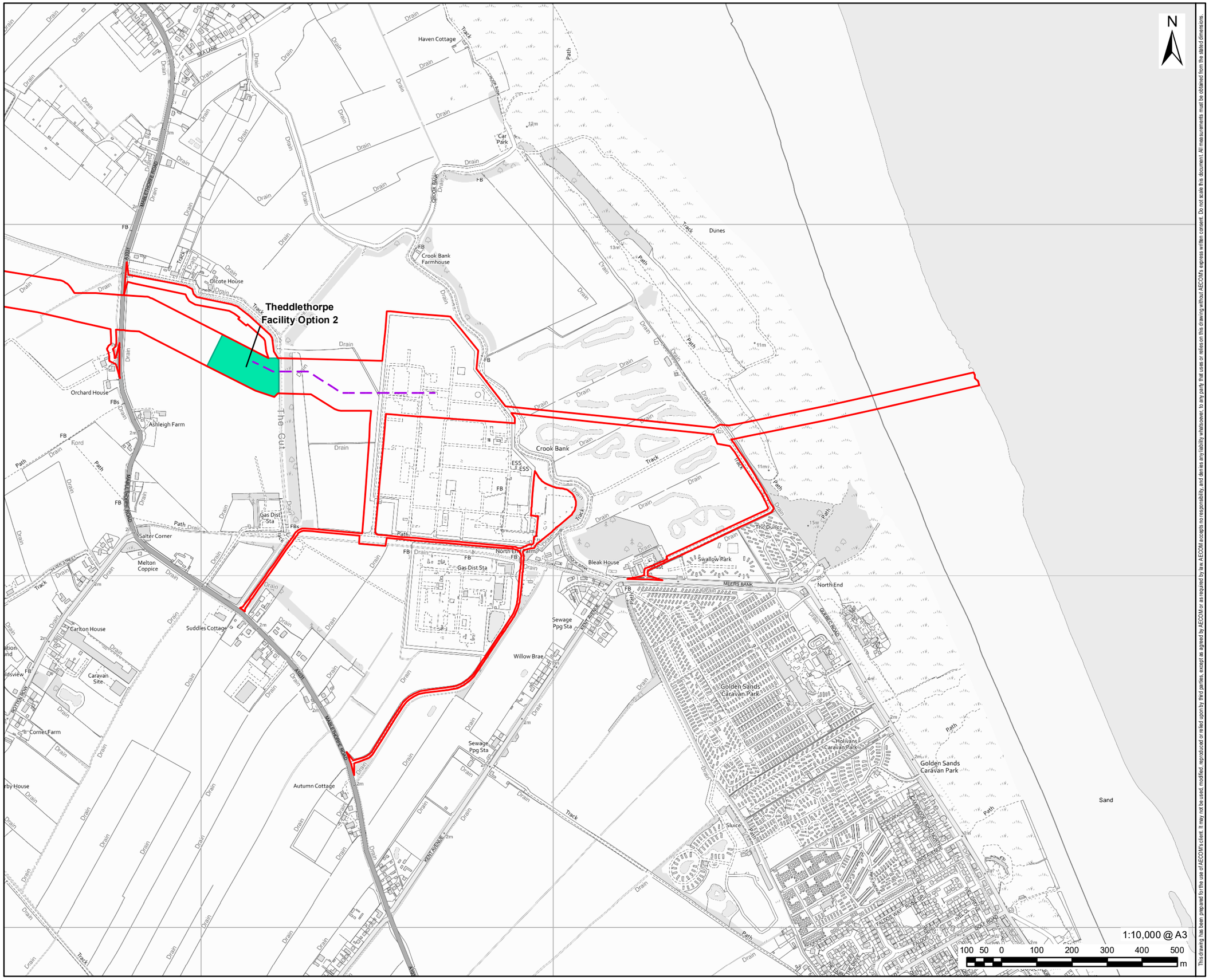

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Preferred Pipeline Route (Indicative)
- Theddlethorpe Facility

NOTES:

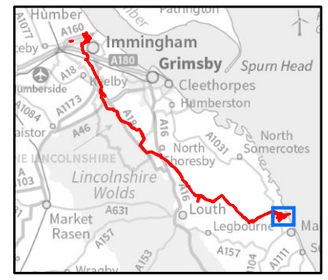

FIGURE TITLE

Figure 3-27
Indicative Route of Extended 36" LOGGS Pipeline

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-27

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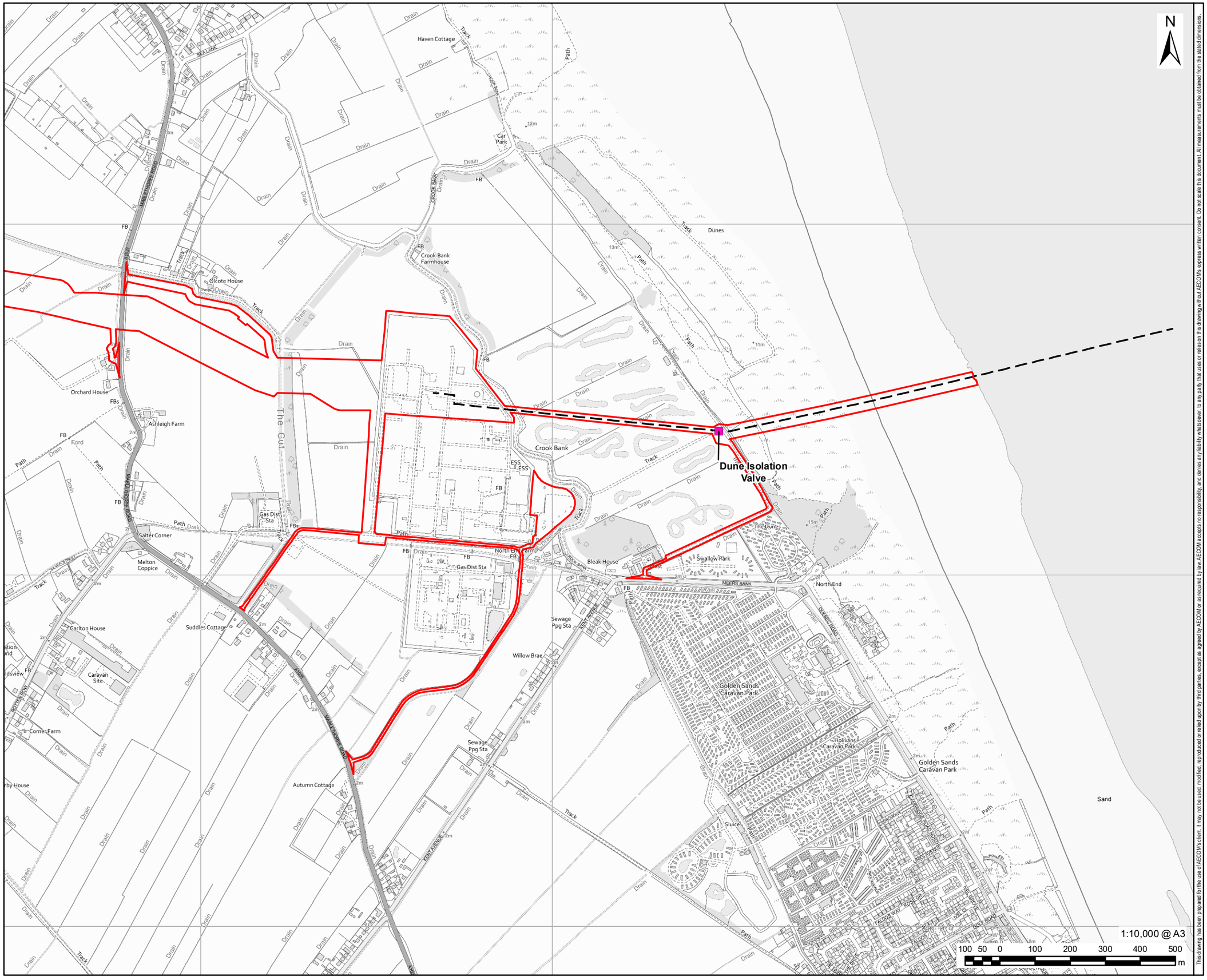

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Dune Isolation Valve
- Existing LOGGS Pipeline

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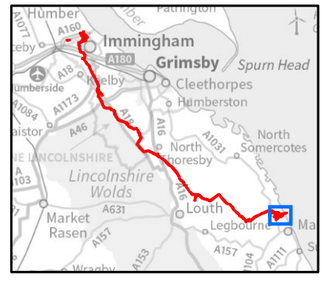


FIGURE TITLE

Figure 3-28
Existing LOGGS Pipeline and Dune Isolation Valve

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231005_ES_3-28

3.12 Construction Phase of the Proposed Development

Summary of Construction Philosophy

3.12.1 The general methods and techniques described within this section, and which will be followed during construction are typical pipeline construction methods that have been developed over many years and successfully used both in the UK and overseas. However, the methods and techniques used in differing locations may vary according to site-specific features including physical constraints and ground conditions, environmental constraints and safety requirements.

3.12.2 In general terms, the following activities would be undertaken during the site preparation and construction works:

- Establish construction compounds (including pipe storage areas), access and laydown areas;
- Main Pipe Laying Construction work, including:
    - Set out Right of Way (RoW) and install all required fencing;
    - RoW preparation works;
    - Pipeline route marking;
    - Pipe delivery and stringing;
    - Pipe (cold) bending;
    - Welding, inspection and joint coating;
    - Trench excavation and pipe lower and lay; and
    - Pre/Post construction drainage.
- Specialist crossing requirements, including:
    - Installation of auger bore crossings;
    - Installation of HDD crossings; and
    - Installation of open-cut crossings.
- Construction of Immingham and Theddlethorpe Facilities and Block Valve Stations;
- Hydrostatic testing and Pre-commissioning; and
- Reinstatement works.

3.12.3 The pipeline would comprise an all-welded steel pipeline construction, 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 depending on the features of each individual crossing (further details are included in *ES Volume IV: Appendix 3.2 (Application Document 6.4.3.2)*). In areas where it is considered prudent, the pipeline may be buried deeper and protective measures, such as concrete slabs, may be laid over the pipeline, to further reduce any risk of third-party interference with the pipeline. Pipeline construction is expected to commence from the northern end at the Immingham Facility and move in a southerly direction.

3.12.4 Block Valve Station construction activities will include civil works which will include ground preparation and landscaping, construction of equipment foundations, laying of access roads, paths and drainage, and fencing.

3.12.5 All Block Valve Station works will be designed and constructed in accordance with appropriate British Standards. The construction sites will be cleared, excavated and graded

to achieve the approximate required finished levels. Surfaces will be constructed so that rainwater can drain to existing open ground, to soakaways or to existing drainage facilities, as appropriate. Roads and hardstanding will have flush concrete kerbs to allow surface water run-off. The majority of the sites will be permeable surface to minimise runoff. Swales and soakaways will be utilised to promote sustainable drainage.

3.12.6 Block Valve Station access roads will be tarmac laid on a recycled MOT Type 1 sub-base. Footpaths will be provided where appropriate and will be concrete flagstones laid on a lean mix concrete base. Surface finishes elsewhere will be stone chippings.

Health and Safety considerations for construction works

3.12.7 All activities will be undertaken in accordance with the Health and Safety at Work Act 1974 (Ref 3-11), and all other applicable health and safety legislation and guidance. Site-specific Risk Assessments and Method Statements (RAMS) will be produced in accordance with best practice prior to any activities taking place. These would identify any potential risks, assess their likelihood and significance, then identify mitigation measures to reduce the risk, likelihood and significance.

3.12.8 All personnel and visitors will undertake a mandatory safety induction prior to entering any construction area (does not apply to main office compound and car park). Whilst visiting the works construction areas, all personnel will wear as a minimum Personal Protective Equipment (PPE) consisting of safety hat, boots and high-visibility jacket and will have ear and eye protection available at all times. Additional PPE will be required depending on activities being performed.

3.12.9 Adequate arrangements will be made to ensure compliance under the Construction (Design and Management) Regulations 2015 (CDM Regulations) (Ref 3-10).

3.12.10 The Pipeline Contractor as Principal Contractor would be responsible for the production and implementation of the Proposed Development's Health and Safety Plan in accordance with CDM regulations. This would set out how health and safety matters are managed, and how risks are identified, avoided, reduced or controlled in accordance with the current best practices and legal requirements. The Proposed Development's Health and Safety Plan would focus on the health and safety of the construction workforce, site visitors and members of the general public in the vicinity of any activities.

3.12.11 The Pipeline Contractor would be regularly audited on its health and safety performance. All procedures and processes would be periodically reviewed internally by the contractor(s) and by the project team.

Construction Schedule

Overall Construction Programme

3.12.12 An initial construction schedule has been developed which sets out all of the key activities and associated timelines, as shown in **Figure 3-29**. The main construction activities are expected to take around 12 months, with additional time required beforehand for pre-construction and site preparation activities and afterwards for commissioning works. Main pipe laying works are predominantly planned during late spring, summer and early autumn months.

3.12.13 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.

3.12.14 Subject to the grant of a DCO, it is currently anticipated that site preparation would commence in late 2025, with main construction taking place in 2026 and the Proposed Development becoming operational in 2027.

Example schedule of works for a particular section of open cut installation

3.12.15 To aid in the general understanding on the typical activities and associated durations which a typical 1km section of open cut pipeline installation would require, we have prepared an indicative list which lays these activities out chronologically. However, it should be noted that activities can be expedited and run concurrently. Additionally, there may be occasions where there are pauses in work in any one area between the different activities as the specific teams move around the spread. **Table 3-5** below presents the typical duration each activity will take to pass through a fixed location.

Table 3-5: Typical Construction Activities and duration of works at any one location

Description of Activities	Duration
Installation of access and laydown area and/or crossing point including Prow/field access modification (as applicable	2 weeks
Erect temporary fencing to mark out the 30m working width	1 week
Removal of any hedges and trees (may be completed as part of initial installation works)	1-2 weeks
Strip top soil and store on side of working width	1 week
Subsoil grading, benching and running track installation	2 weeks
Mark out pipeline route with stakes	1 week
Installation of pre-construction land drainage (if required)	2 weeks
12m pipe lengths are transported to the location and laid out on wooden skids in preparation for welding	1 week
Cold field bending of pipe	1 week
Pipeline sections are welded together	2 weeks
Welds are tested for integrity (starting as close as possible to first weld completion)	1 week
Field coating of welds (based on notification of weld integrity test confirmations)	1 week
Pipe trench is excavated with removed material stored on opposite side of the working width to the top-soil	1 week
Welded pipe “string” is lowered into the trench using side boom crane including pipeline GPS survey	1 week
Trench is back filled (using same material and compacted)	1 week
Hydrostatic testing, cleaning, drying and gauging (if applicable, dependent upon test sections)	2 weeks
Test section areas tied-in and backfilled (as applicable)	1 week
Fibre optic cables installed	1 week

Description of Activities	Duration
Cathodic Protection installed (as applicable)	1 week
Sub Soil ripping and grading	1 week
Top-spoil re-spread over working width	1-2 weeks
Top soil harrowing, stone picking and re-planting to make suitable for agricultural use again (as applicable)	1-2 weeks
Re-planting of hedge rows (can commence on top soil re-spread or earlier, by agreement)	2-3 weeks
Temporary fencing removed (may be commenced on sub soil or top soil works, by agreement)	1 week
Installation or pipeline marker and test posts	1 week
Average duration at one standard location along the pipeline (i.e., not including crossing locations etc)	*7 Months (approximately)*

Working Hours

3.12.16 A normal working schedule of 12 hours (07:00 to 19:00) Monday to Saturday, is expected, with no Sunday or Bank Holiday working anticipated as being typical. Exceptions may be required for extended hours (including Sunday or Bank Holiday working where necessary) for activities such as:

- The pull back phase for a major crossing using HDD, where works once started need to be completed in one phase;
- Where daytime working would be excessively disruptive to normal traffic operation;
- Cleaning/testing of the pipeline;
- Overnight traffic management measures; or
- Emergency works.

3.12.17 Additionally, during construction, environmental and other constraints such as unforeseen ground conditions, weather conditions etc., may be encountered. This may require Sunday and Bank Holiday working to ensure that prolonged disruption in any one area would be limited.

3.12.18 With the possible exception of emergency works, Sunday and Bank Holiday working would be agreed in advance with the relevant Local Authority.

3.12.19 Heavy Goods Vehicle (HGV) movements to and from the site (excluding abnormal loads) during construction of the pipeline will be limited to 07.00 to 19.00 Monday to Friday, and 07.00 to 16.00 on Saturdays, with no HGV movements taking place on Sundays or on national public holidays, unless agreed in advance with the relevant Local Authority.

3.12.20 To reduce congestion on the public highways, and to meet the requirements of the local authorities and police, any abnormal loads would be transported outside normal working hours where practicable. It is currently anticipated that there would only be a requirement for a small number of abnormal loads during construction (e.g., less than 5).

Pre-construction Activities

3.12.21 Prior to the commencement of construction activities, a pre-construction survey will be carried out to provide a full record of condition (photographic and descriptive) of the route and surrounding areas including traffic routes that may be affected by the construction activities. This record will be available for comparison after the works have been completed

to verify that the standard of reinstatement meets or exceeds that recorded in the pre-condition survey.

3.12.22 Ahead of construction, pre-commencement surveys would be undertaken as required (some of which have already commenced). These are anticipated to include:

- Ecological pre-construction surveys and subsequent mitigation work;
- Intrusive archaeological investigation work;
- Contaminated land surveys;
- Geotechnical surveys;
- Detailed utility and drainage surveys;
- Line inspection of the LOGGS pipeline by intelligent pigging; and
- Inspection and function test of the installed ESDV and the dune isolation valve including undertaking any potential remedial work.

3.12.23 Existing utilities within the DCO Site Boundary have been identified and reviewed to determine if they require diversion, or whether the route of the pipeline needs to be modified slightly within the existing DCO Site Boundary to accommodate existing utilities. Those present which require crossing are included in the crossing schedule shown in **Table 3-3**.

3.12.24 The full crossing schedule is provided in *ES Volume IV: Appendix 3.2 (Application Document 6.4.3.2)* which also identifies the proposed crossing methods, including alternatives if deemed necessary.

3.12.25 Consultation with affected landowners will be carried out to investigate and record the location, extent and condition of existing land drainage. A specialist Land Drainage contractor would be procured to undertake the land drainage survey and design both pre-construction and post construction land drainage schemes.

3.12.26 The pre-construction land drainage scheme will be designed so as to maintain the efficiency of the existing land drainage system and to assist in maintaining the integrity of the right of way during construction. The scheme may include a system of ‘cut-off’ drains which feed into a new header drain and the scheme will also take into account surface water runoff mitigation measures. Where necessary, field drainage would be newly installed or restored to:

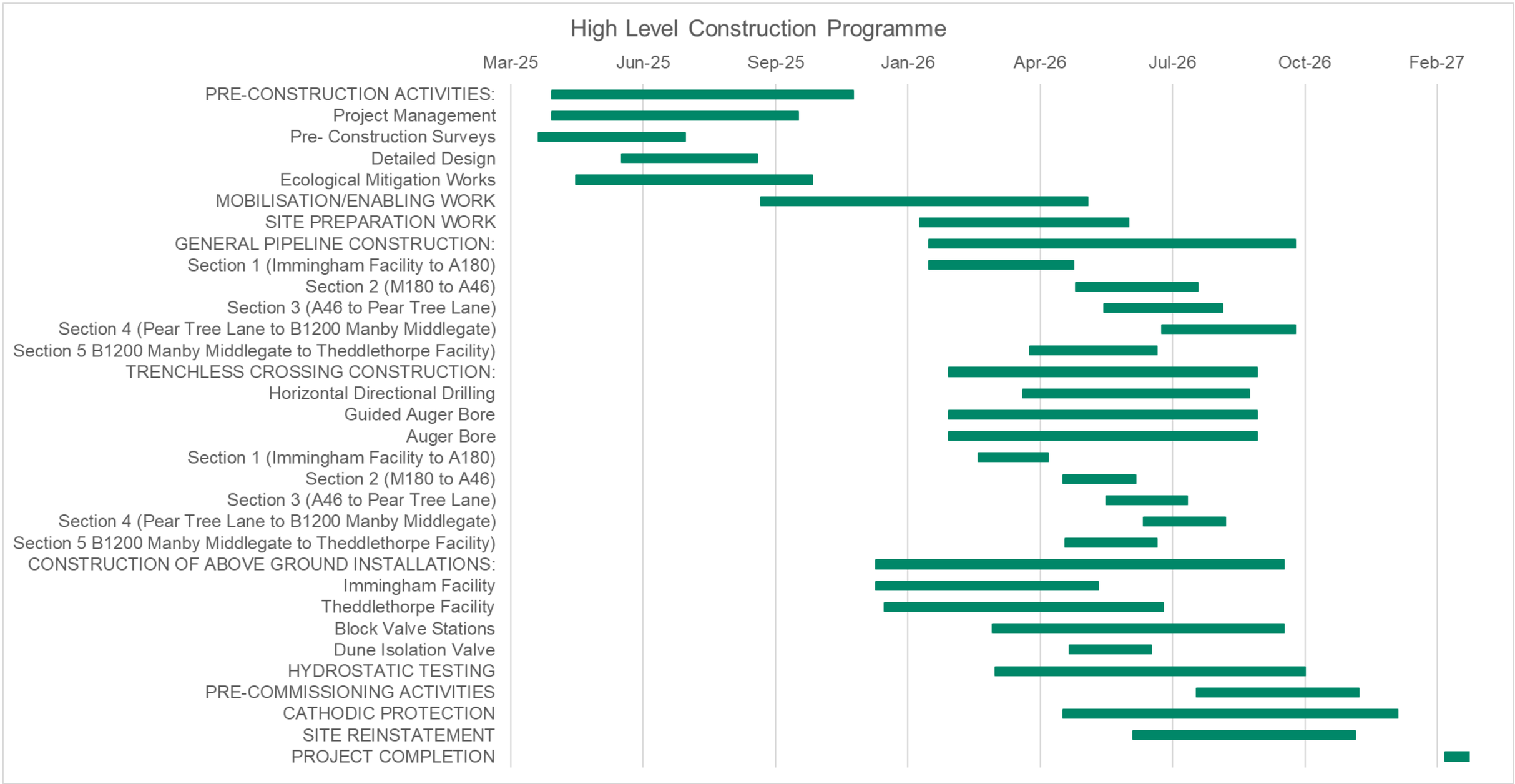
- enable landowner’s field drains to continue working throughout the construction period;
- help prevent soil structure damage and waterlogging of the working width;
- aiding recovery post-construction; and
- help prevent any future drainage problems.

3.12.27 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.

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

3.12.29 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.

Figure 3-29: Preliminary Construction Schedule



3.12.30 Additional activities to be conducted prior to commencement of the main pipeline construction work will include:

- Pre-construction surveys;
- Early environmental mitigation works;
- Working area preparation;
- Construction compound set-up;
- Ground investigations;
- Temporary fencing;
- Road signage installation;
- Provide temporary access points for construction; and
- Establish access points.

3.12.31 During the pre-construction phase of the Proposed Development an intelligent pigging run along the LOGGS pipeline will be undertaken.

Winterisation Activities (if required)

3.12.32 As discussed in section 3.12.12, the pipeline laying work will be programmed to predominantly take place between the start of April and October, when weather and ground conditions are generally most favourable for construction activities. In the event that persistent adverse weather conditions (or other setbacks) mean that construction works could not be completed between this period, then the pipeline construction would be halted at a suitable time and the working width that remained open would be "winterised".

3.12.33 Winterisation involves the cessation of construction works and the securing and preparation of the pipeline working width for over winter conditions. In particular, this involves:

- Removal of non-essential mobile plant and machinery from the working width to minimise the potential for pollution incidents;
- Checking and securing of gates and fencing at access points, track crossings and temporary farm access points across the working width to minimise the potential for unauthorised third-party access; and
- Checking and reinforcing water management measures and provision of additional precautionary measures to minimise potential for sediment loaded discharge into watercourses, alleviate pooling of water within the working width, protect pre- and post-construction drainage.

3.12.34 The working width will be regularly inspected and maintained during the winter period and additional measures will be installed where required. Construction work would then recommence the following spring. However, subject to weather conditions and consent of the landowner, topsoil reinstatement may continue to return the land to former state where this appropriate.

General Construction Activities

Access Routes

Temporary Access Routes

3.12.35 Access ways/temporary access routes will be constructed and maintained as necessary for transporting materials from the public highway to the working width.

3.12.36 The temporary access routes 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.

3.12.37 Along the working width, adequate space will be provided such that two Construction vehicles can safely pass each other at all times. Where this is not practical, passing points no greater than 500 m apart will be provided.

3.12.38 The entrance directly off the public highway would be laid to hardcore. The temporary access routes which lead to the pipeline spread and the running track itself would have the topsoil removed and stored to one side. The running track is effectively the haul road which will be constructed along the entire right of way (excluding certain crossing locations), to allow the passage of vehicles, plant and materials/pipe. Upon completion of construction, these tracks will be levelled, and the topsoil replaced, and land restored to its original condition.

3.12.39 Where necessary depending on ground conditions and weather conditions, some areas may temporarily be covered with a geotextile membrane and stone surface to facilitate traffic movements etc.

3.12.40 Culvert installations would be required for temporary access routes to cross identified 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. A schematic of a temporary construction phase flumed crossing is included in Figure 3-43.

Public Highway

3.12.41 Traffic Control will be secured via a Traffic Management Plan. This will include the use of Temporary Traffic Lights or Stop/Go Boards. Signage will be positioned and maintained at all road crossings. The Traffic Management Plan will follow the approach set out in relevant regulations and guidance:

- Traffic Signals Regulations and General Directions 2016 (the TSRGD) (Ref 3-23);
- Traffic Signs Manual Chapter 8 Part 2 (Ref 3-24);
- Safety at Street Works and Road Works – A Code of Practice (the Red Book) (Ref 3-25); and
- An Introduction to the Use of Portable Vehicular Signals (the Pink Book) (Ref 3-26).

3.12.42 Road sweepers will be employed to maintain all roads free of mud at access locations from pipeline traffic activities, whilst wheel wash facilities will be utilised at construction compounds and Immingham and Theddlethorpe Facilities.

3.12.43 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, or temporarily reduced speed limits, for the safe use of the junction.

3.12.44 An outline construction traffic management plan has been included within *ES Volume IV: Appendix 12.5 (Application Document 6.4.12.5)*.

Construction Compounds

Location

3.12.45 Following the completion of further design review, three main construction compounds are now proposed at specific locations, each of which will include pipe storage areas (also known as pipe dumps), welfare facilities, and plant storage and maintenance areas. The locations of these are shown on **Figure 3-30** and comprise:

- ***Northern Compound -*** located to the south of Habrough Roundabout and the A160, approximately 21,500 m^2 in area. This is greenfield land (arable) and would be used as a main construction compound and pipe storage area. This is expected to hold around 3,000 sections of pipe (12 m lengths). Access would be via Harborough Road;
- ***Central Compound -*** located near Welbeck Hill to the east of Barton Street (A18), approximately 17,100 m^2 in area. This would be used as a construction compound and would act as the main pipe / material storage area. It would be able to hold 2,000 pipe sections (12 m lengths). Access is proposed to be from the A18.
- ***Southern Compound -*** located at the car park on the former TGT site, approximately 13,000 m^2 in area. This would be used predominantly as a pipe storage area and is expected to hold up to 1,000 sections of pipe (12 m length).

3.12.46 Other alternative options presented and considered at the PEIR stage for the northern and central compounds have now been removed from further consideration and have not been taken forward as part of the Proposed Development. Further explanation is provided within *ES Volume II Chapter 2: Design Evolution and Alternatives (Application Document 6.2.2)*.

Set up

3.12.47 The construction compounds will be equipped with the following:

- Secure, lockable site offices for the Pipeline Contractor, subcontractors and the Client team. Offices will be fully serviced with heating, electricity, telephone/data connections and suitable IT systems;
- Welfare facilities including toilet facilities (female and male), messing facilities, drying facilities, etc.;
- Suitable waste and sewage disposal arrangements;
- Parking; and
- Storage facilities for equipment, materials (including pipe) and machinery.

3.12.48 The construction compounds would serve as a point for accepting deliveries of and storage of pipe and other materials/equipment, and from which pipe sections would later be transported directly on to the pipeline spread when required.

3.12.49 Where practicable utility supplies will be taken from main supply utility connections, however where this is not possible, utilities will be provided from temporary facilities such as the use of generators (housed in acoustic enclosures), water bowsers, local waste water storage and transport of waste to an approved off-site disposal point, etc.

3.12.50 The offices for the Pipeline Contractor's project management team will be clearly segregated from any construction facilities, storage, workshops or operational support within this area. Clearly separate parking facilities will be identified and hoarding erected to ensure that the visitor and management facilities are clearly segregated from all constructional support.

3.12.51 Appropriate and adequate fire-fighting equipment will be provided in all of the offices and site facilities and elsewhere on site to cover specific risks e.g., flammable liquid and gas storage and use, hot working.

3.12.52 Appropriate procedures will be in place to ensure safe evacuation in the event of an emergency. Emergency telephone numbers and the method of summoning the emergency services will be clearly displayed within the compound. During set-up and use of the sites, arrangements will be put in place to ensure the sites are properly managed.

3.12.53 Indicative layouts of the proposed construction compounds are shown in **Figure 3-31**, **Figure 3-32** and **Figure 3-33**.

3.12.54 Stored flammable liquids such as diesel would be protected either by double-walled tanks or stored in a bunded area with a capacity of 110% of the maximum stored volume. Spill kits would be located proximate to the storage areas within the compound.

Site Preparation

3.12.55 The location of each construction compound will be fully delineated and typically “heras” type fencing erected to secure the site(s). Where deemed necessary additional security measures may be used e.g., near built-up areas, schools, etc.

3.12.56 Where required, the topsoil will be stripped and stored on-site for later respreading.

3.12.57 Each construction compound will be established utilising a geotextile membrane and stone surface hardstanding including import of sand for pipe berms based upon the following estimates:

- Northern Compound stone roads and hardstanding circa 2,000 tonnes and sand berms 1,000 tonnes;
- Central Compound stone roads and hardstanding circa 1,000 tonnes and sand berms 880 tonnes; and
- Southern Compound stone roads and hardstanding circa 500 tonnes and sand berms 500 tonnes.

3.12.58 Depending on ground and weather conditions, it may be necessary in some areas along the haul road to temporarily lay down a geotextile membrane and stone surface to facilitate traffic movements. The installation of this surface “stabilisation” is subject to weather conditions and location requirements; therefore a worst-case scenario has been based upon an allowance of up to 15% of the total route, which equates to approximately 8.4km and circa 20,160 Tonnes.

3.12.59 The location of the access point to the central compound will be subject to a Road Safety Audit and agreement with the Local Highways Authority, which may entail construction of a haul road to facilitate delivery of line pipe to this location. A worst-case scenario has been assessed based upon a 6 m wide, 1km haul road, which would require circa 2,400 tonnes of stone to be laid.

Lighting

3.12.60 Lighting at the construction compounds will follow a similar philosophy to that at the Immingham and Theddlethorpe Facilities and Block Valve Stations as detailed in paragraphs 3.12.222 and 3.12.228.

Revision: 4 Drawn: LC Checked: HT Approved: MW Date: 2023-10-23

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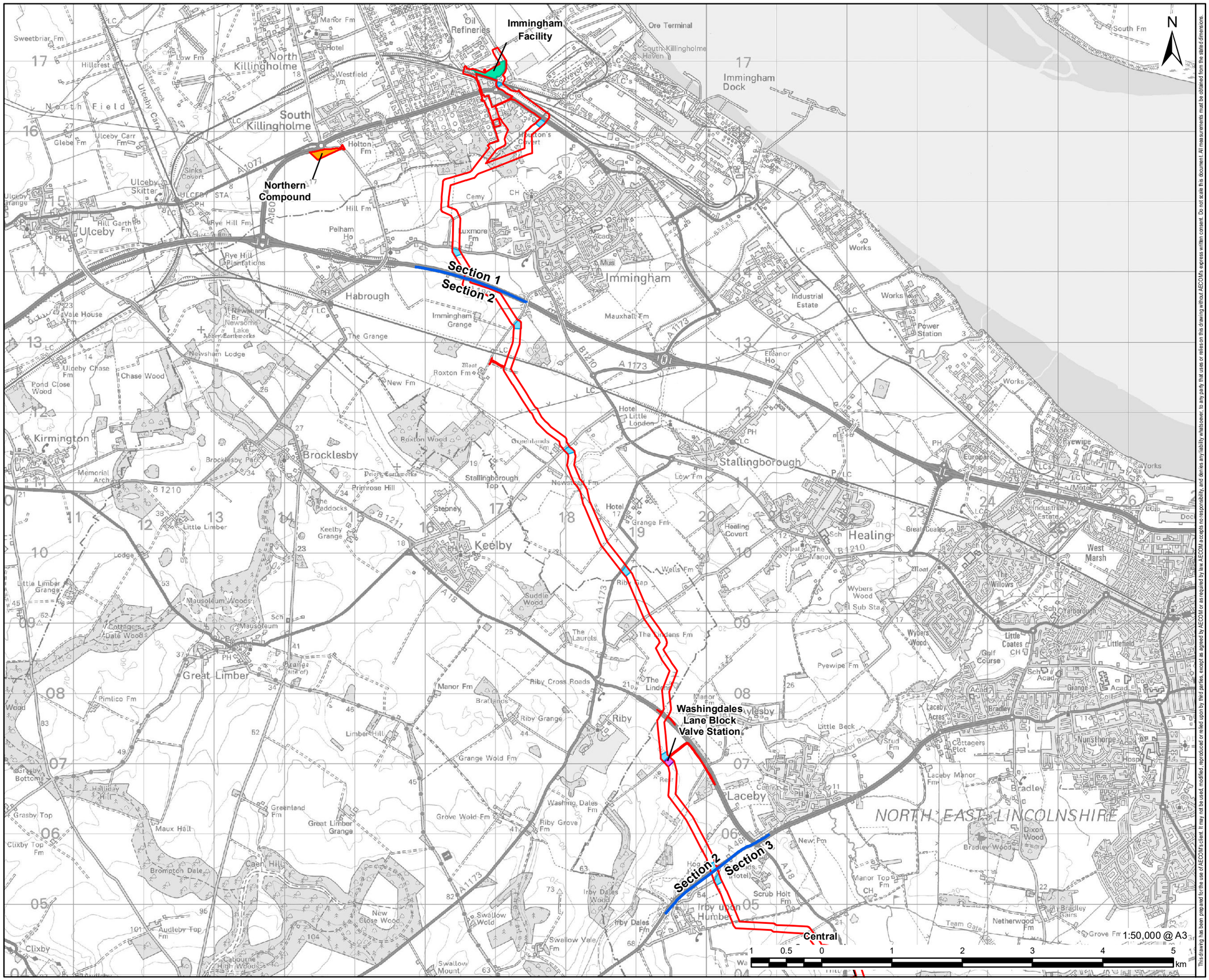

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Temporary Construction Compound
- Block Valve Station Temporary Construction Area
- Immingham Facility
- Temporary Access and Laydown Areas

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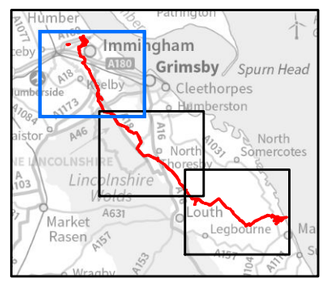

FIGURE TITLE

Figure 3-30 (1 of 3)
Location of Main Construction Compounds, Temporary Facilities and Laydown Areas

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

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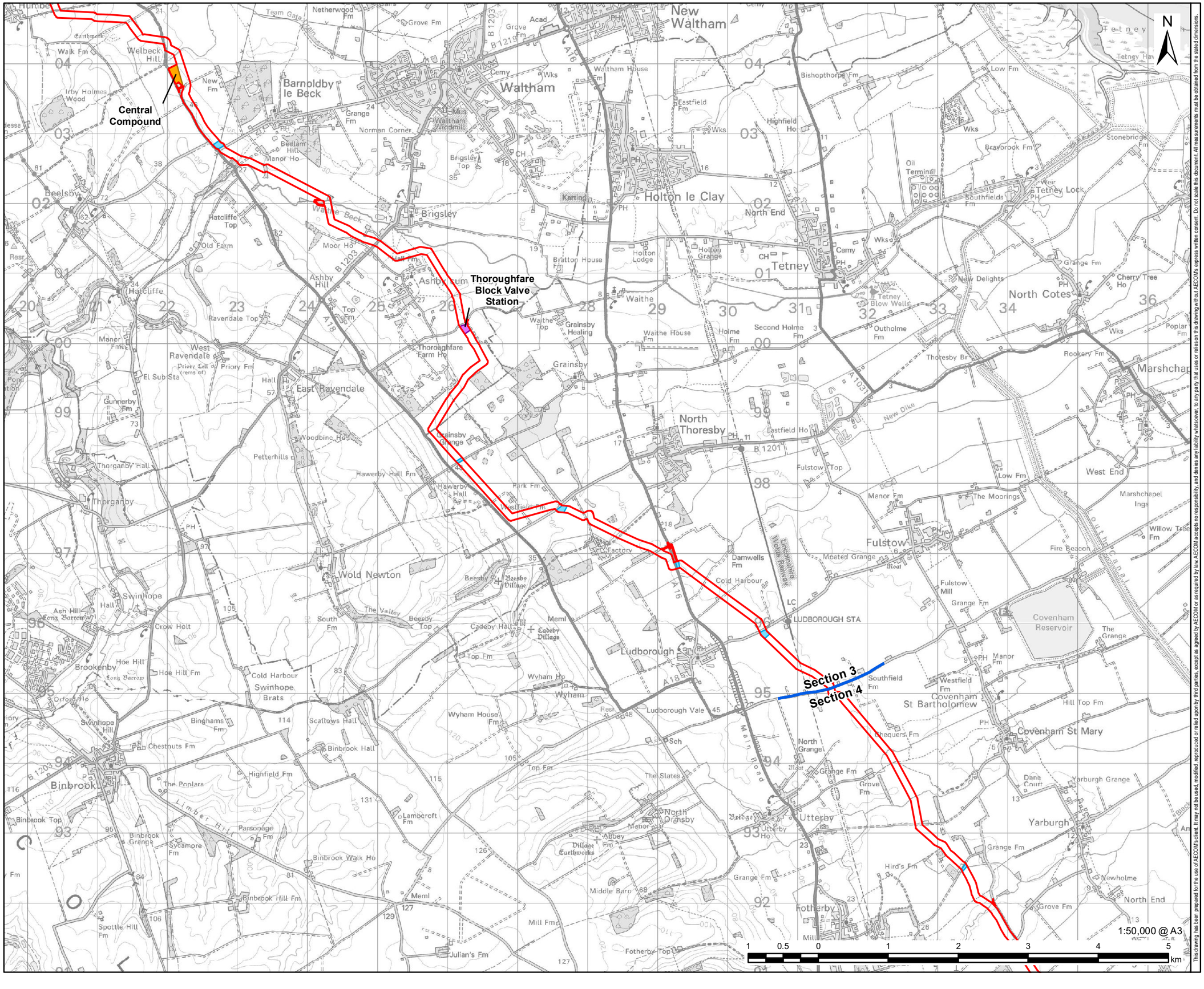

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Temporary Construction Compound
- Block Valve Station Temporary Construction Area
- Temporary Access and Laydown Areas

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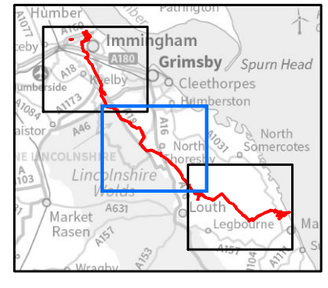

FIGURE TITLE

Figure 3-30 (2 of 3)
Location of Main Construction Compounds, Temporary Facilities and Laydown Areas

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-30

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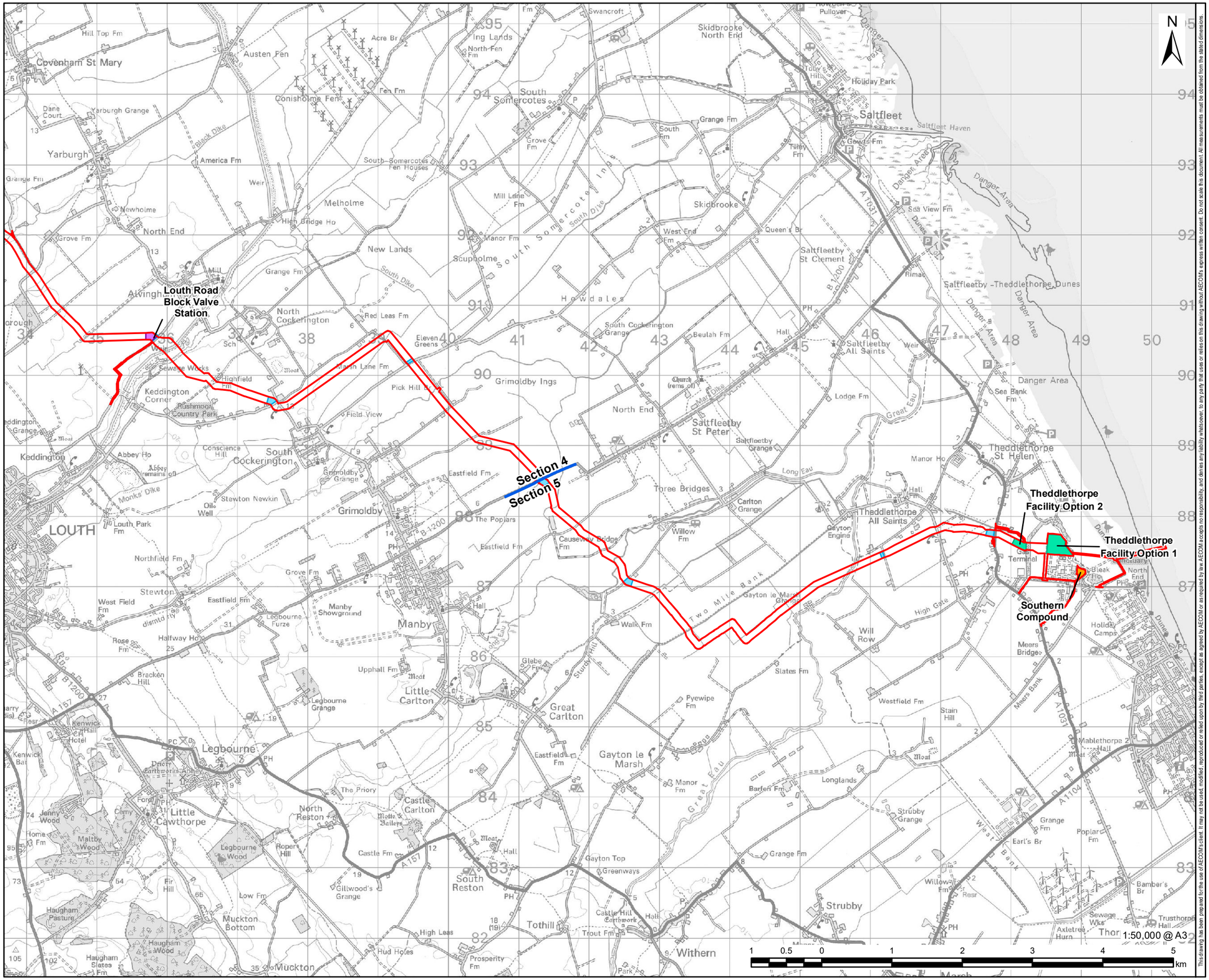

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Temporary Construction Compound
- Block Valve Station Temporary Construction Area
- Theddlethorpe Facility
- Temporary Access and Laydown Areas

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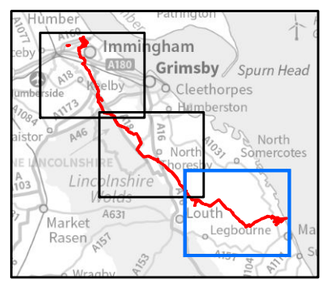


FIGURE TITLE

Figure 3-30 (3 of 3)
Location of Main Construction Compounds, Temporary Facilities and Laydown Areas

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231023_ES_3-30

Figure 3-31: Indicative Layout of the Preferred North Construction Compound

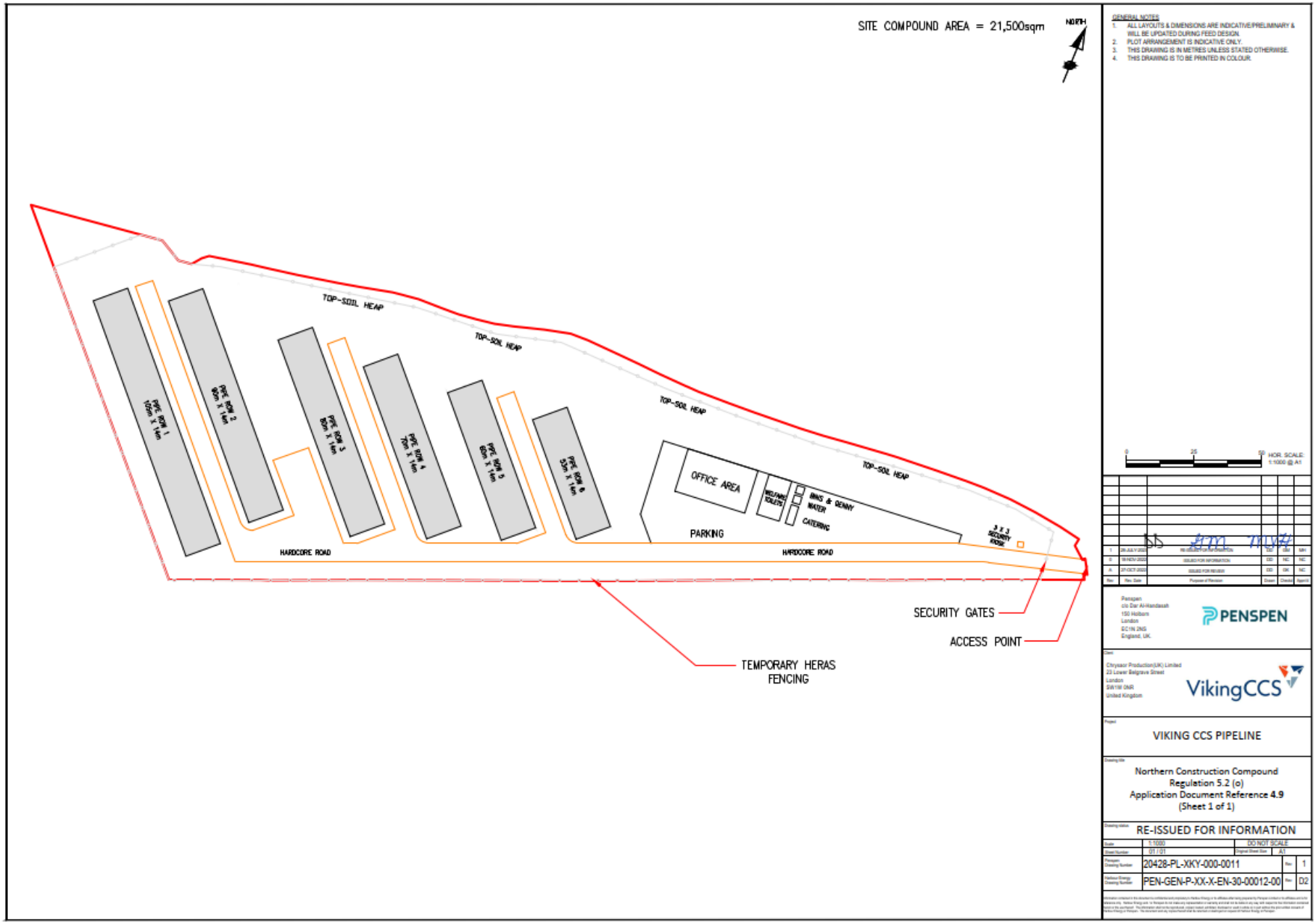


Figure 3-32: Indicative Layout of the Preferred Central Construction Compound

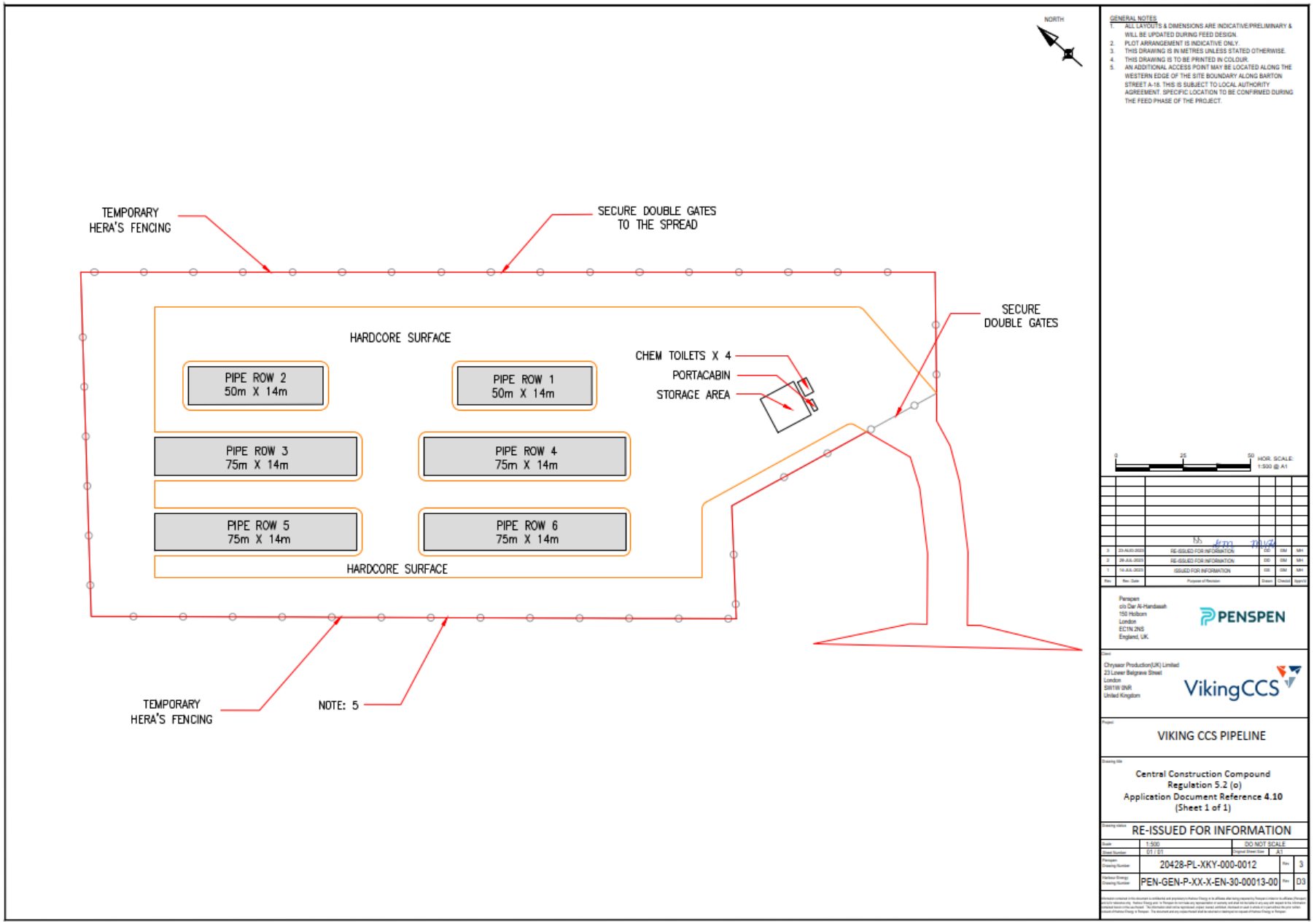
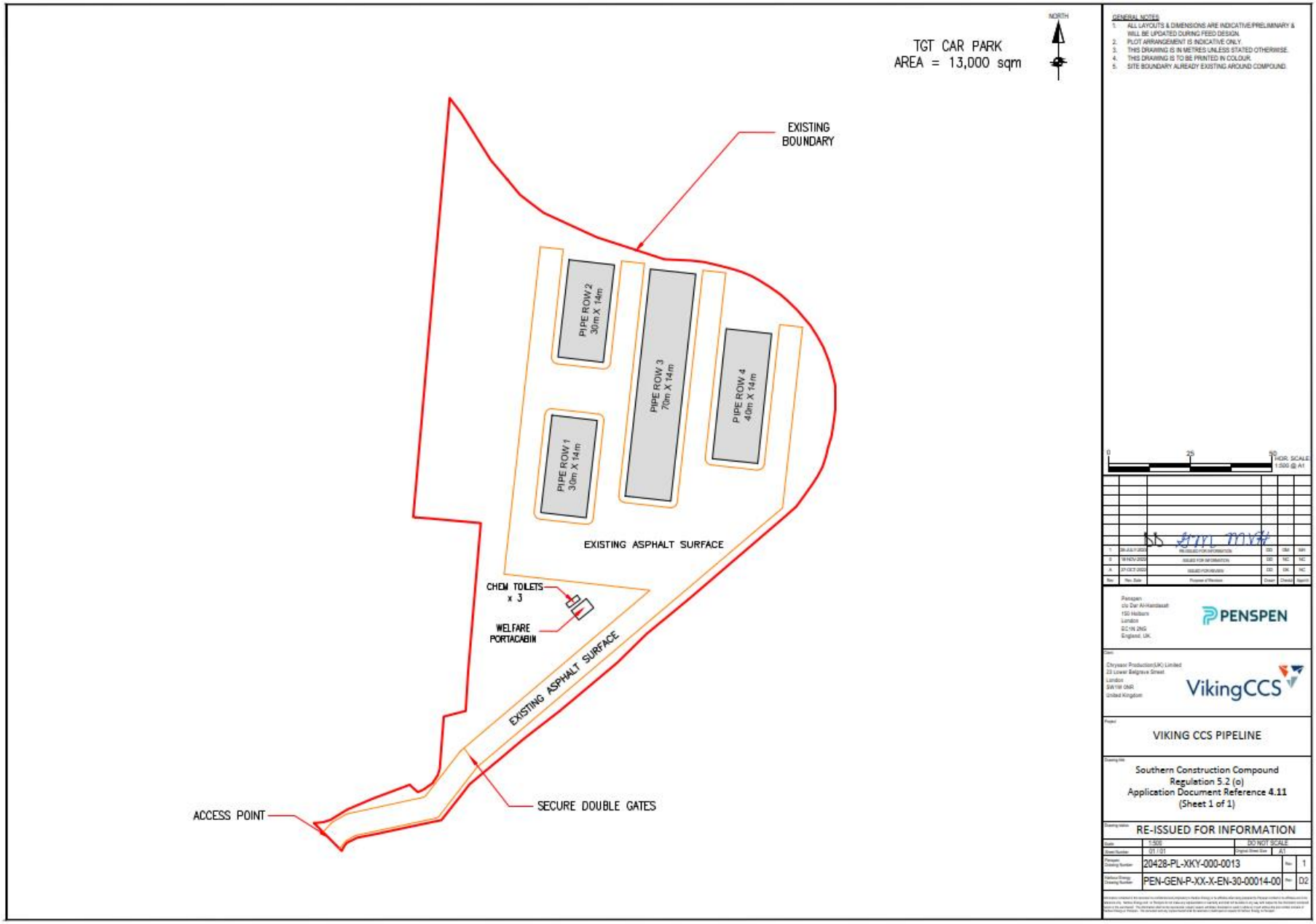


Figure 3-33: Indicative Layout of the South Construction Compound



Temporary Facilities and Laydown Areas at Certain Access Points and Above Ground Infrastructure

3.12.61 To support construction works and the larger construction compounds discussed above, temporary facilities and laydown areas would be required at the following locations (and as shown on **Figure 3-30**):

- *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; and a materials and equipment storage area including crane and earth movers. The temporary land area required is expected to be around 40 m x 40 m. 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 50 m x 40 m;
- *Temporary Laydown, Welfare and Parking Areas at a number of Access points (16 in total):* Within the working areas made available at road crossings, an adequate number of temporary hardstanding lay-by areas (approximately 100m x 100m at each location) will be constructed and maintained, including all necessary temporary work in culverting to ditches, surface drainage, temporary fencing, etc. An indicative layout is shown in **Figure 3-34**. All hardstanding materials will be removed, and the area fully reinstated to their original condition prior to the completion of the works. These areas will:
    - Provide an area for HGV's parking, unloading and storage of construction plant, rigging and de-rigging as necessary with mechanics and their vehicles in attendance;
    - Provide an area for temporary storage of small volumes of pipe when stringing trucks are unable to get down the spread when ground conditions are too wet;
    - Provide welfare facilities including toilet blocks, canteen, drying rooms, storage lock-ups, and offices; and
    - Provide parking areas for construction workers.
- *Smaller Temporary Welfare and Parking Areas at a number of Access points (7 in total):* Smaller areas set up for welfare requirements, (60m x 60m) with limited parking and are situated where the distance between the major access points is too long for serviceable needs. An indicative layout is provided in **Figure 3-35**.

3.12.62 Storage of diesel fuel will be located at construction compounds / pipe dumps only within a suitable bund and/or buffer zone to protect surface watercourses, groundwater borehole abstraction points and springs. It is not intended to maintain fuel storage facilities on the pipeline route for environmental and security/safety reasons.

3.12.63 Heavy plant and temporary power generation units will be required to be fuelled up and maintained on the pipeline route working width or access/laydown areas, as appropriate. Protection measures will be provided against spillages of fuel, equipment lubricates, chemicals and/or any other uncontrolled discharges to the ground that could potentially enter water courses or drainage systems. Precautionary measures for these tasks will include provision of spill kits and drip-trays within all vehicles, plant and at high-risk locations.

Figure 3-34: Indicative Laydown, Welfare and Parking Area Layout

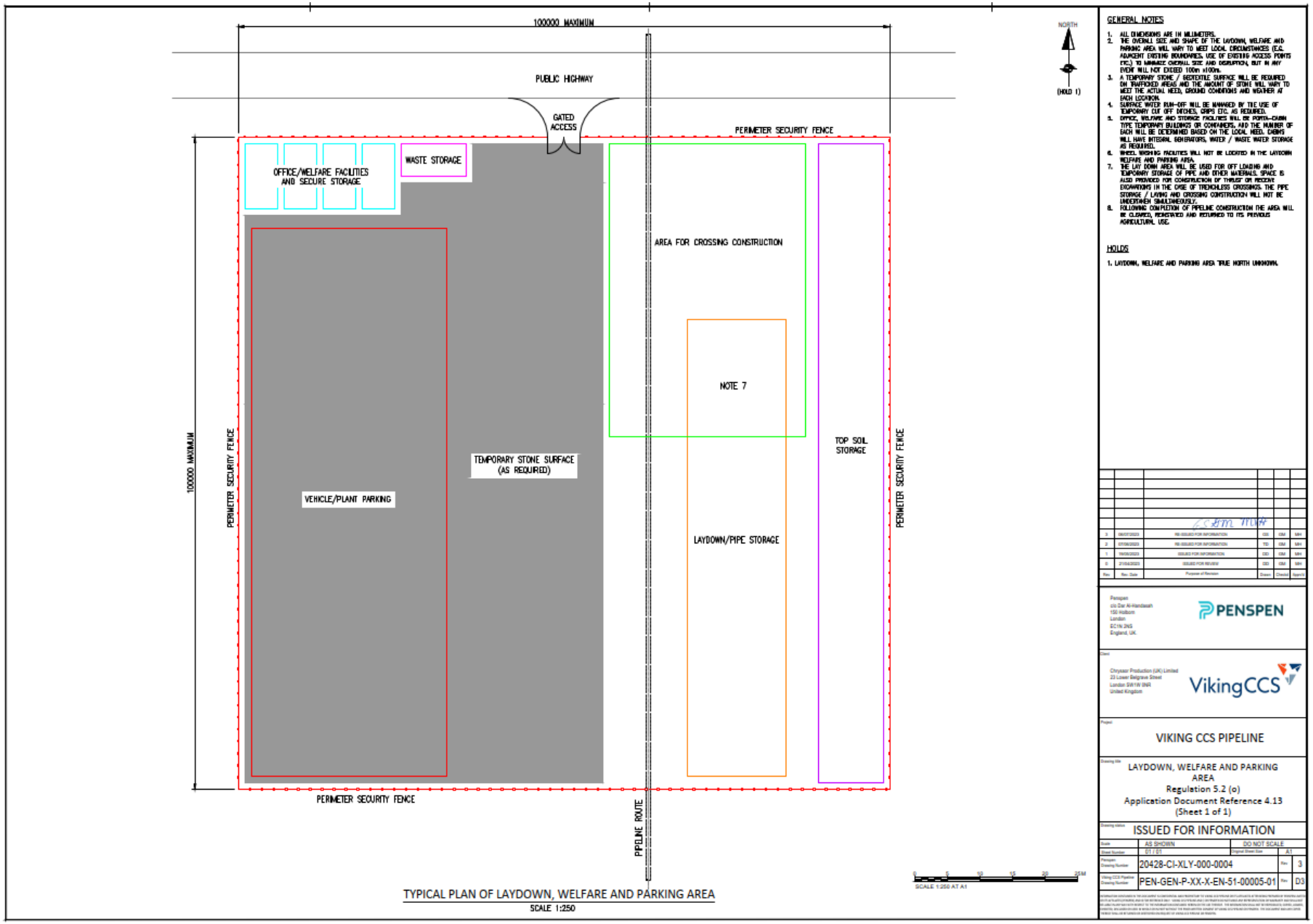
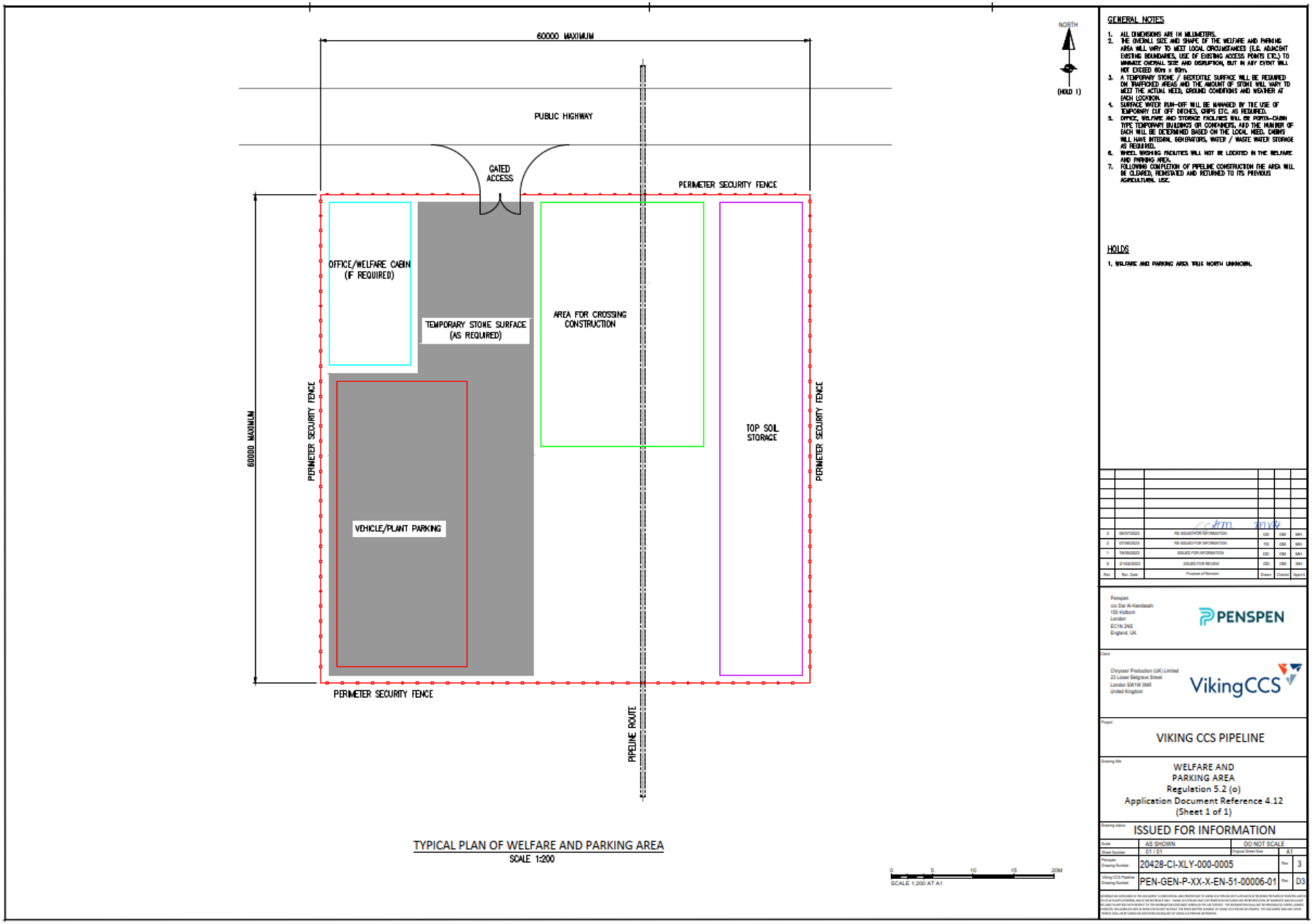


Figure 3-35: Indicative Welfare and Parking Area Layout



Preparation of working width for the pipeline

3.12.64 The standard working width of the pipeline spread would be 30 m. This would provide sufficient area for a running track (described in 3.12.68 below), topsoil storage, separate subsoil storage and would enable safe excavation of the trench (in open cut sections).

3.12.65 The working width may differ from the standard 30 m width in specific areas as a result of existing constraints or crossing points. Typical examples would include:

- Areas of hedgerows or trees (or where trees are to be retained which require the width to be reduced), Working Width reduced to 10 metres;
- Sensitive water crossings – Working Widths reduced; will be reduced to 10 metres where practicable; and
- Major road/rail/water crossings – working width would increase to up to 50 m for major crossings to allow additional space to manoeuvre and laydown of specialist equipment required for HDD or auger boring, whilst maintaining access along the working width.

3.12.66 The pipeline route would be surveyed and pegged (marked) out, and temporary fencing erected along the boundaries of the working width. The type of fencing to be installed is dependent on the area to be fenced and factors considered would include the required security level in relation to the surrounding land; public accessibility; rural or urban environment; and arable or stock farming. Fencing types vary ranging from post and rope demarcation fencing in open low risk arable areas to 'Heras' type security fencing in areas that require high security to prevent unauthorised access to the works. Where stock-proof fencing is required the type of fencing is dependent on the livestock kept and will be determined and agreed with landowner/occupier requirements. Stock-proof temporary fencing could include post and wire, and post and rail fencing with or without barbed wire, pig netting, horse fencing etc.

3.12.67 Fencing would be regularly inspected and maintained during the construction phase then removed as part of the demobilisation unless otherwise specified.

3.12.68 A haul road, known as a running track, will be constructed along the entire working width where practicable to allow the passage of vehicles, plant and materials/pipe. The construction of a haul road will be impracticable where the pipeline route crosses railways, major roads or within HDD areas, hence why access points will be created in these locations. It is intended that the haul road will be directly onto the sub-soil but depending on ground conditions and weather conditions a geotextile membrane and stone surface and/or bog-mats may be used in selected areas to enable traffic movements.

3.12.69 Crossing points across the working width for farm vehicles or stock will be provided using a double gate system similar to a level crossing. Where access to water troughs or other facilities for farm animals is blocked then adequate temporary facilities would be provided as agreed with the landowner/occupier.

3.12.70 Pedestrian access to and from residential, commercial, community and agricultural land would be maintained throughout the construction period. Local vehicle access would be maintained.

3.12.71 Where field to field access points would require alteration as a result of construction, alternative field access would be provided in consultation with the landowner/occupier. Recessed field access from local roads would be reinstated where agreed with the landowner.

3.12.72 Where sensitive features are to be retained within or immediately adjacent to the DCO Site Boundary, an appropriate protective buffer would be created where this extends within the Order Limits. The buffers would be established using appropriate fencing and signage. The buffers will be shown on the Retention and Reinstatement Plans prepared by the Pipeline

Contractor and in some locations, there may be the need to prepare a method outlining how a specific sensitive feature would be retained. A plan showing those trees we intend to retain is included within *ES Volume IV: Appendix 6.10 (Application Document 6.4.6.10).*

3.12.73 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 working width demarcation fencing.

3.12.74 As the working area crew proceed, overhead cable protection measures would be installed. These would comprise a combination of restricted height access under overhead cables, fencing, signage and bunting/warning tape each side of the overhead cable along the working width.

3.12.75 Additionally, temporary protection measures and identification of buried services will be applied. All buried services will be clearly marked using measures that may include temporary spray paint, signage, wooden pegs and high visibility fencing for exclusion zones. Buried services area exclusion measures will be applied as required by the design and by asset owner requirements for services such as gas and oil pipelines, buried cables etc. The area of exclusion and temporary protection measures may include temporary high visibility fencing, temporary construction matting and signage.

3.12.76 Where watercourses are encountered that require the passage of construction traffic, measures to be applied include the use of 'flume' pipes or temporary spanned bridges. Flume pipes are temporary pipes placed in the watercourse to permit the flow of water through the pipe. Once the flume pipe is installed, the area above the flume pipe is backfilled with selected excavated material, a layer of geo textile material prior to construction mats being placed over the backfilled area to permit the passage of plant, equipment, pipeline materials and people. Flume pipes will be sized to reflect the span width and the estimated flow characteristics of the watercourse under peak flow conditions. Where installation of a flume pipe crossing is not possible then a temporary spanned bridge (Bailey type bridge) can be installed and requires the construction of a raised soil platform each side of the watercourse (set back from the watercourse banks) before a temporary bridge structure is lifted onto the spoil platform. Temporary bridges and their supports will be designed specifically to consider the span length and the weight and size of plant and equipment that will cross the bridge.

3.12.77 The crossing schedule provided in *ES Volume IV: Appendix 3.2 (Application Document 6.4.3.2)*, shows the proposed crossing technique for the permanent pipeline installation as well as for the temporary construction for the haul road.

3.12.78 Working areas will be cleared of vegetation, scrub and hedgerow as appropriate, in the winter immediately in advance of pipeline construction.

3.12.79 Topsoil will be stripped, in accordance with the Outline Soil Management Plan (included in *ES Volume IV: Appendix 10.1 (Application Document 6.4.10.1)*) using a combination of excavators and bulldozers. These will be delivered on low-loaders to the construction compound, before being transferred to the working width. Where necessary topsoil from hedgerows or wooded areas may need to be stored separately from the open field topsoil to avoid mixing and to preserve the seed bed. Topsoil will be moved to the edge of the working area and heaped such that the spoil heap does not encroach outside the fenced area. Topsoil storage will be managed to maintain the nature of the soils and measures taken to prevent compaction, soil loss due to erosion and excessive weed growth.

3.12.80 Topsoil will be retained local to where it is stripped and will not be moved outside of this area or taken off-site unless with specific written approval of the Landowner and only in accordance with all relevant environmental requirements.

3.12.81 Block Valve Stations will be set out and fenced progressively as the preparation works continue and in readiness for the later start of construction of the block valves.

Land drainage

3.12.82 The existing land drainage will be carefully inspected and recorded by a drainage company, 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.

3.12.83 Consultation with affected landowners will be carried out to investigate the current extent of land drainage. A scheme of pre-construction land drainage will be designed with the intent of maintaining the efficiency of the existing land drainage system and to assist in maintaining the integrity of the right of way during construction. The scheme may include a system of 'cut-off' drains which feed into a new header drain and the scheme will also take into account surface water runoff mitigation measures. As the working width construction progresses, surface water runoff mitigation measures may be installed. These may include measures such as water stops, grips, silt netting, temporary lagoons, cut-off drains, cut-off channels and silt busters (filtration tanks). The extent and detail of surface runoff mitigation measures will be specified in the working width design.

3.12.84 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.

Utility Diversions

3.12.85 As part of the Statutory Consultation, utility companies were contacted and details of assets requested to confirm their locations/details. No utility diversions are planned at this point with agreement to construct as per standard engineering practices at a suitable clearance. Where the pipeline crosses an existing asset/service, it will be laid so that a minimum clearance of 600 millimetres (mm) (dependent upon service/agreement) from obstructions and other services is maintained. A reduction of the separation distance may be considered if acceptable protection is provided. However, any reduction in clearance will be confirmed as acceptable with the relevant utility provider in advance.

Review and maintenance of Public Rights of Way

3.12.86 The Public Rights of Way (PRoW) that intersect the Proposed Development are identified on **Figure 3-36**.

3.12.87 PRoWs would only be temporarily diverted or closed to allow for construction works to be carried out safely. Those PRoW which will require temporary diversions have been identified within **Table 3-6** and on figures provided within the Rights of Ways Plans (*Application Document 4.20*).

Table 3-6: Public Right of Way's Requiring Temporary Works

Area	Name of PRoW	Brief description of work
Immingham	North Lincolnshire/ SKIL 91A	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Immingham	Habrough/11	Temporary closure with two diversions provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Immingham	Habrough/4	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*

Area	Name of PRoW	Brief description of work
Aylesby	Alyesby/116	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Aylesby	Alyesby/130	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Irby Upon Humber	Laceby/119	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Irby Upon Humber	Irby Upon Humber/161a	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Irby Upon Humber	Irby Upon Humber/124	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Barnoldby Le Beck	Barnoldby Le Beck/94	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Ashby cum Fenby	Ashby cum Fenby/81, Ashby cum Fenby/82, and Ashby cum Fenby/85	Temporary closure with multiple diversions provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Ashby cum Fenby	Ashby cum Fenby/86	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Ashby cum Fenby	Ashby cum Fenby/87	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Ashby cum Fenby	NTho 113/1	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Louth	Utte 78/1 and Utte 83/1	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Louth	Utte 83/1 and Utte 83/2	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Louth	LGri 77/1	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Alvingham	NCoc 68/1	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*

Area	Name of PRoW	Brief description of work
Alford	GayM 193/1	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Theddlethorpe St. Helen	ThSH 250/2	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*
Theddlethorpe St. Helen	ThSH 249/1	Temporary closure with diversion provided between points shown on the Rights of Ways Plans *(Application Document 4.20).*

3.12.88 Public Rights of Way will be maintained and suitable arrangements to protect the public implemented. These arrangements would be detailed in the Construction Environmental Management Plan (CEMP).

3.12.89 The temporary diversion or closure of PRoWs which intersect the pipeline spread would comprise 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 20 m to 50 m 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.

Construction Lighting along the Pipeline Working Width

3.12.90 Lighting on the pipeline spread is not currently envisaged to be required, as main lay works are predominantly planned during late spring, summer and early autumn months; however, task lighting may be required during specific activities.

3.12.91 Task lighting will typically be provided during construction activities and the required levels will vary depending upon the type of activity being undertaken. It is not intended to have lighting for general works as part of the pipeline construction works, such as clearance, excavation and lower/lay operations; however, lighting may be necessary to complete activities which cannot be completed during normal working hours such as HDD activities, hydrostatic testing and tie-in/golden welds or where lighting will be required for monitoring/inspection activities.

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

3.12.93 Construction lighting will follow BS EN 124646 (Parts 1 and 2) (Ref 3-20) and guidance notes from the Institution of Lighting Professionals, GN01 (Ref 3-21) and GN08 (Ref 3-22). In general, lighting will be used for the minimal time required and at the lowest luminosity necessary for safe delivery of each task. It will be designed, positioned, and directed to reduce the intrusion into adjacent properties and habitats.

3.12.94 Lighting requirements at the Immingham and Theddlethorpe Facilities and Block Valve Stations are detailed in paragraphs 3.12.222 to 3.12.228.

Construction Power

3.12.95 Mobile and portable (diesel) generating equipment will be required for construction activities along the construction spread, with portable generators typically providing between 6 kW and 28 kW of power.

3.12.96 Portable diesel generators, estimated at 10 KVA, will have overall dimensions of 785mm width x 890mm height x 1290mm length. The noise level from diesel generators at a distance of 7 m will be approximately 66 dB(A). It is estimated that up to 30 of these units would be required along the construction spread at any one time. Diesel Generators and pumps for will be screened, either within housed units or using straw bales.

3.12.97 Mobile generators are larger units with greater power capacity, with typical units providing between 8 kW and 500 kW. Due to their size, they may be set up on trailers to aid transportation between locations. Power will be provided by a mobile diesel generator, estimated to be a 60 kVA unit with a footprint of 3.05m length x 1.17m width x 2m height. Fuel usage is estimated at 7.97l/hr at 50% demand rising to 15.67l/hr at 100% demand. Noise levels at 75% demand will be approximately 64dB(A) at a distance of 7 m. It is estimated that 4 to 6 of these units would be required along the construction spread at any one time.

Cathodic Protection Beds

3.12.98 At Immingham, a vertical anode groundbed comprising high-silicon-iron-chrome (H.S.I.) anodes in carbonaceous backfill shall be installed at the required location. The ground bed shall be constructed with a ring-main cable trench excavated 1200mm deep and 600mm wide, to the length specified. At the specified anode spacing, a nominally 250mm diameter hole shall be augered or drilled to the specified depth. An anode complete with centraliser shall be carefully lowered down each hole, and supported centrally in the hole, until carbonaceous backfill material has been placed around it. The anodes shall be lowered into the holes using ropes. Carbonaceous backfill shall then be packed around and over each anode. Should the top of the backfill column be lower than the bottom of the trench the remainder of the hole shall be filled with pea gravel. Care must be taken when tamping the backfill not to damage the anodes. Broken or cracked anodes shall be replaced.

3.12.99 At Theddlethorpe, a horizontal groundbed comprising a high-silicon-iron-chrome (H.S.I) anodes laid in carbonaceous backfill will be constructed at the required location. The groundbed shall be constructed with a trench to the specified depth and 600mm wide, leaving a cable step of width 300mm and height 300 mm for the specified length of the groundbed. All roots, stones and rocks shall be removed from the trench. A 150 mm deep layer of carbonaceous backfill shall be laid in the trench and tamped firmly into place. Each anode shall then be centrally located in the trench and the anode cable tail taken to one side and positioned on the cable step. A further 150mm deep layer of carbonaceous backfill shall then be laid by hand over the anodes and along the trench and tamped firmly. Over the anodes, a long plank of timber shall be used, and care should be taken that no point load is applied over the brittle anodes. The plank shall be removed after anode backfilling.

3.12.100 Common to both facilities will be a ring main cable laid on a 75mm bed of soft sand and care taken to ensure the cable has no kinks or damage to the insulation or sheathing. The anode cable tails shall be spliced to alternate sides of the ring main cable, using line taps, and the splices sealed with branched splice encapsulation kits in accordance with the manufacturer’s instructions. Each encapsulated splice shall be individually inspected before backfilling. Any encapsulated splice found to be defective shall be rejected and replaced.

Revision: 2 Drawn: LC Checked: HT Approved: MW Date: 2023-10-20

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VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- National Cycle Route
- Public Right of Way

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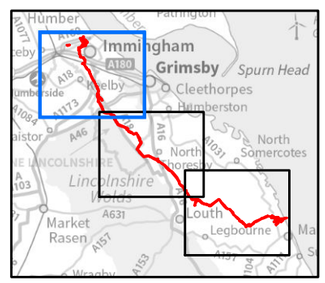

FIGURE TITLE

Figure 3-36 (1 of 3)
Identification of Public Rights of Way within the DCO Site Boundary

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231020_ES_3-36

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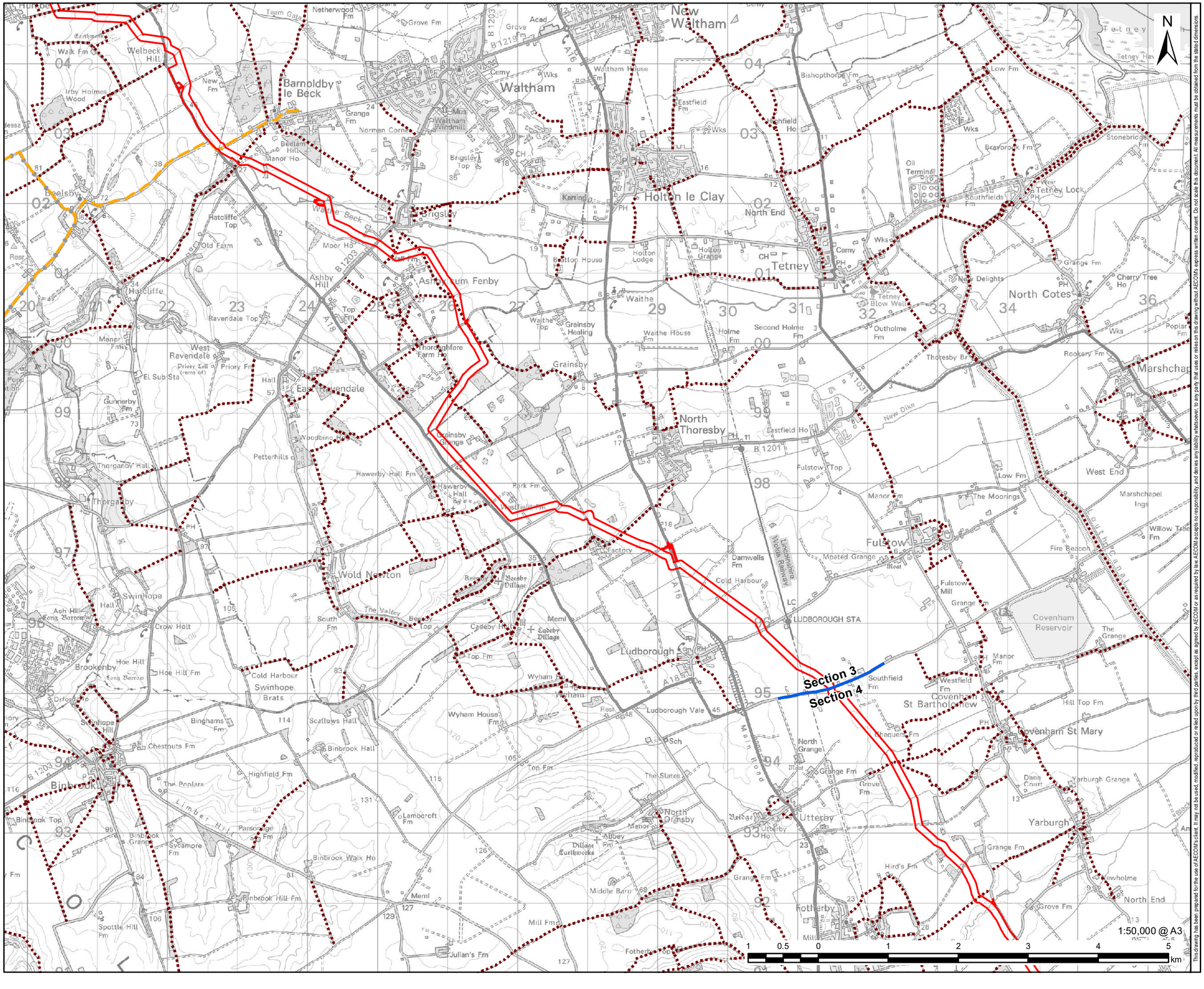

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- National Cycle Route
- Public Right of Way

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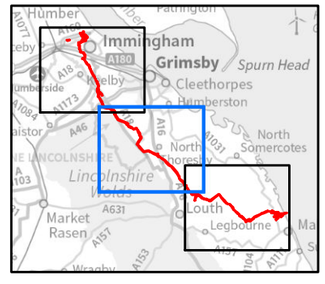

FIGURE TITLE

Figure 3-36 (2 of 3)
Identification of Public Rights of Way within the DCO Site Boundary

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231020_ES_3-36

Revision: 2 Drawn: LC Checked: HT Approved: MW Date: 2023-10-20

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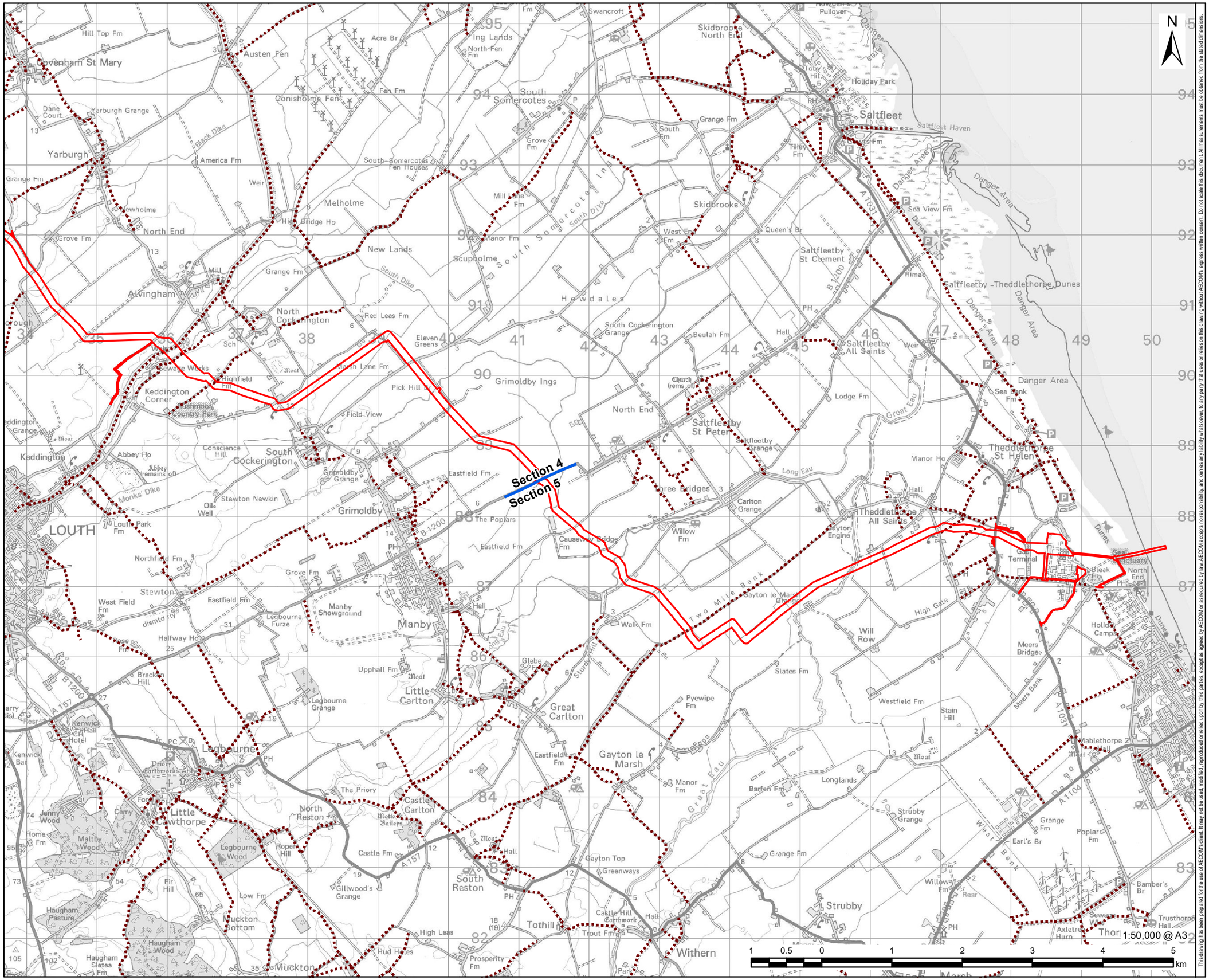

N

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Public Right of Way

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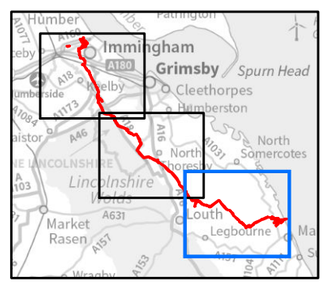


FIGURE TITLE

Figure 3-36 (3 of 3)
Identification of Public Rights of Way within the DCO Site Boundary

ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231020_ES_3-36

Pipeline Construction

Pipeline Construction techniques and sequencing

Overview

3.12.101 Approximately 55.5 km of steel pipe will be required. The pipe will be manufactured in specific pre-determined lengths (12 m). The exact manufacturer of the pipe is yet to be determined. However, for the assessment work it has been assumed that initial delivery of the pipe will be via ship, delivered to the Port of Immingham. Sections of pipe would then be transported for temporary storage at the northern, central and southern Construction Compounds before they are distributed along the pipeline route.

3.12.102 The majority of the pipeline route will be installed using an open-cut trench excavation technique, which is explained in detail in the following sections.

3.12.103 Where the pipeline route crosses railways, roads, other utilities or certain watercourses and an open-cut excavation technique is not feasible, trenchless crossing techniques will be utilised as detailed in paragraphs 3.12.146 to 3.12.179. Further details on the proposed crossing schedule are included in *ES Volume IV: Appendix 3.2 (Application Document 6.4.3.2).*

Pipe Stringing and Cold Bending

3.12.104 Following working area construction and topsoil stripping, the transport of pipe and bends to the working area from the pipe storage areas, the stringing (laying out the pipe and bends in readiness for welding) and cold bending operations will be carried out.

3.12.105 The 12 m line pipe sections will have a factory applied protective coating applied to the entire length apart from the ends which are left bare to enable butt welding of the pipes. Factory made bends (made using the forged or induction bend process) are also required to enable changes in direction of the route to be completed. Small changes in direction and also level (vertical alignment) can be accomplished in the field using cold bending, a process where shallow bends are formed using line pipe.

3.12.106 Pipes and bends will be carefully loaded onto flatbed HGV trailers using specialist certified lifting equipment. Pipe and loads will be secured to ensure they are not damaged during transportation to site. The vehicles used to transport the pipe will be suitable to negotiate the proposed route and, where necessary, specialist vehicles will be used such as those fitted with rear wheel steering. For the assessment, it has been assumed that each HGV would carry a maximum of 2 pipe sections.

3.12.107 No offloading/transfer will be carried out on public roads. If it is not practicable to transport the pipe and bends to the working width using road-going vehicles, they will be transferred to trailers suitable for off-road travel at a laydown area.

3.12.108 All lifting will be carried out in accordance with a dedicated lift plan by a suitably qualified and experienced lift team. On arrival at the working width for installation, pipes and bends will be offloaded in a line and “strung” in readiness for welding onto wooden pipe supports and secured with wedges.

3.12.109 A detailed “bending survey” will then be undertaken to measure the precise ground profile along the proposed pipeline centreline and then selected pipes are cold bent to a specified angle to ensure the correct depth of cover is achieved but without over deepening of the trench. A cold bending machine consists of a cradle in which the pipe sits and is bent using hydraulic rams whilst an internal mandrel prevents loss of pipe ovality. The cold bending machine travels progressively along the working area carrying out cold bending where required. After bending and quality inspection the pipe is replaced back into position within the stringing line in readiness for welding.

Welding, Inspection and Joint Coating

3.12.110 Each pipe and bend will be joined by butt welding. Welding, grinding and pipe coating will be carried out to a detailed procedure that meets the standards required by international, national and project-specific specifications. Welding will most likely be carried out by automatic or semi-automatic welding machines although manual welding may still be used in some instances.

3.12.111 To commence pipe welding, the first pipe in the string will be set onto and secured on timber pipe supports and an internal pipe alignment clamp will be inserted into the pipe. The second pipe will be lifted from its pipe supports and fed over the internal pipe clamp that protrudes from the open end of the first pipe. Welding will then be then carried out until the first weld pass is completed after which the two pipes will be lowered onto timber supports. The clamp will be moved forward using in-built hydraulic rollers until it protrudes from the open end of the second pipe and the third pipe will be lifted into the internal clamp and welded in the same manner as the first weld; with the process repeated to form a continuous pipe string.

3.12.112 While second and third pipes are being set up and initially welded, the remaining passes of the first weld will be completed. This process will be repeated to form a continuous pipe string. The open ends of pipe strings will be sealed with plastic end caps to prevent the ingress of dirt and foreign objects.

3.12.113 Where induction bends are encountered (bends made in a factory under controlled conditions with a shorter radius than site-made cold bends) an external mechanical cage clamp will be used instead of the internal clamp.

3.12.114 Gaps between pipe strings will be left at pre-determined locations for example at railway, road, watercourse and utility crossings. Individual fabrications will be made to fill these gaps at a later date as excavation and “lower and lay” progresses or via different installation techniques such as HDD or auger boring. These individual fabrications may be made by further smaller welding crews ahead of or behind the pipeline welding crew.

3.12.115 All welding will be subject to strict quality control procedures. All welders will be fully qualified and will also be specifically pre-qualified to complete the welding procedures to be used on this Proposed Development. All welding operations will be overseen by qualified welding inspectors.

3.12.116 When the welds have cooled to ambient temperature, non-destructive testing will be carried out. An Automatic Ultrasonic Test (AUT) will be carried out at each weld. The effectiveness and sensitivity of the Automatic Testing Procedure (ATP) will have been proven to ensure that it meets detailed international, national and project specific standards. If a weld defect is detected that falls outside the tolerances permitted within the international, national and project specific standards then the weld will be repaired or cut-out and then reinspected.

3.12.117 It should be noted that radiography was previously utilised for weld inspection prior to the development of AUT. In some limited circumstances, radiographic methods may still be required and if so, all radiographic testing will be carried out in strict compliance with the Ionising Radiation Regulations 2017 (Ref 3-27) and measures such as local shielding and exclusion zones will be in place to ensure that the workforce and members of the public are protected.

3.12.118 Once weld quality requirements have been met then field joint coating (FJC) will proceed. Initially the weld area will be blast-cleaned using screening to avoid stray grit affecting the workforce or any area outside of the working width, and exclusion zones will be enforced during this activity. The joint coating, typically a liquid epoxy coating, will be applied using either a spray or by hand to build up to the minimum required coating thickness.

3.12.119 Like welding, FJC is subject to strict quality control procedures including visual examinations, thickness checks and electrical testing of the coating to confirm full coverage is achieved. When the pipe strings and fabrication welds have been completed, non-destructively tested and coated successfully, they are ready for the lower-and-lay activities.

Trench Excavation and Pipeline Installation (Lower and Lay)

3.12.120 Trench excavation will commence progressively to keep up with welding and FJC activities so that excavations are kept open no longer than necessary. This section covers how works would be carried out in the typical 30m working width. A GPS survey will be carried out along the trench centreline and the location will be clearly marked with wooden pegs indicating the required trench location and required depth.

3.12.121 The trench will be progressively dug using excavators and the excavated soil will be placed adjacent to the trench. Excavation will be undertaken using 360° tracked excavators or specialist trenching machines. Excavated soil will generally be stored on the opposite side of the working area from topsoil and there will be no mixing of topsoil and subsoil.

3.12.122 The trench will be dug between the edge of the working width and the above ground pipe string with the excavated material being placed adjacent to the working width fencing. Temporary works and any edge protection will be installed as required.

3.12.123 Dependent on the structure of the subsoil it may be necessary to excavate some areas in distinct layers and backfill the material in the same structured layers once the pipe is installed.

3.12.124 As the trench excavation progresses the condition of the excavated trench bottom will be assessed. If the trench bottom is not suitable to receive the pipe (e.g., due to the presence of stones or flint that may damage the pipe coating), bedding to the trench bottom will be required. Where suitable, bedding will comprise filtered/sieved subsoil taken from the adjacent area. If subsoil is unsuitable, bedding material such as sand will be imported for use and delivered to site using HGV tipper wagons. Bedding materials will not be stored in areas accessible to the public and will be transported from the stockpile area using dumper trucks specifically designed for off-road use.

3.12.125 Periodically to match the breaks in pipe strings, ‘bell-holes’ – larger excavated holes around the laid pipe used for man access into the trench – will be excavated at locations where below-ground welds are required. Because the workforce need to enter bell-holes they are designed to make entry and working within the bell-hole safe. Temporary works systems at bell-holes include ‘battering’ (creating a slope) of the excavation sides, stepping the excavation sides, trench boxes, and sheet piles with supporting frames. These may be at locations such as buried services, ditches, roads and areas where trenchless crossings have been carried out where it is not possible to lay the pipe strings in a single continuous length.

3.12.126 Once the trench is prepared to an acceptable condition to receive the pipe, lower and lay operations can commence. Pipe strings and fabrications will be lifted from their supports and the integrity of the coating of the entire pipe string/fabrication tested (electrical coating test) to ensure the soundness of the coating system. Lifting will be carried out using certified equipment, either excavators or side booms in accordance with a pre-agreed plan by a certified and competent lifting crew. The tail of the first pipe will be lowered into the trench using the natural curvature of the pipe. Once the first pipe section is on the trench floor the lifting equipment will be moved along the pipe string individually so that the pipe string will remain secured and supported by the lifting device each side. During this process, the pipe string will be manoeuvred from the supports above ground into the trench. Known as ‘hopping’, this technique is applied progressively until the last lifting device reaches the last pipe section and it is lowered into the trench.

3.12.127 Pipe strings and fabrications will be progressively lowered into the trench in this way, and they may be 'overlapped' at bell-hole locations where pipes can be later cut to matching lengths and welded tie-in connections made in the bell-hole. The same welding, non-destructive testing and coating process will be applied as that used above ground. After lower and lay is complete, the coordinates of the precise position of each butt weld will be recorded using GPS for the as-built record.

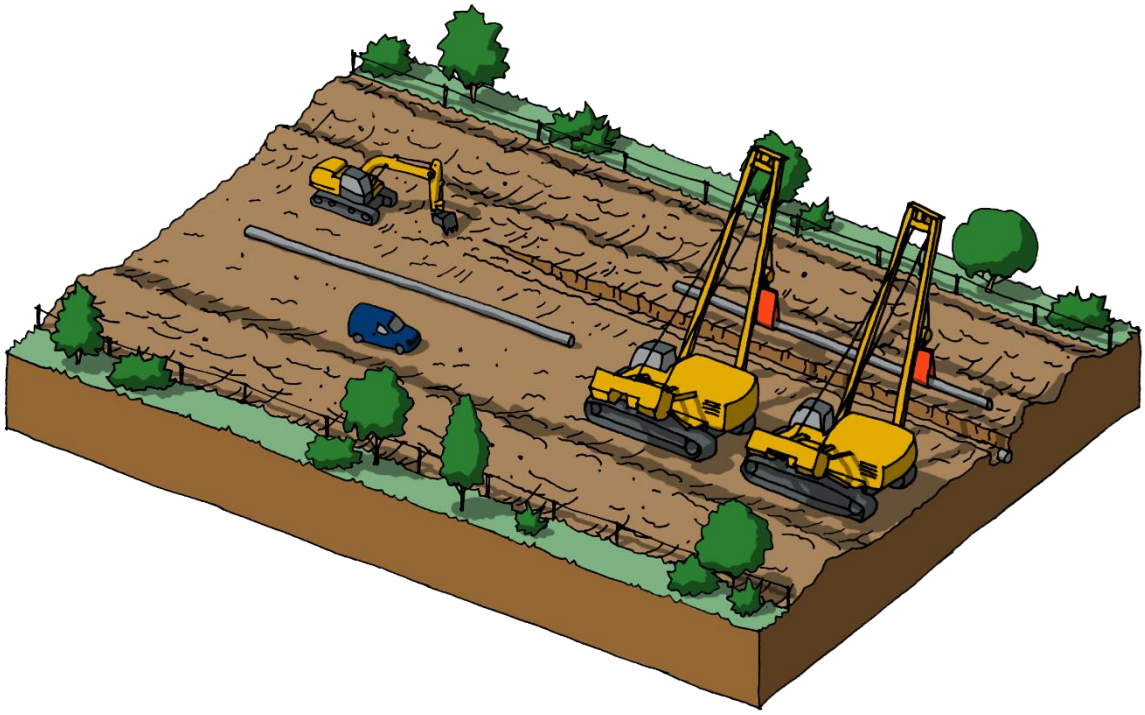
3.12.128 Dewatering of the trench and other excavations may be required in some areas to stabilise the surrounding ground during construction. Temporary tanks (typically clay plugs) would be installed within the trench prior to undertaking dewatering/draining activities, to prevent migration of water within the trench. Water will be discharged in accordance with a water management plan prepared by the Pipeline Contractor and will be filtered using a variety of techniques that may include silt netting, straw bale filtration barriers, temporary settlement lagoons, silt socks over pump discharge hoses and silt busters (purpose designed filtration tanks).

3.12.129 The pipelaying sequence is illustrated on **Figure 3-37**.

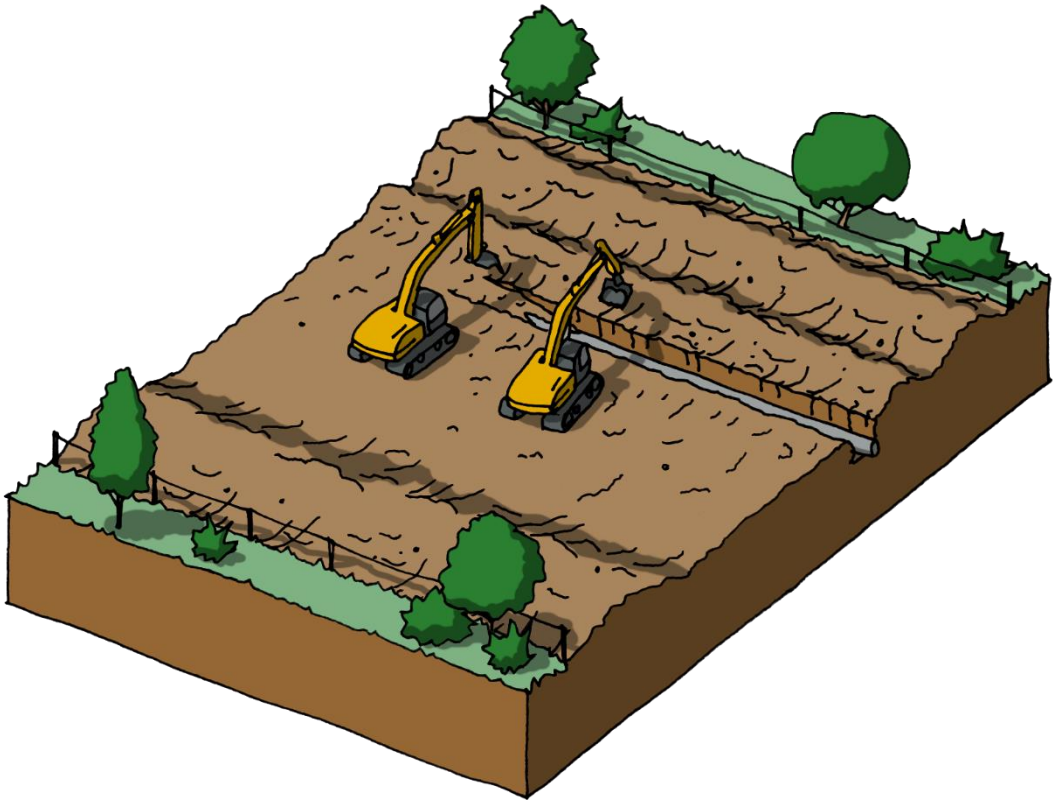
Depth of Cover

3.12.130 The minimum depth of cover of the pipeline across open country and farmland will be 1.2 m where the depth is measured from the ground surface to the top of the pipe. The depth to the bottom of the trench will include the minimum cover of 1.2m, the diameter of the pipe, a pipe bedding layer and an extra tolerance to ensure the minimum cover is always achieved. Hence for pipe nominal bore 24" (600mm) the depth of trench will be in the range 2.0m to 2.2m.

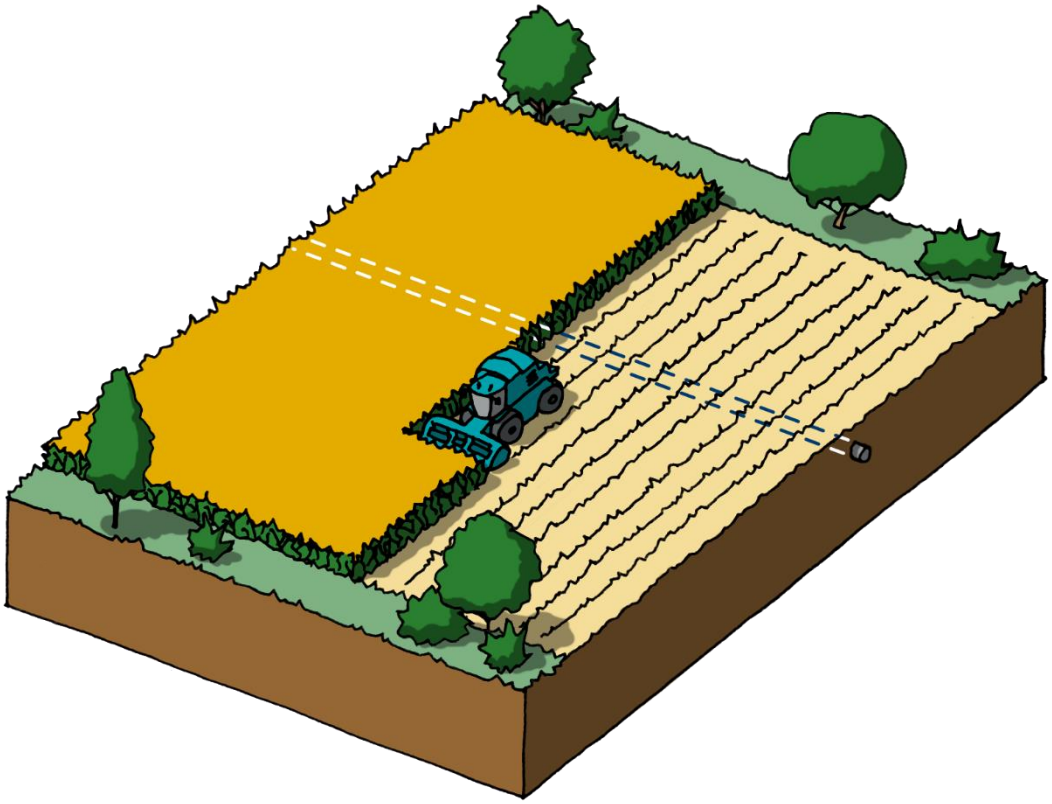
Figure 3-37: Overview of Pipeline Laying Sequence



1) Trench excavation and laying of the pipeline



2) Backfilling the trench



3) Reinstated land returned to its original use

3.12.131 As the pipeline route approaches a crossing point (e.g., roads, watercourse, utility services, etc.) the depth of cover to the pipeline will increase, over a length of up to 36m (e.g., 3 pipe lengths) to the depth needed to pass beneath the obstacle with sufficient clearance at the crossing point.

3.12.132 The depth of trench will depend on a variety of local circumstances for instance ground conditions or the size/diameter and depth of services (sewers can be several metres deep) which could require a much deeper pipeline position.

3.12.133 The depth for open-cut installation is typically up to 4m, with the pipeline usually buried to a minimum of 1.2m to the top of the pipe. Whilst the trench will always be the minimum necessary to enable sufficient clearance below deep ditches or sewers the trench depth may need to be deeper, with depths of 6.5 m in some limited cases due to localised constraints.

Fibre Optic Cable Installation

3.12.134 The primary data transmission network infrastructure will consist of an optical fibre communications network along the pipeline route linking the Immingham and Theddlethorpe Facilities. The primary network will provide SCADA data communications, together with critical telephone, CCTV and potentially leak detection across the pipeline.

3.12.135 A Fibre Optic Cable (FOC) will be installed along the complete length of the pipeline as part of the communications backbone. Multiple-fibre single mode cable will be employed, subject to a definition of acceptable minimal physical separation between cable and the pipeline. Single cables laid either side of the pipeline will also be considered.

3.12.136 The FOC will generally be installed straight with minimum bends to avoid exceeding the bending radius of the FOC and damage to the fibres. The final position, installation and protection measures for the FOC will be determined during further design development; however, at this stage it should be considered that the FOC will be installed within a High Density Polyethylene (HDPE) conduit buried in the same trench as the pipeline. At each of the Immingham and Theddlethorpe Facilities and at the Block Valve Stations, the FOC will

be routed into the appropriate equipment kiosk for connection to the communications equipment.

3.12.137 A secondary (back-up) transmission network will provide backup for SCADA data communications, together with limited selected CCTV and other system data communications. This will enable the operation of the pipeline to be maintained, albeit with reduced functionality for non-critical processes.

3.12.138 The backup transmission network suitable for adoption could be a second FOC network, a VSAT system, GSM and Tetra mobiles, or microwave radio. The backup communications will be entirely independent of the primary network and unaffected by the failures in the primary network. The backup system will provide a minimal level of communications between strategic stations and will be automatically initiated on failure of the primary system.

Backfilling

3.12.139 Once each pipe-string has been safely laid into the trench and each welded joint location captured by GPS, the trench will be backfilled. Backfilling will be conducted progressively to keep up with lower and lay activities so that excavations are kept open no longer than necessary.

3.12.140 The first layer of backfill material must be suitable for direct contact with the pipe i.e., contain no stones or flint which may damage the pipe. It may be necessary to “riddle / sieve” subsoil taken from the adjacent area to obtain good “intimate backfill” to surround the pipe. Only if there is insufficient satisfactory material available then imported sand would be used, normally to 300 millimetres (mm) above the pipe, then the general excavated trench material can be placed into the trench. Backfill will progress in layers, with each layer compacted sufficiently to prevent subsidence in the future using a compacting machine called a “Rammax”. These vary in size from a small remotely controlled version to the larger sit-on machines.

3.12.141 Part way through the backfill process heavy duty warning tape will be laid as a protection measure against the possibility of damage to the pipeline from future excavation activities.

3.12.142 During the backfill process impact protection measures such as protection slabs or protection mesh may be installed where detailed in the design. As backfill is completed, post construction drainage will be applied in accordance with site-specific design. The design will take into account the original design prepared for pre-construction drainage which considered the existing scheme and landowner requirements.

3.12.143 Excavated materials will not be stored in areas accessible to the public. Excavated materials will be transported from the stockpile area using dumper trucks specifically designed for off-road use. Where it is necessary to dispose of surplus trench material, this will be transported away to a suitable site. Imported backfill materials will be delivered to site using HGV tipper wagons.

Cleaning and Gauging

3.12.144 Once the pipeline is in-situ, the pipeline would then be cleaned internally using a variety of types of cleaning tool such as foam, urethane and metal-bodied pigging products that have scrapers and brushes for initial removal of debris and water, and bi-directional pigs with brushes and/or magnets attached, driven through the pipeline under water pressure or compressed air.

3.12.145 Following cleaning of the pipeline, a gauge plate will be attached to one of the pipeline cleaning tools and the pipeline checked to ensure that the minimum internal diameter and ovality limits are achieved and acceptable.

Figure 3-38: Variety of Cleaning Pigs (Brushes and Magnetic)

Pipeline Crossing Techniques and Locations

Overview

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

- *Auger boring* – usually require a working width of 30m x 10m (300 m^2);
- *Guided auger boring* – usually require a working width of 45m x 25 m (1,125m^2);
- *Horizontal Directional Drilling (HDD)* – usually require a working width of approximately 40m x 85m = 3,400 m^2 on drill side, and 20m x 20m (400 m^2) on the opposite of the crossing. Note this does not include the pipe string which will require a zone 10m wide by the length of the string to span the total crossing length; and
- *Micro-Tunnelling* – It's not currently anticipated that this crossing technique will be required. However, if it is adopted during construction, it will require a similar working footprint to the guided auger bore requirements and expected to have similar impacts.

3.12.147 A Crossing schedule for the Proposed Development, which shows both permanent crossing for the pipeline installation and the temporary flumed crossings for the construction haul road is included in *ES Volume IV: Appendix 3.2* (*Application Document 6.4.3.2*).

3.12.148 Trenchless crossings are typically carried out by separate crews to the main pipelaying works such that works can be undertaken independently and minimise delays.

3.12.149 At trenchless crossings of roads, watercourses and railway lines and other major infrastructure, the pipeline will be laid at greater depths than the open-cut trench excavation technique.

3.12.150 At the majority of crossings of existing utility services (e.g., pipelines, water/gas mains, sewers, telecom cables, etc.) the pipeline will have to cross beneath the existing service. The depth of the pipeline will be increased to ensure sufficient clearance between the bottom of the service and the top of the pipeline and in compliance with the utility service operators requirements.

3.12.151 The depth of the watercourse crossings will be influenced by the depth of the true clean bottom of the watercourse (i.e., excluding any soft sediments to allow for watercourse maintenance/cleaning operations), the ground and the groundwater conditions, where the watercourse is navigable and the flexibility (bend radius) in the pipe and installation equipment. Watercourses would be crossed as close to 90-degree angles where possible, and not less than 67 degrees.

3.12.152 At road and rail crossings the depth is increased below the road surface/rails to ensure the pipeline is not affected by future works and to meet Highway/Rail Authority requirements. The pipeline at a road crossing must also be sufficiently deep to pass under any services running along the road or parallel ditches either side. In the case where the road or rail is on an embankment then the pipeline will be laid below the pre-existing ground level (i.e., below the base of the embankment).

Open-cut crossing

3.12.153 This crossing technique is the default installation method, unless otherwise identified. This 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 (**Figure 3-39**). The surface is then reinstated with appropriate material.

3.12.154 Open-cut will be used in agreement with the local Highway Authority or other relevant body where minimal disruption is anticipated. Typically, at road crossings the pipeline under the crossing can be installed in two halves such that traffic flow is maintained.

Figure 3-39: Open Cut Technique

3.12.155 At open-cut crossings, the pipeline will be laid at typical depths of up to 4 m, but an allowance will be made to increase the depth if required in a few limited cases due to localised conditions or constraints, to around 6.5 m.

3.12.156 In total, there are currently expected to be approximately 136 open cut crossings along the pipeline.

Auger Boring

3.12.157 Auger boring is a technique where a pipe is pushed into the ground whilst the soil at the front face is cut away by an auger which also moves the excavated material back along the pipe.

3.12.158 This crossing technique involves digging two pits (launch and reception pits) either side of the crossing section (**Figure 3-40**). Excavations for the launch and reception pits will be made to a pre-determined depth and size as indicated in the crossing-specific design. During construction the excavations will be battered or supported to protect the workforce from side wall collapse and to provide a safe working environment. The width of the launch pit needs to accommodate the set of rails upon which the auger equipment runs and be long enough to accommodate one 12m pipe length, as a minimum.

3.12.159 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 DCO Site Boundary.

3.12.160 A solid base foundation will be installed in the bottom of the launch pit excavation at the correct alignment and depth in readiness for the auger bore machine support rails. The auger bore support rails will be lifted into position ensuring accurate alignment by GPS survey to the bore path as this dictates the accuracy of the auger bore drill alignment.

3.12.161 An auger bore shield will be installed at the end of the first pipe. This provides a shroud for the cutting head and protects the pipe end as the pipe progresses through the auger bore.

3.12.162 The first auger screw with the cutting head attached will be inserted into the lead pipe and the assembly will be lowered into the drive pit using either a hydraulic excavator or mobile crane in accordance with a specific lift plan. The lead pipe assembly will be held in alignment at the auger bore entry point and the auger bore machine will be propelled forward using the auger bore hydraulic rams. The connection will then be made to the drive coupling at the rear of the first auger screw to engage the auger bore machine.

3.12.163 Drilling will then be carried out in a controlled manner by rotating the auger screws that sit inside the carrier pipe while moving the auger machine forward on the base rails until the first pipe is installed. Spoil will be removed as it is discharged from the rear of the first pipe during the boring process.

3.12.164 While the lead pipe is being drilled/inserted into the bore another auger screw will be loaded into the second pipe. Once the lead pipe has been successfully installed into the bore, the auger bore machine will be withdrawn and disengaged from the lead pipe screw. The second pipe will be lowered into the drive pit and the auger screw that sits at the front of the second pipe will be coupled to the auger screw that sits inside the rear of the lead pipe.

3.12.165 A weld will be made between the lead pipe and second pipe then inspected and the joint coated using methodology similar to that described in paragraphs 3.12.110 to 3.12.119.

3.12.166 The auger bore machine will then be engaged to the drive coupling at the rear of the second auger screw which sits inside the second pipe and auger boring will recommence as detailed above for the lead pipe. This process will be repeated using sufficient lengths of pipes to achieve the desired length of crossing.

3.12.167 During the installation process, the line and level of installed pipes will be surveyed for alignment in the drive pit by GPS survey technology to ensure that the pipe is being installed on the correct drill path. The auger bore crossing will be considered successful when the lead pipe protrudes through the reception excavation face at the correct location.

3.12.168 In challenging ground conditions where there is a risk of damage to the pipe coating, sacrificial pipe may be used to carry out the drilling installation. Once the auger bore crossing is completed, the product pipe will be welded to the rear of the last sacrificial pipe and pushed through in sections using the auger bore jacking system. As the new pipe sections are inserted from the launch pit, the sacrificial pipe sections will be removed at the reception pit side of the crossing. This reduces the risk of damage to coating on the permanent pipe.

3.12.169 The auger screws will be removed in sections from the installed pipe bore by withdrawing them using the auger bore machine rams. The auger machine will then be disassembled from the rear of the last screw, and the auger bore machine and rails removed from the launch pit using either an excavator or mobile crane in accordance with the specific lift plan.

3.12.170 The connecting open trench pipeline installation may not take place at the same time as the auger bore section and therefore the bell-hole will be appropriately fenced and secured until both sections are ready to be welded together. Once the pipeline at each end of the auger bore section is installed, the sections will be welded to the auger bore pipe and the welds tested and coated.

3.12.171 As the excavation supports are removed, the excavations will be backfilled and compacted using track or wheel-mounted excavators and compaction equipment to a standard that ensures no future subsidence will occur.

3.12.172 Any waste generated by the auger bore process will either be recycled or removed to a licensed facility in accordance with the Site Waste Management Plan forming part of the Construction Plan.

3.12.173 The pipeline at auger bore crossing locations will be installed at typical depths of between 4 m and 6 m but are very unlikely to exceed 10 m. Where auger boring is used to cross watercourses the launch and reception pits will be located a minimum of 2m to 10m back from the bank subject to relevant authority agreements

3.12.174 In total, there are currently expected to be approximately 48 auger bore crossings along the pipeline.

Figure 3-40: Auger Boring at a Road Crossing

Guided Auger Boring

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

3.12.176 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.

3.12.177 Assisted by pilot rods equipped with optical passage, steering head, and theodolite with couple-charged device (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.

3.12.178 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.

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

3.12.180 Where guided auger boring is used, the pipeline will be installed at depths of between 6 m and 8 m.

3.12.181 In total, there are currently expected to be approximately 6 guided auger bore crossings along the pipeline.

Horizontal Directional Drilling (HDD)

3.12.182 Currently four HDD crossings are anticipated and included in the crossing schedule.

- Golf Course/Childrens Avenue South of P66 (alternative options, depending on where the pipeline exits the P66/VPI sites) - approximate length of either 636 m or 240 depending on which option is required;
- North Beck Drain near Newstead Farm – approximately 544 m in length;
- River Ludd/Louth Canal to the northeast of Louth - approximately 540 m in length; and
- Old Engine Drain and Great Eau west of Theddlethorpe – approximately 384 m in length;

3.12.183 The proposed guided auger bore crossings may be replaced by HDD crossings, subject to ground conditions and further design:

- Hornsea Cables and gas pipeline crossing, south-west of Immingham, approximately 240 m in length;
- Crossing of A46 Road and Old Main Road, approximately 240m in length;
- Waithe Beck, east of Keelby, approximately 384 m in length;
- Greyfleet Drain, north of Grimoldby, approximately 384 m in length;
- B1200 Manby Middlegate Road and drains, east of Grimoldby, approximately 240 m in length;
- Long Eau, Head Dike Drain and Willow Row Bank, east of Grimoldby, approximately 384 m in length; and
- A1031 Mablethorpe Road and drain, west of the former TGT site, approximately 240 m in length.

3.12.184 The detailed design for HDD will include depth and profile and consider methods to reduce the risk of groundwater breakout during drilling.

3.12.185 The footprint required for the HDD works is greater than that required for an auger bore due to the ancillary equipment (including control cabins) required for this technique. Therefore, the working width would need to be widened immediately adjacent to the crossing to accommodate extra plant.

3.12.186 Excavations (to a size detailed in the site-specific design, normally approximately 2 m deep and 3 m x 3 m in area) will be made by mechanical excavator at both the drill entry point (launch pit) and the drill exit point (reception pit) to contain drilling fluids at each end of the drill path.

3.12.187 The HDD technique requires a smooth curve for the HDD bore profile in which to install the pipeline from the entry and exit points at ground level and typically pass well below the object of the crossing (e.g., a river or canal); therefore, the maximum depth of pipeline could be up to 20 m beneath the surface. Where possible, consideration will be given to limiting this depth to no more than 10 metres where the underlying chalk layer is closer to the surface. Where this is not possible, additional mitigation and discussions with the EA will be required.

3.12.188 The HDD rig has an angled bed and will be set up at the surface pointing towards the entry point. The pilot hole will be drilled along the trajectory indicated on the crossing specific design which shows the angle of entry and exit, radius of the curvature, and depth.

3.12.189 The pilot hole will be drilled using screw-jointed drill pipes connected as the drilling proceeds, gradually forming the drill string. Drilling will progress utilising the hydraulic cutting action provided by a combination of the tool bits and a drilling fluid (comprising bentonite, a non-toxic, biodegradable natural clay) which will be pumped from tanks to the head of the drill bit.

3.12.190 The drill head steering will be controlled via a tracking system or similar by rotation of the pilot drill head and 'live' tracking will be maintained and controlled from within the drill control unit, sited at the drill entry point.

3.12.191 Following the successful completion of the pilot drill it will be necessary to enlarge the drill bore by carrying out a reaming operation (this creates a slightly larger-diameter hole ahead of the front of the drill). Reaming tools will be installed on the end of the drill string at the exit point and the drill string will then be withdrawn through the bore, enlarging the bore using the reaming tools in readiness for pipe pullback. Multiple passes using successively larger diameter reaming tools may be required to achieve the required bore diameter. An illustration of the HDD process is shown on **Figure 3-41**.

3.12.192 Throughout the drilling process, parameters such as drill torque and drill fluid pressures will be monitored and compared against predicted values to ensure that the drill is progressing as expected and to make adjustments as required. Monitoring will also be carried out at predetermined locations to check that there is no surface disruption during drilling such as settlement or heaving caused by the drilling process. Contingency plans will be in place to deal with any indications of subsidence encountered. Drilling fluid levels will be monitored and the drill path will be patrolled to ensure that there are no break outs of drilling fluid at the surface. The drilling fluid within the annular space between the installed pipe and the HDD bore will be left in-situ on completion of the pipe pull back. Any surplus drilling fluid will be removed off-site for recycling and/or disposal. Contingency plans will be in place to deal with any indications of drilling fluid release.

Figure 3-41: HDD Technique Cross Section

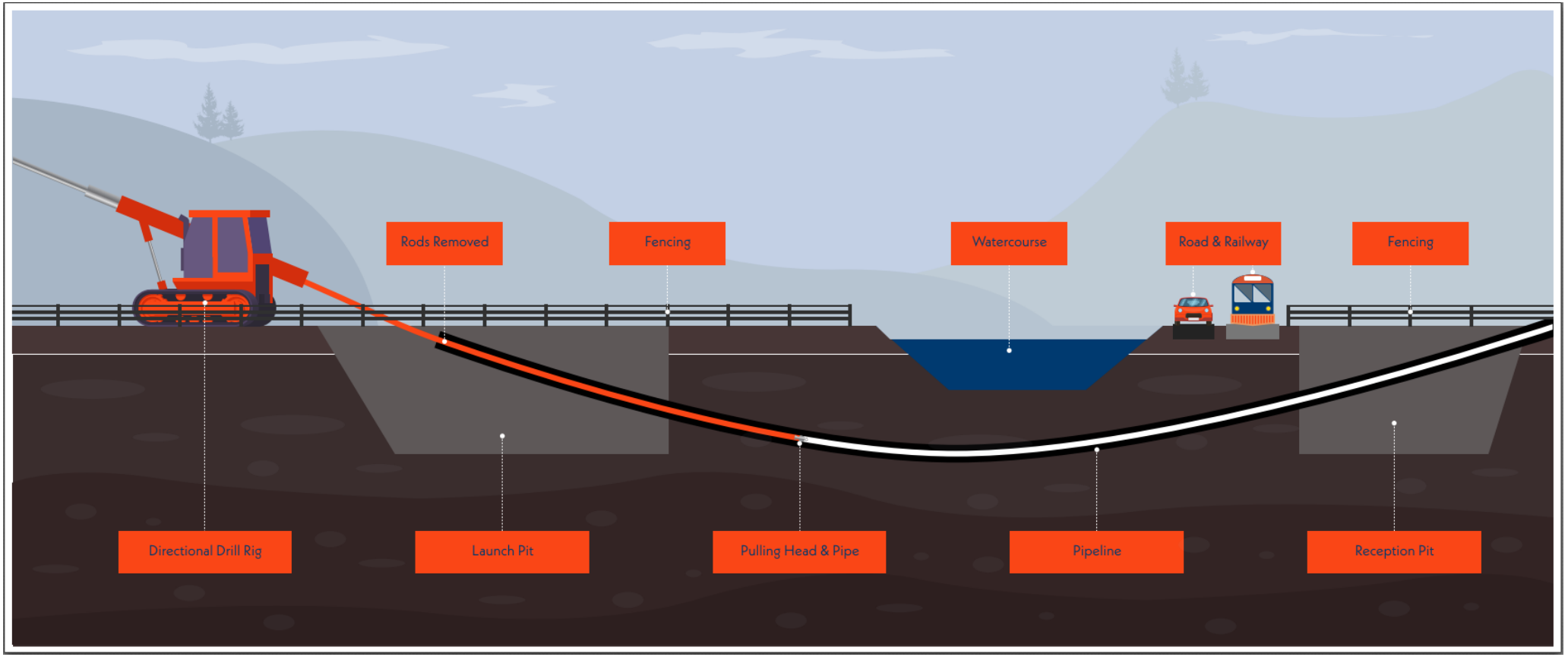


Figure 3-42: HDD Technique

3.12.193 A pipe stringing area will be set up at the drill exit/reception pit end of the HDD profile within the DCO Site Boundary. Individual pipe lengths will be welded together to form one string (to the full length required for the crossing), using the method detailed for open trench excavation. The pipe string will then be subject to a hydraulic pre-test prior to installation. The front of the pipe string will be lifted to a pre-determined height to provide the correct curvature that matches the angle of drill exit point to provide for a smooth entry for the pipe string into the HDD bore.

3.12.194 Utilising the HDD rig at the drill entry point the pipe string will be pulled through the drill bore from the drill exit point using the connected drill rods in a controlled manner, with pulling pressures monitored constantly in the HDD control cabin. As the pipe string is pulled through the drill bore it will be supported at the drill exit point by a combination of the pipe rollers and excavators to maintain the correct entry profile.

3.12.195 On completion of the pipe pullback, the HDD rig will be de-coupled from the pipe string and the pulling head removed. Following the successful installation of the pipeline into the drill bore, a gauge plate mounted on an internal carrier (PIG) will be passed through the bore of the installed pipe string to ensure that the pipes have maintained their shape during the pipe pullback operation.

3.12.196 The HDD equipment will be disassembled and transported from site in reverse of the mobilisation process. The open trench installation of the pipe may not take place at the same time as the HDD section and therefore the bell-hole will be appropriately fenced and secured until both sections are ready to be welded together. Once the pipeline at each end of the HDD section is installed, the sections will be welded to the HDD pipe string and the welds tested and coated.

3.12.197 Excavations will be backfilled and compacted using track or wheel-mounted excavators and compaction equipment to a standard that ensures no future subsidence will occur. The bund and membrane site surrounds will be removed, and the topsoil replaced.

3.12.198 Any waste generated by the HDD process will either be recycled or removed to a licensed facility in accordance with the Site Waste Management Plan forming part of the CEMP.

Microtunnelling

3.12.199 Microtunnelling is a remote controlled trenchless construction method that provides continuous support to the whole excavation process with the help of a guided pipe jacking process. It is typically made up of micro tunnel boring machine, jacking system, spoil removal system, guidance system (laser), remote control system and pipe lubrication system.

3.12.200 Microtunnelling offers a very accurate installation with a wide variety of boring machines available based on the anticipated soil conditions of the site, the groundwater level and potential obstructions that may be encountered.

Pipeline Construction through Sensitive Areas

Watercourses

3.12.201 Any works within main rivers or ordinary watercourses will be conducted in accordance with a method approved by the Environment Agency, Lead Local Flood Authorities, Local Drainage Boards and Landowners.

3.12.202 Typically crossings of main rivers/ditches, canals, etc., are installed by trenchless methods as detailed in paragraphs 3.12.146 to 3.12.179; however, the majority of small watercourses and ditches will be crossed using open-cut methods. Temporary crossings of smaller water crossings will also be installed during the construction phase, with example crossings provided in **Figure 3-43**.

3.12.203 For these open-cut crossings, initially, a zone will be defined either side of the watercourse including the banks in which no topsoil stripping would take place. The size of this zone will be dependent on the type, maturity and quality of the vegetation and habitats in the vicinity of the watercourse and could be up to 10 m in length. This mitigates the risk of surface water runoff carrying silt from the working area entering the watercourse, by creating a barrier. If required, this could be supplemented by the use of silt fencing across the width of the working area.

3.12.204 Within the defined zone, the working width will be reduced to a maximum of 10 m wide although this could be narrower where conditions allow, such as narrow/shallow watercourses. The boundary of the narrowed working area will be defined with fencing to prevent encroachment onto the watercourse banks beyond the 10 m working width, but fencing will not usually be placed down the banks or within the watercourse, unless specifically required for ecological mitigation purposes (e.g., known areas of water vole or otter habitat).

3.12.205 Topsoil and subsoil will not be stored directly adjacent to the watercourse but will be moved further along the working area to reduce the risk of silt laden runoff reaching the watercourse.

3.12.206 In-stream vegetation within the crossing area would be temporarily translocated within the watercourse slightly upstream or downstream of the works and will be returned to its original position as part of the reinstatement. The bed material will also be stored separately and used for reinstatement.

3.12.207 Only the bank vegetation within the working width will be removed to reduce biodiversity impacts and fragmentation. The species mix of the removed vegetation will be recorded by the Environmental Team so that it can be reflected in the reinstatement, as appropriate.

3.12.208 A single suitably-sized flume pipe or box culvert will be placed in the watercourse (in the direction of the flow). It will be sized to accommodate the likely maximum flow anticipated during the construction period plus a factor of safety. Both ends of the flume pipe, starting at the upstream end, will be sealed to the banks using soil filled sandbags, a clay plug or a proprietary system such as Aquadam. This will ensure that all water is then directed through the flume pipe to maintain the flow of the watercourse during the open cut installation. If required, scour protection will be placed at the downstream end of the flume to reduce the risk of bed erosion.

3.12.209 The level above the flume pipe will be built-up to bank level using selected excavated material over the flume pipe as necessary to create the haul road and allow connectivity along the working area for plant and vehicles. To install the pipeline, a trench will be dug to a depth necessary to ensure adequate depth of cover below clean true bottom/hard bed of the watercourse. The pre-bent pipeline fabrication will then be installed into the trench by passing it under the flume pipe. Following installation, the trench will be backfilled and the bed material replaced.

3.12.210 When works in the area are complete and/or the crossing is no longer required, the materials used to create the haul road will be removed. The seal around either end of the flume pipe will be slowly removed to allow the gentle return of the watercourse flow and then the flume removed.

3.12.211 Reinstatement can then take place, with in-stream vegetation returned from its temporary locations, and the banks of the watercourse replanted and reseeded in accordance with the reinstatement plans contained within the Landscape and Ecological Management Plan (LEMP). The area of bank reinstatement will be covered with hessian to encourage plant establishment and reduce the risk of soil erosion. The hessian will naturally degrade in-situ as the vegetation grows back.

Woodland

3.12.212 The route avoids woodland so far as is practicable, but where larger areas of woodland intersect the route, trenchless crossing methods will be used to minimise the loss of habitat. Although minimal, there are a number of smaller wooded areas through which the open-cut pipeline excavation route will pass. Within these areas the pipeline will be laid as described in the main Pipeline Construction section above with the following exceptions:

- When crossing wooded areas, the detailed design process would consider a reduction to the working width whilst maintaining safe working practices/conditions. The target will be to reduce the working width to 10 m in these locations. Topsoil and excavated material may have to be moved outside of the restricted working width area for temporary storage then bought back during backfilling and later reinstatement;
- Trees not being retained will be removed from the working area. These will be cut down to ground level by a specialist contractor. As with typical woodland management, tree stumps will be left in situ to reduce the ground disruption and for ecological value (for invertebrates during decomposition), providing this does not impede pipeline construction;
- The Pipeline Contractor would consider and apply the relevant protective principles set out in the National Joint Utilities Group Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees (‘NJUG Volume 4’ (2007)) (Ref 3-28). For example, trees being retained will be fenced to protect the trunk and roots from installation activity in line with the Tree Protection Zone (TPZ) recommended in NJUG Volume 4 (2007) (Ref 3-28); and
- Landowners retain rights over felled timber and the method of disposal will require agreement of the landowner. Typically, timber can be used within the woodland for

habitat creation, nearby ecological or community projects, or it is recycled. The Environmental Team/arboriculturist will provide advice when any works to trees such as branch removal are required.

Hedgerows

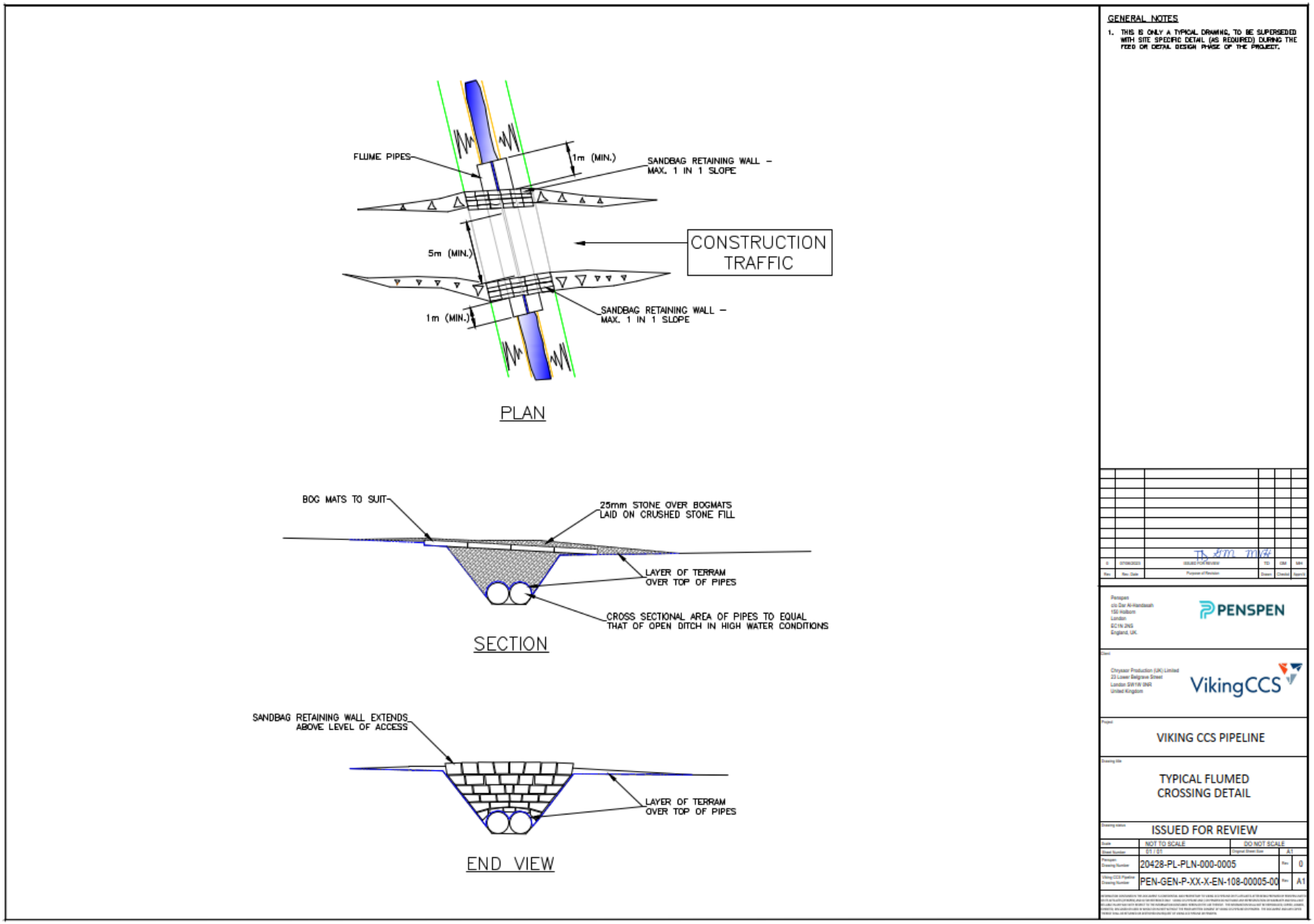
3.12.213 Where the pipeline route intersects hedgerows, the pipeline will be laid as described in the main Pipeline Construction section above with the following exceptions:

- The working width would be reduced to the minimum necessary to enable plant to cross the boundary and for the pipeline to be laid safely, whilst only removing the minimum length of hedgerow required. Where possible, hedgerow removal is to be kept to 20 m to minimise habitat loss;
- Within the DCO Site Boundary, and taking account of other local considerations, the detailed design will select the least impactful point at which to cross, taking advantage of gaps within existing hedgerows or reducing the number of trees removed where possible. For example, if there is a tree within the hedgerow, the tree will be retained if possible, by positioning the working area to the side. Similarly, utilising existing gaps or entrances already within the hedgerow will reduce the amount of vegetation to be removed;
- When necessary, tree felling and hedgerow removal will be undertaken by a specialist contractor;
- Fencing of the working width will be continuous when crossing a hedgerow, creating a barrier between the retained hedge and the working width and taking account of relevant TPZs where practicable;
- Topsoil will be stripped from the working width. If the haul road crosses the TPZ of a retained hedge, appropriate ground protection such as matting will be used;
- On completion of the works, dead hedging will be installed at all hedgerow removal locations to restore ecological connectivity until permanent reinstatement can be undertaken; and
- Hedgerows temporarily removed during construction are to be reinstated and, where appropriate, improved from their baseline condition: defunct or species-poor hedges will be replanted so as to achieve species-rich and continuous hedgerows, once re-established. Reinstatement and replanting will take place in the appropriate season following completion of construction activities.

Schools

3.12.214 The pipeline route does not come in close proximity to schools such that construction activity would disrupt activities at the school. Where the DCO Site Boundary is in the vicinity of schools or the routes to them then enhanced security will be provided to prevent unauthorised entry onto site as required. Where it has been possible, pipeline traffic routes have been selected to avoid schools, however inevitably some routes do pass schools and the TMP will detail requirements so that construction traffic does not use these routes during school opening or closing times for both safety reasons and to reduce impact on school-related traffic.

Figure 3-43: Typical temporary flumed crossing detail during construction



Immingham and Theddlethorpe Facilities and Block Valve Station Installation

General overview

3.12.215 The Immingham Facility, Theddlethorpe Facility and Block Valve Stations will be constructed by separate crews to the main pipelaying works such that works can be undertaken independently and minimise delays. Typically, crews will be subdivided into work activities packages such that a civil crew will start on site preparation and earthworks and when finished will move onto the next site, then the mechanical and pipe installation crew will start work at the first site, and so on. The following sequence of activities is typical of the construction process:

- Pre-construction activities (e.g., site access and the formation of a temporary construction compound and material stores and erection of secure fencing);
- Construction of drainage measures (where required);
- Earthworks to establish foundation levels;
- Formation of plant foundation bases, chambers and above ground structures;
- Construction of pipework and equipment and associated infrastructure;
- Installation of instrumentation and control (I&C) works and electrical installation;
- Testing and quality control;
- Installation of permanent security fencing; and
- Perimeter reinstatement landscape works.

3.12.216 Preparation at each of the AGI and block valve station locations will include topsoil removal, levelling to achieve the approximate required finished levels and preparation and installation of temporary roads.

3.12.217 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 sites would be permeable surface to minimise runoff. Swales and soakaways will be utilised to promote sustainable drainage. Cut-off drainage channels will be provided at the site entrance gates.

3.12.218 Concrete bases would be poured for the required above ground infrastructure (e.g., control kiosk, block valve and vent stacks). The GRP kiosks and block valves would be delivered prefabricated and placed on their bases. Where practicable, pipework and equipment will be pre-fabricated onto skids and brought to site for hook-up and I&C and electrical equipment will be pre-fabricated in kiosks and brought to site.

3.12.219 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.

3.12.220 Roads and hardstanding would have flush concrete kerbs to allow surface water run-off.

3.12.221 Following the completion of installation, 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 strips planted up.

Lighting

3.12.222 Construction lighting at the AGIs and Block Valve Stations will not generally be required as the main works are scheduled to occur between April and September. However, where they are required, the installed lighting will follow BS EN 124646 (Parts 1 and 2) (Ref

3-20) and guidance notes from the Institution of Lighting Professionals, GN01 (Ref 3-21) and GN08 (Ref 3-22). In general lighting will be used in shifts at the lowest luminosity necessary for safe delivery of each task i.e., it will not be continuous. It will be designed, positioned, and directed to reduce the intrusion into adjacent properties and habitats.

3.12.223 The primary objectives of lighting during the construction phase are:

- To provide illumination for construction activities;
- To provide a safe working environment in the absence of natural light;
- Allow workers and site traffic to safely undertake various construction-related tasks; and
- To provide security lighting.

3.12.224 Due to the dynamic nature of a construction site, different levels of illumination will be needed for certain tasks or stages in the construction process. Some areas will require suitable task lighting while other areas will require a level of ambient lighting.

3.12.225 Task lighting will typically be provided during construction activities and the required levels will vary depending upon the type of activity being undertaken. Task lighting will also be required at security check points to allow the inspection of vehicles entering and exiting sites.

3.12.226 Ambient lighting will be constant and typically be provided at fixed locations such as contractors' compounds and within the AGI's/BVS sites to aid the safe navigation for areas. Where ambient lighting is identified as 'required', it will be implemented whenever natural light levels are insufficient.

3.12.227 A range of mitigation measures are available to address the potential impact from the construction phase lighting. These range from equipment choice, use of site topography and competent design and site management. The following mitigation measures will be adopted for construction phase lighting:

- Adopt the lowest safe lighting levels possible for task being undertaken;
- Limit the hours of lighting where practicable;
- Use a luminaire with good optical control;
- Use the lowest possible mounting for the luminaire based on the required level of illumination needed for the task being undertaken;
- Direct luminaires into the area to be lit (light from the boundary inwards) and ensure they are mounted horizontally, avoiding any tilt;
- If required, make use of manufacturers' supplied custom louvres; and
- Provide local control for the lighting, so it may be switched off when not required.

3.12.228 All lighting installed will have some form of control to suit the tasks being undertaken and ensure energy is not wasted with lights being in operation unnecessarily and/or without purpose.

Immingham Facility Construction

Access

3.12.229 Access to the site during construction will be provided via a temporary construction road off Rosper Road, the location of which will be subject to agreement with the local highways authority.

Groundworks

3.12.230 Due to assumed soft ground near the surface, supported by geotechnical investigation results from the adjacent VPI site, piling will be required for cable bridges, pipe-racks and above-ground pipelines. The piles will be founded in the chalk layer underlying the surface alluvium and glacial till, at around 20-25 m depth.

3.12.231 Raft foundations are assumed for other equipment and buildings not sensitive to settlement.

3.12.232 Excavation of unsuitable soil and replacement with compacted backfill is likely to be required in trafficked areas, due to low California Bearing Ratios (CBR) measured at the adjacent site.

Facilities Connections

3.12.233 During construction the Immingham site will be self-sufficient in terms of lighting, power, utilities and welfare.

3.12.234 Power will be provided by a temporary diesel generator, estimated to be a 60 kVA unit with a footprint of 3.05m length x 1.17m width x 2m height. Fuel usage is 7.97l/hr at 50% demand rising to 15.67l/hr at 100% demand. Noise levels at 75% demand is 55dB(A) at 7m.

Construction and laydown areas

3.12.235 New security fencing will be installed around the construction and laydown areas. Welfare and laydown facilities will be provided within the site. The preferred option is to locate the laydown area to the east side of the plant area, but there is an option to locate the laydown area to the west side of the plant area should this be deemed more practical. The laydown area is expected to cover an area of approximately 20 m x 15 m within the site.

3.12.236 The laydown area will include a site office/cabin with electricity, water supply and welfare facilities, and a materials and equipment storage area including crane and earth movers.

3.12.237 The existing topsoil will be removed to a minimum depth of 150 mm and remaining soil compacted with a vibrating roller or similar. Should ground conditions dictate that more than 150 mm of soil is to be removed then this will be carried out until suitable ground is reached. Crushed aggregate (type 1) will then be placed in layers not exceeding 150 mm and compacted and levelled until the laydown area is level with adjacent ground. If required, the laydown area can be barriered on three sides with temporary barriers/ropes to segregate from other working areas.

3.12.238 It is estimated that 16 people will be required to be working on-site during construction of the Immingham Facility (including supervisors and site engineers) and the construction time is estimated at 32 weeks.

3.12.239 Estimates of the quantities of equipment and bulk materials required during construction of the Immingham Facility are presented in **Table 3-7**.

Table 3-7: Estimates of Equipment and Bulk Materials Quantities – Immingham Facility Construction

Item Category	Weight (Tonnes of material)
Equipment	20
Piping, Valves and Fittings	430
Structural Steel: piperacks, bridges, pipeline supports	130
Piles	270
Concrete foundation bases	910

Theddlethorpe Facility Construction

Access

3.12.240 Construction access to the Theddlethorpe Facility will be via an existing gate at the south west corner of the site.

Groundworks

3.12.241 Based on the ground conditions identified during the original site investigation at Theddlethorpe it is estimated that approximately 30 x 300 mm diameter piles would be required to a depth of 18 m (within stiff boulder clay) to provide the necessary support to above ground pipelines. If surface bearing foundations were used, they would be subject to significant settlements.

3.12.242 For the LER and other equipment not sensitive to settlement, raft foundations or footings can be used to spread the load adequately.

Facilities Connections

3.12.243 The base case is that during construction of the Theddlethorpe site will be self-sufficient in terms of lighting, power, utilities and welfare.

3.12.244 Power will be provided by a temporary diesel generator, estimated to be a 60 kVA unit with a footprint of 3.05m length x 1.17m width x 2m height. Fuel usage is 7.97l/hr at 50% demand rising to 15.67l/hr at 100% demand. Noise levels at 75% demand is 55dB(A) at 7m.

Construction and laydown areas

3.12.245 New security fencing will be installed around the construction and laydown areas. Welfare and laydown facilities will be provided within the site. The laydown area is expected to cover an area of approximately 20 m x 15 m and can be accommodated within the site boundary.

3.12.246 It is assumed that existing security fencing surrounds the site and will remain in place during construction.

3.12.247 The laydown area will include a site office/cabin with electricity and water supply and welfare facilities, and a materials and equipment storage area including crane and earth movers.

3.12.248 A concrete batching plant is proposed for the Theddlethorpe Facility as there are no concrete manufacturing facilities located within 30 minutes of Theddlethorpe. A compact batching plant producing around 30 m^3/h would require an area of approximately 12 m x 17 m in addition to the laydown required.

3.12.249 It is estimated that 16 people will be required to be working on-site during construction of the Theddlethorpe Facility (including supervisors and site engineers) and the construction time is estimated at 32 weeks.

3.12.250 Estimates of the quantities of equipment and bulk materials required during construction of the Theddlethorpe Facility are presented in **Table 3-8**.

Table 3-8: Estimates of Equipment and Bulk Materials Quantities – Theddlethorpe Facility Construction

Item Category	Weight (Tonnes of material)
Equipment	40
Piping, Valves and Fittings	495
Structural Steel: pipeline supports only	6
Piles	79
Concrete foundation bases	1,140

Block Valve Station Construction

3.12.251 Block Valve Station sites will be surveyed and marked out before clearing and grading to the required level.

3.12.252 Cut and fill activities will be undertaken as required. The piping assembly is then fabricated, with all welding, non-destructive testing, and coating completed. A below-ground concrete valve base will be cast in parallel, which will support the valve body after installation. The block valve assembly is then connected (tied in) to the pipeline on either side. The valve high head extension stem, and body cavity blow-down piping can now be mounted. The pipeline and block valve is then backfilled and compacted in accordance with the requirements of the project specification.

3.12.253 Once this work is complete the security fencing can be erected followed by setting out of the access road. Subsequently, drainage, kerb laying, kiosk base, surface ducting, concrete plinths for above-ground pipe supports, lighting towers, vent stack, and pedestrian paving can be completed. All above-ground pipework can be painted, the control room kiosk positioned, and electrical and instrumentation concluded. The final finishing will then proceed, which includes 3.2m high, mesh perimeter security fence (e.g., weldmesh) with double access gate, 3 bar wooden post and rail outer perimeter fence with landscaping between that will encompass seeding and planting schemes. Granular subbases overlain with a thick top dressing to provide a low maintenance gravel surface will be provided to the inner areas of the site, with asphalt flexible paving for road surfaces and lastly bollards and parking bay delineation.

Facilities Connections

3.12.254 Portable generating equipment will be required for block valve construction activities, typically between 6 kW and 28 kW. The number and size of the portable generators will vary dependent upon the works being undertaken and number of personnel actively working on the site at specific times.

LOGGS Pipeline Emergency Shutdown Valve and Dunes Isolation Valve

3.12.255 Work will be undertaken to check if the existing equipment on site is suitable for future use. However, for the purposes of the assessment, the worst-case scenario will be assessed, which is full removal, replacement and re-instalment of the existing shutdown and isolation valves at both the Theddlethorpe Facility and at the Dune Isolation location.

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

Construction Equipment and Materials

Indicative List of Construction Equipment

3.12.257 A variety of construction plant and equipment would need to be deployed during the construction of the Proposed Development.

3.12.258 The plant and equipment that would be used on the pipeline spread includes D6 type bulldozers, backhoe/excavators, 24'' pipe bender and mandrel, 583 type sideboom cranes, pay-welder, crawler crane, cold bending machine, pipe carrying crawler, front-end welding equipment, guided auger-boring equipment, standard auger-boring equipment, HDD equipment, non-destructive testing (NDT) equipment and land drainage trenching/laying unit.

Indicative List of Required Materials and Equipment

3.12.259 An indicative list of the materials required for each key component of the Proposed Development are presented in the Bill of Quantities which has been developed for the Proposed Development. A copy of this is located in *ES Volume IV: Appendix 3.4 (Application Document 6.4.3.4).*

3.12.260 The required materials and equipment will include:

- Aggregates;
- Concrete;
- Asphalt;
- Steel (reinforcing and structural);
- Line pipe (carbon steel);
- Cables;
- Valves;
- Junction boxes;
- Instrument and Control Kiosks;
- Lighting;
- CCTV;
- Venting system;
- Pig Traps;
- Anodes;
- Transformer units;
- Transmitters;
- Fire and Gas (F&G) detectors;
- Remote Terminal Unit;
- Fencing;
- Gates;

- Cabins; and
- Storage containers/tanks.

Pre-Commissioning Testing (hydrostatic testing)

3.12.261 After the pipeline sections are cleaned and gauged, they will be subjected to a hydrostatic test. Temporary test ends will be welded or bolted to both ends of the pipeline section, which is then filled with water and then undergo, as a minimum, a standard hydrostatic test to the lower of the following, either 150% of the Maximum Actual Operational Pressure (MAOP) or 90% of the Hoop Stress Level Equivalent. The specific hydrostatic testing philosophy will be defined during the design phase. The testing period will normally be 24 hours. This test is a vital safety step and integrity check and proves the pipeline is fit for service.

3.12.262 Water is used as the test medium. Construction phase planning for the hydrostatic testing will specify the number and location of the hydrostatic test sections and test points, the elevation of the pipeline route and the length (which ultimately dictates the volume of test water required), the source and discharge arrangements for hydrostatic test water, the proximity to dwellings and public access arrangements.

3.12.263 The Immingham and Theddlethorpe Facilities will be tested separately. Tests will include hydrostatic pressure tests, system leakage tests and such other tests, checks and inspections as may be required to verify the integrity and proper condition of each facility.

3.12.264 At Block Valve Stations the pipeline can be laid straight through a Block Valve Station and the hydrotested pipe subsequently cut for installation of pre-tested Block Valves. Alternatively, Block Valves may be included in the pipeline test or may be situated at the test section ends.

3.12.265 Hydrostatic testing will be carried out in accordance with site and task specific procedures that ensure that members of the public and the workforce are not put at risk. It should be noted that the majority of the pipeline under test is buried and that any exposed pipe at the test end tie-in points will be below ground level. Risk reduction measures include the application of exclusion zones, additional physical barriers around areas of exposed pipe and test fittings, signage, and regular security patrols around the areas under hydrostatic test. All hydrostatic testing equipment will be fully pre-tested and certified and competency assessments of the hydrostatic testing crew will be carried out.

3.12.266 Two options for the source of the hydrotest water are currently being explored. The first is via a water supply provided by the P66 site, and the second is from water sourced from outside of the local area and delivered to the site by road-going water tanker. For the purpose of the assessment, it is the latter scenario which has been assessed, with traffic numbers included in the CTMP.

3.12.267 The pipeline will be split into a number of test sections and test water will be passed from the first section on completion of that test and into the second section for reuse and so on. The quality of the water used for hydrostatic testing will be tested before it is pumped into the pipeline section. The pipeline section will be filled using hydraulic pumps and the volume will be measured as the section is filled.

3.12.268 The pipe section will be pressurised in stages in accordance with national and project standards to a pre-defined test pressure and held for 24 hours. On successful completion of the hydrostatic test, the test pressure will be gradually reduced in a controlled manner.

3.12.269 The water within the pipeline will be tested again before it is discharged to another pipeline test section to be re-used, discharged locally in accordance with discharge permits or emptied into a road tanker to be disposed of.

Figure 3-44: Hydrotesting in Operation

3.12.270 Hydrostatic testing of each individual test section will progress as the test sections become available and in accordance with the detailed construction plan. Based on the current assumption that the pipeline will be tested in 3 sections, and test water can be reused in successive test sections, then the indicative maximum test water volume requirement is 6,642,664 litres.

3.12.271 Following removal of the hydrostatic test water the pipeline section will be 'swabbed' (by running cleaning tools through repeatedly) to remove any debris and ensure that it is free of standing water. Each test section will then be dried using 'super-dry' air with a low dew point value and the moisture content assessed. This is called a 'soak test'.

3.12.272 Once it has been confirmed that the moisture content is satisfactory the pipeline will be sealed in readiness for final tie-in at a later date. Note that the pipeline may be dried in combined test sections or as an entire pipeline, in any event the maximum permissible moisture content will never be exceeded.

3.12.273 As adjacent pipeline sections are hydrostatically tested/dried, 'final tie-ins' are carried out to connect the tested sections. The welds made to connect the tested sections are known as 'golden welds' as these welds will not be subjected to the hydrostatic test. The number of golden welds will be kept to an absolute minimum, and they will be subjected to additional forms of non-destructive testing. The final tie-in welds will be coated, and the coating tested.

3.12.274 The excavations will be backfilled as the work progresses, topsoil will be replaced, and the surfaces will be reinstated.

3.12.275 Once all hydrostatic testing and drying is completed the entire pipeline will be internally examined using a calliper inspection gauge tool which is a specialised pig and is propelled

using dry air. The calliper inspection gauge tool gives final assurance of pipeline bore, ovality and internal diameter and provides a baseline for future reference.

3.12.276 Following completion of all testing activities the pipeline will then be filled with nitrogen which is left in the pipeline until the pipeline commissioning and introduction of CO_2.

Reinstatement

3.12.277 Along the pipeline route, land will be reinstated after construction, allowing previous uses to resume where that would not impact on the operation and maintenance of the Pipeline and subject to restrictions imposed to protect the Pipeline. Reinstatement works will be undertaken at the appropriate time within the same year as construction, should weather conditions allow.

3.12.278 Reinstatement will be conducted in accordance with Landscape and Ecological Reinstatement Plans and will include the following steps:

- In areas where land compaction has occurred, or where required by the landowner, it may be necessary to undertake subsoil restoration techniques to restore the structure of the subsoil and to assist with future drainage;
- Topsoil would be returned to its final location at the earliest suitable time of year;
- The topsoil would be levelled, cultivated and reseeded as agreed with the landowner/occupier;
- The contractor would clear all temporary working areas and accesses as the work proceeds, and when they are no longer required for the works;
- On completion of the construction works, all plant, materials and temporary works/structures would be removed;
- Where possible, reinstatement of natural vegetation would generally be conducted using the same or similar species to that removed (subject to restrictions for planting over and around pipeline easements);
- Hedgerows, fences and walls would be reinstated to a similar style and quality to those that were removed, with landowner agreement; and
- A five-year aftercare period would be established for all mitigation planting and reinstatement.

3.12.279 Where required, weed suppression measures will be applied to the topsoil stockpiles before topsoil replacement. Topsoil will be removed from the stockpile using excavator buckets and displaced gradually to the correct grade using either excavators or bulldozers. As reinstatement progresses, topographic levels will be checked regularly by GPS survey equipment to ensure that reinstated levels match the existing profile before construction commenced.

3.12.280 Reinstatement will be completed as much as possible along the route within each hydrostatic test section so that any mechanical works necessary for reinstatement will be completed before hydrostatic testing is carried out. This is to prevent the use of mechanical equipment over the hydrostatically tested pipeline.

3.12.281 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.

3.12.282 Permanent pipeline aerial and ground makers, and Cathodic Protection Test Posts would also be installed along the pipeline route, at agreed locations.

Waste Management

3.12.283 A Detailed Site Waste Management Plan (SWMP). 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 is submitted with this DCO submission (*ES Volume IV: Appendix 18.1, Application Document 6.4.18.1*).

3.12.284 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.

3.12.285 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.

3.12.286 The Proposed Development 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 Proposed Development 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.

Security, Welfare and Control of Nuisance

Security

3.12.287 During construction, all working areas will be appropriately fenced. The choice of fencing will be decided following a risk assessment relevant to the work location.

3.12.288 Specific areas such as construction compounds and Above Ground Facilities may require additional security measures such as lighting, 24-hour security guards or CCTV.

3.12.289 All fencing along the route will be maintained and checked on a regular basis. Entry points via gates will be closed, secured and locked when not in use. For some locations the fencing used may also serve to provide acoustic and visual screening of the work sites and reduce the potential for disturbance of users in the surrounding areas.

3.12.290 Provision of additional fencing on a site-by-site basis may be used to reduce the potential for impacts on wildlife and habitats. Fencing will be removed as part of the demobilisation unless otherwise specified.

Welfare

3.12.291 Sufficient welfare facilities will be provided at the construction compounds, access and lay-down areas and the Immingham/Theddlethorpe Facility during the works for the use of all site personnel. Some of the facilities would be more mobile and only be present at a particular location whilst particular activities were undertaken. These facilities would include toilet facilities (female and male), messing facilities and drying facilities.

3.12.292 The welfare facilities will include toilet facilities (female and male), messing facilities and drying facilities Provision of potable water, emptying of effluent and the removal of any waste would be undertaken by a registered contractor on a regular basis.

3.12.293 Health and safety information and Control of Substances Hazardous to Health (COSHH) data sheets would be displayed within the welfare area.

Control of Nuisance

3.12.294 The Proposed Development recognises the potential nuisance its activities may cause. The principal measures for limiting and controlling potential nuisance will be set out the Construction Phase Plan. Potential nuisances include light, noise and dust from construction activities at construction compounds and facilities as well as along the working width.

3.12.295 Appropriate site layout and housekeeping measures would be implemented by the contractor(s) at all construction locations. These may include:

- Preventing pests and vermin and treating any infestation promptly. This would include arrangements for the proper storage and disposal of waste produced on site;
- Inspecting and collecting any waste or litter found on site;
- Burning of rubbish, other waste or organic material will be prohibited;
- Suppressing windblown dust on open areas of land or due to moving vehicles/plant using water spays or similar;
- Minimising transfer or accumulation of mud onto roads by using wheel washing/cleaning facilities or road sweepers as appropriate;
- Locating or designing site offices and welfare facilities to limit the overlooking of residential properties; locating designated smoking/vaping areas to avoid significant nuisance to neighbours;
- Managing staff/vehicles entering or leaving site, especially at the beginning and end of the working day; and
- No music or radios would be played on site.

3.12.296 Potential power supply tie locations have been identified for each of the 3 construction compounds. But in any short-term absence of a mains electricity supply, super-silent pack generators would be used as an alternative power supply.

3.12.297 Any activity carried out or equipment located within a laydown area or construction compound that may produce a noticeable nuisance from dust, noise, lighting etc would be located away from sensitive receptors such as residential properties or ecological sites where practicable.

3.12.298 Lighting would be of the lowest luminosity necessary for safe delivery of each task and would be designed, positioned and directed to reduce the intrusion into adjacent properties and habitats.

Construction Traffic Access and Management

Traffic Management

3.12.299 Ahead of construction works a Construction Traffic Management Plan (CTMP) will be prepared and will include any applicable highway authority permits. A draft of the Outline CTMP is included in *ES Volume IV: Appendix 12.5 (Application Document 6.4.12.5)*.

3.12.300 Traffic Management measures will be applied to all construction traffic in accordance with the CTMP. Access points to and from a public road to the construction site(s) will be subject to a Road Safety Audit (RSA) which will identify what measures are needed to ensure the safety of the access point, in agreement with the local highways authority. This may include bellmouths, visibility splays, installation of kerbs, signage, etc. An example temporary access junction required for the construction phase is included in **Figure 3-45**.

3.12.301 Vegetation for visibility splays will be removed where required to create visibility splays. No veteran trees would be removed. If protected species licences are required, they will be applied for and approved by Natural England before construction activities commence.

3.12.302 Wheel washing tanks/facilities would be provided at the three construction compounds and an adequate supply of water would be made available at these locations at all times.

3.12.303 Where needed, traffic management measures will be designed to reduce risks to members of the public including road users and the workforce. Typical measures applied include road signage, traffic cones, barriers, traffic lights, “Stop/Go Boards” systems and lane closures, and the CTMP will specify which measures will apply to each site location.

3.12.304 An appropriate speed limit would be imposed on vehicles travelling on site, but it is noted that the Proposed Development has no powers to enforce lower speed limits on public roads.

3.12.305 Vehicle loads would be sheeted during the transportation of loose, potentially dusty or contaminated excavation material. Water-assisted road cleaners would be deployed on public roads where necessary to address excessive dust or mud deposits.

3.12.306 A range of delivery vehicles will be used e.g., Light Goods Vehicles (LGV) and vans to deliver smaller items, through to Heavy Goods Vehicles (HGV) and low-loader units to deliver larger items such as excavators, construction mats, bending machines, and porta-cabin type local welfare units.

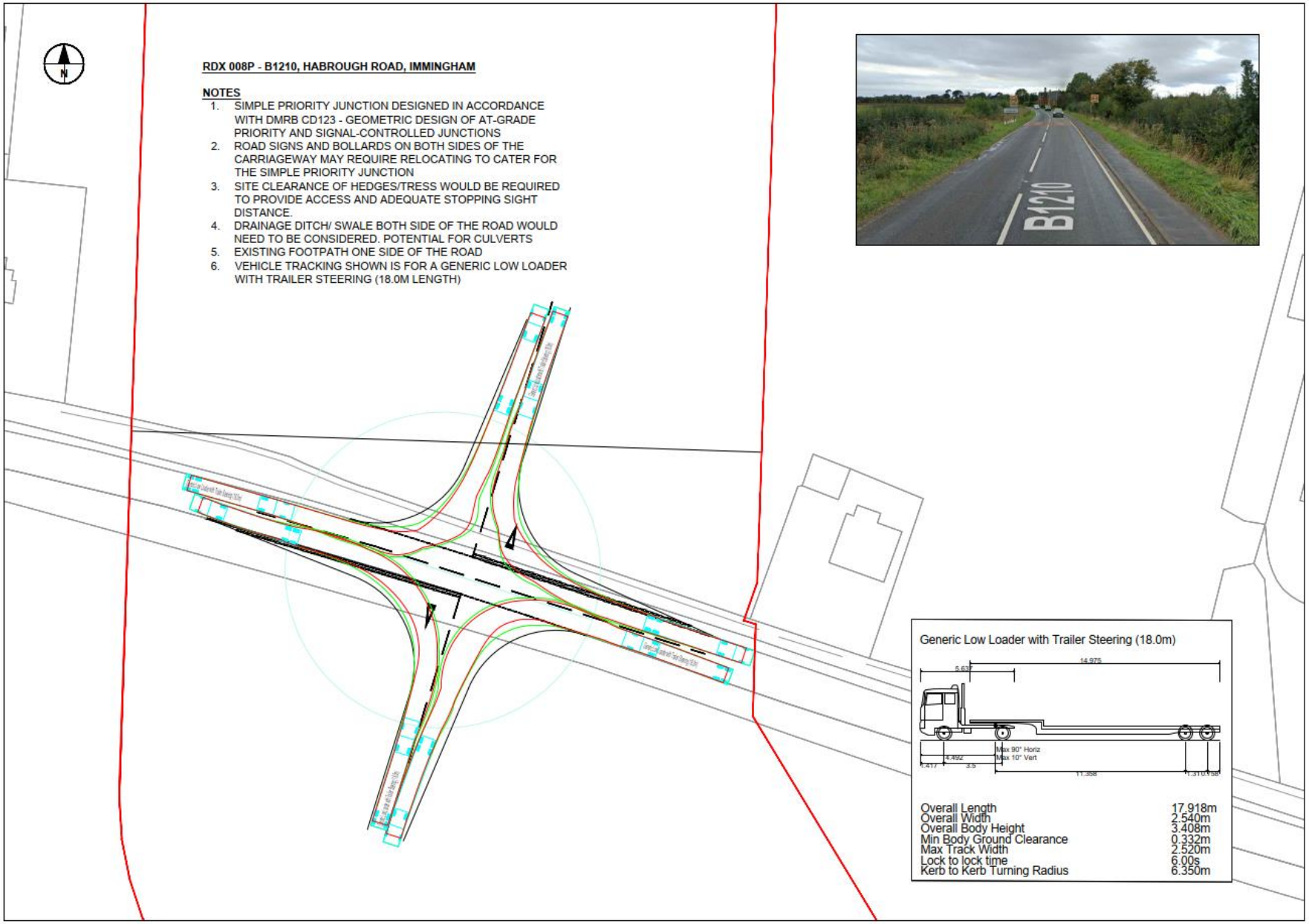
3.12.307 Construction traffic movements would be kept to the minimum reasonable for the effective and safe construction of the Proposed Development.

3.12.308 Equipment and materials will be delivered and offloaded at site using on-board cranes (HIAB type), telehandlers, mobile cranes etc., as needed. All lifting appliances and equipment will be certified and lifting will only be carried out by certified and competent personnel. Lifting will be closely controlled to ensure that members of the public and the workforce are not put at risk from any lifting operation and will be carried out in strict compliance with a specific lift plan. The lift plan will take into account the type and weight of the load, positioning of the lifting equipment (e.g., proximity to members of the public and the workforce, buried and overhead services/utilities) and weather conditions.

3.12.309 At site access points from the public highway, security fencing will be installed along with signage restricting access to construction traffic and construction teams only. Where necessary, additional security measures will be provided including 24hr security guards, CCTV, etc.

3.12.310 All plant and vehicles would be required to switch off their engines when not in use and when it is safe to do so.

Figure 3-45: Example Temporary Access Point Provisional Junction Design



Initial Pipeline Delivery

3.12.311 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 HGVs to the North Compound, Central Compound and Southern Compound via the construction traffic routes identified in **Figure 3-46**. These construction traffic routes have been designed to use major "A" roads and routed away from minor roads where feasible.

A total of approximately 4,700 (24” line pipe of 12 m in length) are required which will generate a minimum of 2,333 one-way movements and 4,666 two-way movements across the programme. It is estimated that it would take 6 HGVs making 4 trips each around 14 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.

Main Construction

3.12.312 For the main construction phase there will be a total of 47,888 vehicle movements which equates to 95,776 two-way trips across the full programme of development in which 60,458 will be two-way HGV movements.

3.12.313 In terms of worker private vehicle movements, the peak month (August 2026) will generate 743 movements per day which is 1,486 two-way daily trips. This In total the construction vehicles alongside the private worker movements will generate 2,036 two-way vehicle movements of which 555 are HGV movements within the day.

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

3.12.315 Low-loader trucks would be used periodically to move heavy plant around the pipeline spread as required.

3.12.316 The average workforce is anticipated to be approximately 743 during the peak period of construction, and from 21 to 677 during the off-peak, as illustrated in **Figure 3-47**.

3.12.317 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 *ES Volume II Chapter 12: Traffic and Transport (Application Document 6.2.12)*.

3.12.318 A Draft CTMP has been prepared and will be submitted as part of the DCO application *ES Volume IV: Appendix 12.5, (Application Document 6.4.12.5)*. 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.

Revision: 3 Drawn: LC Checked: HT Approved: MW Date: 2023-10-20

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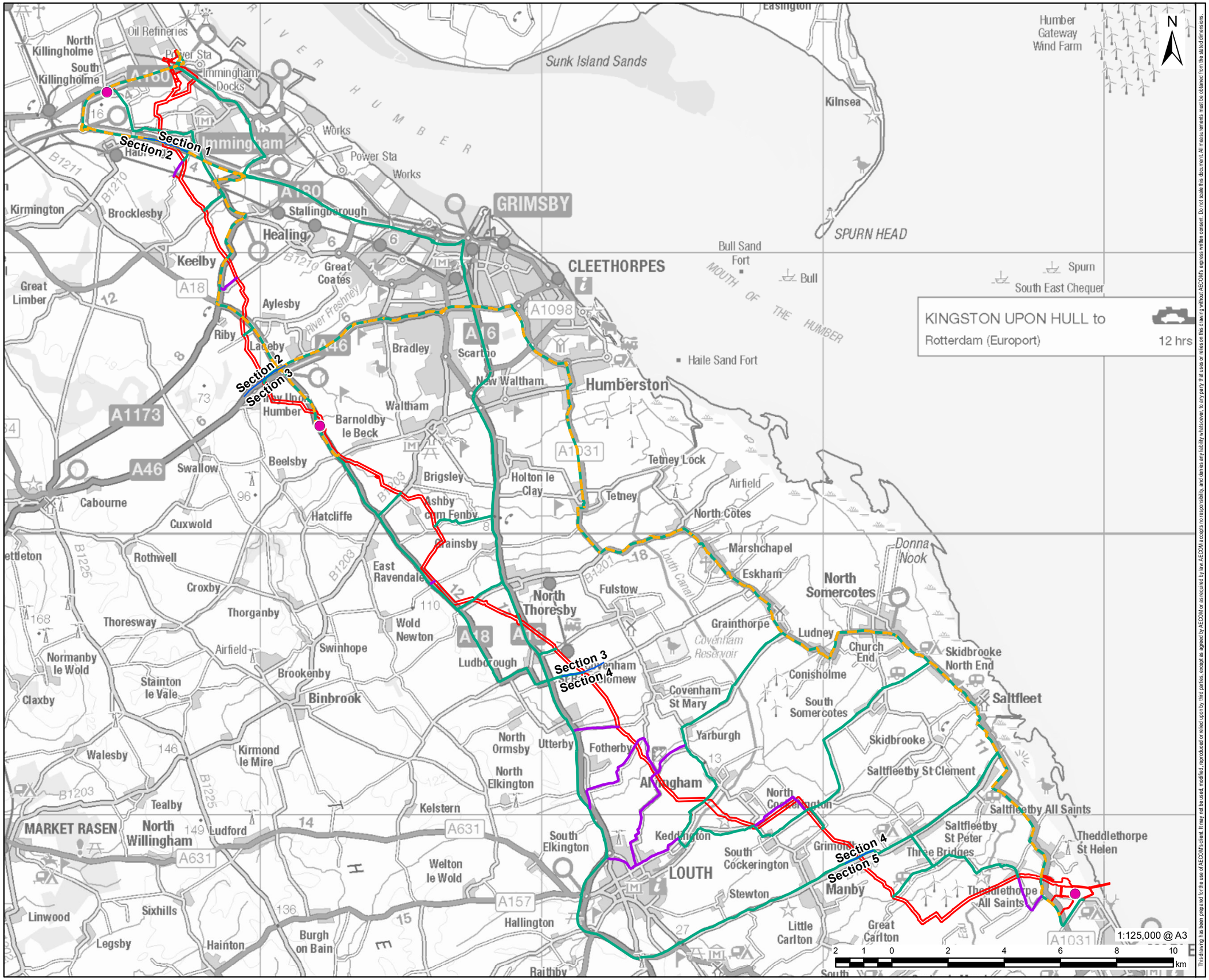


VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- DCO Site Boundary
- Route Section Break
- Proposed Construction Compound Location
- Proposed Route from Immingham Docks to Construction Compounds
- Proposed Construction Access Route LGV
- Proposed Construction Access Route HGV/LGV

NOTES:

FIGURE TITLE

Figure 3-46
Construction Traffic Routes for Initial Pipeline Delivery

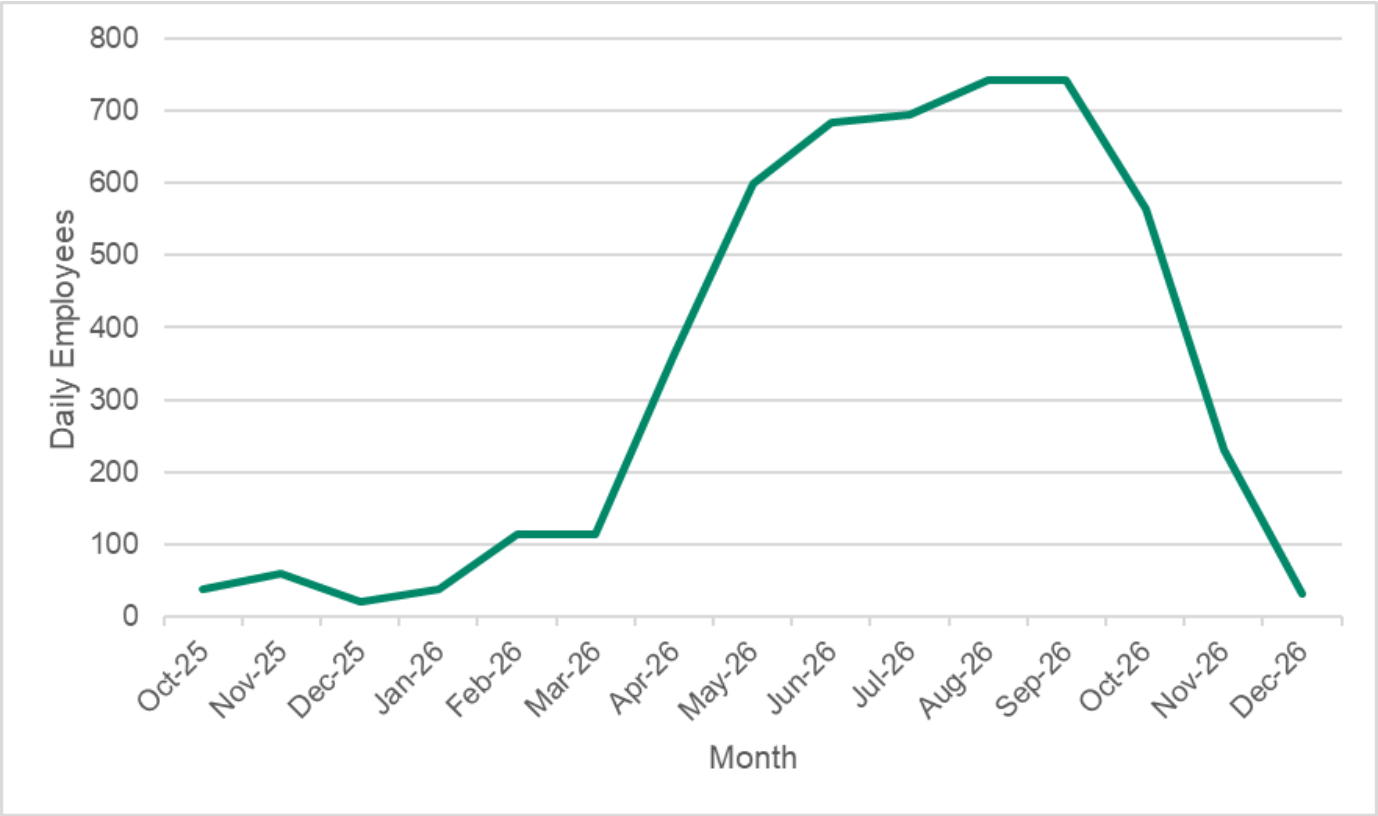
ISSUE PURPOSE

ENVIRONMENTAL STATEMENT

PROJECT NUMBER / REFERENCE

60668955 / VCCS_231020_ES_3-46

Figure 3-47: Estimated Workforce during Construction Phase



3.12.319 There may be an infrequent requirement for Abnormal Indivisible Loads (AILs), predominantly for the delivery and movement of large items of plant. The proposed delivery routes to compounds/pipe dumps and to the construction spread have been identified and are included within the Outline TMP. An 'abnormal load' is a vehicle that has any of the following:

- a weight of more than 44,000 kilograms (kg);
- an axle load of more than 10,000 kg for a single non-driving axle and 11,500 kg for a single driving axle;
- a width of more than 2.9 metres; or
- a rigid length of more than 18.65 metres.

3.12.320 Where a vehicle / delivery movement is large enough to be ranked as an AIL, there is a standard process for managing the transport of such loads that would ensure compliance with regulatory commitments (Ref 3-19). When an AIL movement is required, the relevant highway authorities and police will be notified and appropriate forms completed. This will be completed through the Electronic Service Delivery for Abnormal Loads (ESDAL) system.

3.13 Draft Construction Environmental Management Plan

3.13.1 A Draft Construction Environmental Management Plan (CEMP) has been prepared and updated to capture feedback from Statutory Consultation and is presented in *ES Volume IV: Appendix 3.1 (Application Document 6.4.3.1)*. This document contains information relevant to the construction phase such as best practice and pollution prevention measures, specific environmental management plans, incident reporting, method statements and environmental risk assessments. A Mitigation Register is included in the Draft CEMP which tabulates all the environmental mitigation proposed as part of the ES and includes detailed descriptions of the actions required by the main contractor(s) and the Applicant during the construction and operational phases of the Proposed Development.

3.13.2 The Draft CEMP will subsequently be further developed once the Contractor(s) is appointed. The draft DCO includes a requirement that ensures that those measures included in the Draft CEMP are legally secured and have to be actioned pre / during / post construction. An appendix to the CEMP also includes a list of relevant measures which will be adopted during the operational phase.

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

- ***Project description**:* a high-level description of the Proposed Development;
- ***Construction programme***: a high-level description of the construction schedule for the Proposed Development;
- ***Environmental organisation and responsibilities***: sets out the key Contractor roles and responsibilities of parties involved in the construction of the Proposed Development. 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 anticipated consents and licences required for the Proposed Development. The Contractor(s) will be responsible for identifying any further statutory consents required for the construction, pre-commissioning and re-instatement of the Proposed Development;
- ***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 Proposed Development's design.

3.13.4 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.

3.13.5 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 Pipeline Contractor and Decommissioning Environmental Management Plan (DEMP) produced prior to the decommissioning phase.

3.14 Operational Phase

General Operating Philosophy

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 Carbon Dioxide will be provided by each emitter to meet the requirements of the Harbour Energy CO_2 Specification and fed into the inlet manifold located on the Immingham facilities. Future proofing provision has been made for approximately five connections from emitters to the Immingham Facility to allow for possible future expansion. The capture, metering and compression of 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).

3.14.3 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 Proposed Development. Each emitter would also undertake flow metering and compositional analysis to an agreed standard which would be auditable by Harbour Energy.

3.14.4 Harbour Energy will continuously measure and monitor overall flowrate, composition, temperature and pressure into the onshore pipeline and take action to reduce or stop flow from individual emitters or all emitters should measured parameters deviate significantly from specified values.

3.14.5 The flow of CO_2 will be directed through a High Integrity Pressure Protection System (HIPPS) which will provide protection to the pipeline in the event of a high-pressure surge from an emitter. It will do this by continually monitoring the pressure of the system and automatically closing ESDV valves if pre-determined pressures are exceeded. There is a duty and standby path provided in order to allow maintenance and testing of the system.

3.14.6 The pipeline operation would be managed from the CCR at the Immingham Facility. The CCR will remotely monitor all aspects of the pipeline operations such as flow, temperature and pressure. From the CCR it will also be possible to open or close valves at the block valve stations and the Theddlethorpe facilities as necessary. The CCR 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 before the Proposed Development becomes operational.

3.14.7 CO_2 will flow from the new onshore pipeline to the existing offshore LOGGS pipeline via the Theddlethorpe facility. The two pipelines will be connected with a cross over section of pipework that will pass through a HIPPS.

3.14.8 Once the CO_2 passes into the LOGGS pipeline it will flow out to a Not Permanently Attended Installation (NPAI) where it will be directed into the subsea storage reservoir.

3.14.9 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.

3.14.10 When transporting CO2 in dense phase, the operating temperature of the pipeline will be up to a maximum of 35 ^{O}C and there will be little reduction in this temperature over the length of the pipeline. Research has indicated that in UK soils, soil temperature responses are restricted to within 450mm of the heat source (Ref 3-28). Given that the depth of the pipeline is 1200 mm from top of pipe to ground level, this means that there will be no temperature responses in the top 750mm of topsoil. The main rooting zone for crops is down to 600mm and any changes in soil temperature will therefore not occur in the crop rooting zone. For this reason, pipeline temperature is not considered in the remainder of this report.

3.14.11 A list of the operational phase mitigation measures which have been identified within the ES are included within *ES Volume IV: Appendix 3.6 Operational Phase Mitigation (Application Document 6.4.3.6).*

Maintenance and Inspection

3.14.12 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.

Immingham Facility

3.14.13 Equipment on the Immingham Facility is expected to require planned maintenance every two years (or less frequently as required). Systems will typically be designed with a duty/standby configuration that will allow the process to remain online whilst allowing the required maintenance to be undertaken safely.

Pipeline

3.14.14 The onshore pipeline will require In-Line Inspection (ILI) pigging. The frequency will be based on a risk-based approach. An ILI is expected to be conducted within the first 1-2 years of pipeline operation, and every five years thereafter.

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

3.14.16 During operation, the CCR operator will monitor the site via connection to all monitoring and metering systems and will request support from maintenance personnel as required.

Theddlethorpe Facility

3.14.17 Equipment on the Theddlethorpe Facility is expected to require planned maintenance every two years (or less frequently as required). Systems will typically be designed with a duty/standby configuration that will allow the process to remain online whilst allowing the required maintenance to be undertaken safely.

3.14.18 During operation, it is expected that the site will be visited 2-3 times per week in the initial operating period of approximately six months, and once per week thereafter.

3.14.19 The existing LOGGS pipeline will require periodic ILI pigging. It is expected that the first ILI will be required two years after start-up, with subsequent ILI's at five-year intervals.

Block Valve Stations

3.14.20 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 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.

Dune Isolation Valve

3.14.21 The maintenance of the Dune 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 only 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 3-9: Maintenance Regime

Infrastructure	Maintenance / Inspection Activity	Indicative Frequency
Immingham Facility	Maintenance with low volume venting to de-pressure equipment	Every two years
Pipeline	Aerial surveillance survey	Fortnightly
Pipeline	Walkover of pipeline easement	Annual
Pipeline	In-line inspection (using PIG)	Every five years
Pipeline	Cathodic Protection System – Transformer Rectifiers at Immingham/Theddlethorpe	Monthly
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 low volume venting to de-pressure equipment	Every two years
Dune Isolation Valve	Visual survey of valve surface works	Monthly

Operational and Maintenance Waste

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

3.14.23 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.

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

3.14.25 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.

3.14.26 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 Lighting

3.14.27 Operational lighting will be zoned to provide light only where required and will follow BS EN 12464 (Part 2) and guidance notes from the Institution of Lighting Professionals GN01.

3.14.28 It is proposed to mount all operational lighting required for the facility onto proposed building/kiosks/pipe racks to limit the visual impacts around the boundaries of the facility, as far as is practical whilst meeting safety and security requirements.

3.14.29 Lighting will be directed only into the facility area and will incorporate measures such as louvres and/or barn-doors to minimise light-spill on the occasions that the lighting is required.

3.14.30 Should additional lighting be required for infrequent overnight works then this would be brought to the site as required. Road and personnel access route lighting will be automatically controlled by either a photocell, time switch or similar device to suit local conditions.

3.14.31 Security lighting will provide illumination of security fence areas and be activated upon unauthorised access to the pipeline facilities. A security lighting override switch will be provided for Operator control at any time.

3.14.32 High pressure sodium floodlights will be provided for outdoor area lighting, supplemented with fluorescent luminaires for local lighting as required for enhanced illumination at the plant. Fluorescent luminaires will be provided for lighting within LER/Kiosks. Adjacent luminaires will not be connected to the same circuit or same phase of three phase circuits.

3.14.33 The Theddlethorpe Facility and Block Valve Stations will be unmanned and routine visits will be made only during the hours of daylight. Lighting will be installed at these locations as described above but will only be activated if required for an unexpected maintenance visit, during low light conditions or in the event of an emergency. Lighting will therefore only be used for short temporary time periods.

Operational Vehicles

3.14.34 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 Immingham Facility and used by personnel to visit the unmanned facilities (Block Valve Stations and the Theddlethorpe Facility) for routine maintenance or inspections.

3.14.35 Company vehicles will be maintained in accordance with legal and manufacturers recommendations.

Drainage

3.14.36 Pre-Construction drainage will be installed to prevent excessive water drainage from the surrounding area leading to flooding of the pipeline trench and protect the working width during construction, whilst post Construction drainage will be identified and installed to prevent too much standing/excess water, ensure that soil is properly aerated and reduce

the risk of soil slippage on slopes and to maintain the previous land drainage performance, as appropriate.

3.14.37 The drainage at both Immingham and Theddlethorpe facilities and Block Valve Stations will be passive and low maintenance. Drainage will be inspected and maintained as necessary to maintain performance.

3.15 Decommissioning Phase

3.15.1 An initial Draft Decommissioning Strategy has been developed for the Proposed Development and is presented in *ES Volume IV: Appendix 3.5 (Application Document 6.4.3.5*). The Proposed Development has a minimum operational life of 25 years, which may be extended further. At the end of the Proposed Development's operations, 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, the Block Valve Stations, the Theddlethorpe Facility and the Dune Isolation Valve.

3.15.3 At the end of the operational life the final shutdown of the process will be carefully coordinated between Harbour Energy and the emitters that are connected into the pipeline.

3.15.4 A final intelligent pigging run may be conducted ahead of shutdown to give a record of the pipeline condition at the end of its life in case there is potential for it to be re-purposed. The flow into the pipeline from emitters will be stopped and all inlet valves will be closed.

3.15.5 The residual pipeline inventory of carbon dioxide will be carefully vented so as to ensure safe dispersion of material. As the rate of venting will be carefully controlled the final venting process could take around 4-6 weeks. The location of the venting will be determined nearer the time through an options appraisal process, but it will likely be via the 25m vent stack at either Immingham or Theddlethorpe although offshore venting will also be considered.

3.15.6 Once the pipeline pressure is verified as being at safe levels then the inlet connections to the pipeline will be removed in order to positively isolate the Immingham facilities from the emitters. The LOGGS offshore pipeline will also be positively isolated from the Theddlethorpe facilities which will allow the decommissioning programme to begin.

3.15.7 Removal of the infrastructure at Immingham and Theddlethorpe plus the block valve station removal could take between 6-12 months dependent on sequencing of the works.

3.15.8 A detailed decommissioning strategy would be developed prior to the commencement of any decommissioning activities; 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 (as detailed above);
- 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;
- The base case is that the pipeline will be left in-situ along its entire length. Special consideration will however be given to key locations such as road and railway crossings. At such locations agreed methodologies between relevant stakeholders will be employed

to ensure the pipeline is left in a suitable condition; this may involve cutting out or grout filling sections of pipeline; and

- Any open ends of the pipeline would be capped and the remaining pipeline marked on all required maps and plans.

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