Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 3: Need and Alternatives

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 3: Need and Alternatives

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	**Date**	**Status of Version**
Revision 1	21 September 2023	DCO Application

Table of contents

3 Need and Alternatives

3.1 Introduction

3.1.1 This Chapter of the Environmental Statement ("ES") explains the need for the Project, which is established by the National Policy Statement for Ports ("NPSfP") (Ref 3-1) and further reinforced by other relevant national and local policy. A detailed explanation of need is set out in Chapter 5 of the **Planning Statement [TR030008/APP/7.1]**.

3.1.2 In summary, there is an imperative and urgent need for the Project to provide port infrastructure for the import and export of liquid bulk energy products in the Humber to support the transition to net zero and the decarbonisation of the Humber industrial cluster and other locations.

3.1.3 The objectives of the Project, which partly arise out of that need, are then set out and explained. Finally, this chapter describes the alternatives that have been considered by Associated British Ports ("ABP") ("the Applicant") and indicates the main reasons for choosing the option that is now the Project, taking into account the effects of the Project on the environment.

3.1.4 The Applicant's responses to comments received during two rounds of statutory consultation relating to alternatives are set out in the **Consultation Report [TR030008/APP/5.1]**.

3.2 The Need for the Project

3.2.1 The NPSfP (Ref 3-1) establishes that there is a "*compelling need for substantial additional port capacity*" over the next 20–30 years (i.e. to 2032 - 2042), to be met by a combination of consented and new development (paragraph 3.4.16). The need for the specific infrastructure comprising the Project derives from the following inter-related factors:

a. The national need to provide port capacity.

b. The need for port capacity to serve the energy sector in the humber.

c. The need to achieve energy security through a diversity of technologies.

d. The urgent need to scale up hydrogen production capability.

e. The urgent need for carbon capture and storage ("CCS[1]") technologies.

3.2.2 The need for the Project is explained further below, commencing with consideration of the national need, then regional need and then specific technologies related to net zero.

[1] This chapter refers to carbon capture and storage ("CCS") and carbon capture, utilisation and storage ("CCUS") where appropriate. CCUS is the process of capturing carbon dioxide CO_2 emissions from fossil power generation and industrial processes for storage deep underground or re-use, such as creating synthetic fuel. CCS is the process of capturing carbon before it enters the atmosphere.

The national need to provide port capacity

3.2.3 There is an established national need for port operators and developers such as ABP to bring forward new port infrastructure in locations where it is required and in response to market demand, to provide additional capacity, create competition and build resilience in the sector and deliver wider economic benefits in the public interest.

3.2.4 The NPSfP (Ref 3-1) recognises the essential role that ports play in the growth of the UK economy and further notes that shipping will continue to provide the only effective way to move the vast majority of freight in and out of the UK, and the provision of sufficient sea port capacity will remain an essential element in ensuring sustainable growth in the UK economy (paragraph 3.1.4 of the NPSfP).

3.2.5 The Government seeks to encourage sustainable port development to cater for long-term forecast growth in volumes of imports and exports by sea with a competitive and efficient port industry capable of meeting the needs of importers and exporters cost effectively and in a timely manner, thus contributing to long-term economic growth and prosperity (paragraph 3.3.1 of the NPSfP).

3.2.6 A commercial decision has been taken to bring forward the Project in response to market demand at the Port of Immingham for the import and export of liquid bulks. This will increase port capacity and develop resilience, core objectives of the NPSfP.

The need for port capacity to serve the energy sector in the Humber

3.2.7 There is an imperative need for port infrastructure to provide capacity to serve the energy sector, for the import and export of liquid bulks relating to hydrogen and CO_2, to help achieve the 2050 legally binding net zero target.

3.2.8 There is a particular need for port infrastructure on the Humber, (one of the major industrial areas in the country, an important contributor to the national and regional economy and the industrial cluster emitting more CO_2 than any other industrial cluster in the country) to support decarbonisation in the region and elsewhere, to support the provision of alternative sources of clean energy locally (and to contribute to the national need) and to contribute to the regional and local economy. As shipping provides the most effective way to move hydrogen in the form of refrigerated ammonia in and out of the UK, sufficient port and landside infrastructure is required for ammonia storage and processing. Shipping of CO_2 also helps maximise the use of CCS infrastructure.

3.2.9 The role that ports play in the energy market is recognised at paragraph 3.1.5 of the NPSfP (Ref 3-1) which states that '*Ports have a vital role in the import and export of energy supplies' and that 'port handling needs for energy can be expected to change as the mix of our energy supplies changes and particularly as renewables play an increasingly important part as an energy source*". Paragraph 3.3.5 of the NPSfP (Ref 3-1) explains that the Government wishes to see port developments supporting sustainable development by providing additional capacity for the development of renewable energy.

The need to achieve energy security through a diversity of technologies, fuels and supply routes

3.2.10 There is an urgent need to achieve energy security through a diversity of technologies, fuels and supply routes. The UK is vulnerable to international energy prices and dependent on imported oil and gas. Government policy including that set out in the NPSfP (Ref 3-1), the energy National Policy Statements[2] ("NPSs"), the draft energy NPSs[3] and Powering up Britain 'Energy Security Plan' (March 2023) (Ref 3-12), demonstrates the need for new energy infrastructure including necessary import and export facilities at ports, responding to market demand and new technologies, in order to develop competition and diversity of supplies to help in the net zero transition. The need for energy security means that energy from a range of reliable renewable sources is required. The Government's 2050 net zero target underpins the urgency of bringing forward necessary infrastructure to facilitate the availability of clean energy as soon as possible in order to tackle climate change. In line with national policy, a range of technologies is required to be developed on the Humber to facilitate the production of low carbon hydrogen and the use of carbon capture, utilisation and storage ("CCUS") which has a wide range of applications which will support the transition to net zero. CCUS is likely to predominantly utilise renewable sources of energy and is complemented by other technologies such as gas-fired generation, which assists in maintaining a diversity of sources, and hence energy security.

3.2.11 The NPSfP (Ref 3-1) recognises the importance of ensuring security of energy supplies through ports and provides that ports will need to be responsive to changes in the different types of energy supplies needed (paragraph 3.1.5) and further at paragraph 3.3.3, the NPSfP (Ref 3-1) reiterates the need to ensure that new port infrastructure should ensure security of supply.

The urgent need to scale up hydrogen production capability

3.2.12 As part of the need to deliver energy security and decarbonisation, there is an urgent national need to scale up low carbon hydrogen production capability as an established alternative "clean" source of energy. Low-carbon hydrogen includes "green hydrogen" (hydrogen from renewable electricity) and "blue hydrogen" (hydrogen from fossil fuels with CO_2 emissions reduced by the use of CCS).

3.2.13 The UK Hydrogen Strategy (August 2021) (Ref 3-4) recognises the scale of the challenge to increase green hydrogen production, stating in Chapter 1 "*With virtually no low carbon hydrogen produced or used currently, particularly to supply energy, this will require rapid and significant scale up from where we are today"*. Paragraph 1.2 of the Hydrogen Strategy (Ref 3-4) emphasises the need for hydrogen infrastructure recognising that hydrogen can only be considered as a decarbonisation option if it is readily available. Paragraph 1.3 builds on this, stating *"as a result of its geography, geology, infrastructure and capabilities, the UK has an important opportunity to demonstrate global leadership in low carbon*

[2] Overarching National Policy Statement for Energy (EN-1) (July 2011) (Ref 3-5)
[3] Draft Overarching National Policy Statement for Energy (EN-1) (March 2023) (Ref 3-11)

hydrogen". Section 2.2 of the Hydrogen Strategy (Ref 3-4) outlines how hydrogen development can be delivered and scaled up, and states *"Investors, developers and companies across the length and breadth of the UK are ready to build if the policy environment is in place",* further stating at 2.4.2 that *"developing and scaling hydrogen power during the 2020s can reduce the burden on other technologies such as renewables, CCUS and nuclear".*

3.2.14 The British Energy Security Strategy (April 2022) (Ref 3-6) notes that the UK is well-placed to exploit all forms of low carbon hydrogen production and commits to 10GW of hydrogen production by 2030. The British Energy Security Strategy (Ref 3-6) seeks up to 1GW of electrolytic 'green' hydrogen and up to 1GW of CCS-enabled 'blue' hydrogen to be operational or in construction by 2025. It recognises that to accelerate our supply of low carbon hydrogen, it requires "*designing, by 2025, new business models for hydrogen transport and storage infrastructure, which will be essential to grow the hydrogen economy*".

3.2.15 Once fully constructed and operational, the Project could deliver 3% of the Government's 2030 10GW target for green hydrogen (300MW) and help meet the need for decarbonisation of industry including the heavy transportation sector.

The urgent need for carbon capture and storage technologies

3.2.16 There is an urgent national need for CCS technologies to support decarbonisation and therefore a need for CCS infrastructure, particularly in industrial areas such as the Humber where the need for decarbonisation is the greatest. CCS technology captures carbon dioxide from power generation, low carbon hydrogen production and industrial processes, storing it underground where it cannot enter the atmosphere. The Project would help maximise the potential of emerging CCS infrastructure in the Humber, particularly in relation to the Viking CCS project.

3.2.17 The Government's Net Zero Strategy Build Back Greener (October 2021) (Ref 3-13) sets out the Government's ambition to capture 20-30 Mt of carbon dioxide per year by 2030 and at least 50Mt by the mid 2030's. The Project can facilitate the import of up to nearly 10 Mt of Carbon dioxide, or one third of this objective.

3.2.18 Draft EN-1 (Ref 3-11) identifies the urgent need for new nationally significant CCS infrastructure for the transition to a net zero economy (paragraph 3.5.1). In paragraph 3.5.2, Draft EN-1 explains that the Government's Climate Change Committee has advised that new CCS infrastructure is a *"necessity not an option"* and that *"CCS infrastructure will also be needed to capture and store carbon dioxide from hydrogen production from natural gas, industrial processes, the use of bioenergy …. and from the air".*

3.2.19 Draft EN-1 (Ref 3-11) recognises the importance of ports to enable the transfer of carbon dioxide from onshore infrastructure onto ships and that the need for CCS infrastructure set out in Draft EN-1 is likely to be a relevant consideration.

3.2.20 The Project provides an opportunity to facilitate the use of CCS infrastructure, including in industrial locations which do not have direct access to CCS systems and develop wider economic opportunities, including inward investment related projects that will utilise the hydrogen and CCS infrastructure.

3.3 The Project Objectives

3.3.1 The objectives for the Project are as follows:

a. To provide essential port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone;

b. To provide capacity to support the import and export of a range of liquid bulk energy products including (i) ammonia (NH_3) (to produce green hydrogen) to support the decarbonisation of industrial activities and in particular the heavy transport sector and (ii) carbon dioxide (CO_2), to facilitate carbon capture and storage, both of which will assist in the UK's transition towards net zero;

c. To deliver and operate new port infrastructure, and its first user's hydrogen production facility, in a safe, efficient and sustainable manner by making effective use of available land, water, transport and utility connections which exist in and around the Port of Immingham;

d. To minimise adverse impacts on the environment and safeguard the health, safety and amenity of the surrounding community; and

e. To enhance both the local and regional economy through direct investment in and around the Port of Immingham and by partnering with the supply chain, provide opportunities for training, upskilling, apprenticeships and local employment.

3.3.2 Objective (a) responds directly to the need identified above for new port infrastructure, capacity and resilience at a national and specifically Humber level. It leads to a requirement for a suitable marine site on the Humber with landside capacity for associated facilities, and proximity to local industry and potential customers.

3.3.3 Objective (b) addresses the particular need for infrastructure to import and export a range of liquid bulk energy products. Those include, but are not limited to, ammonia to produce green hydrogen and CO_2 to facilitate CCUS.

3.3.4 In order to facilitate the import and export of liquid bulk energy products including ammonia, the Project must be capable of receiving and discharging vessels of a variety of sizes. The dimensions of the largest vessel, very large gas carrier ("VLGC"), expected to be used to transport ammonia to and from the jetty would be approximately 250m in length, 45m beam and 12.8m draught. Accordingly, access to a deep-water port is required. These larger ships are required to optimise the shipping logistics and reduce the environmental impact of shipping.

3.3.5 Ammonia is a hazardous substance transported in refrigerated liquid form and, once imported, must be stored and treated in a way that limits the toxic risk that arises from it. The pipeline from the jetty to the ammonia storage tank represents the greatest risk of potential damage and/or accidental leakage. The further the ammonia is moved in pipes the greater the loss of refrigeration and the greater the energy use in maintaining the correct refrigeration temperature. As a result, the ammonia storage tank should be as close to the Terminal as possible.

3.3.6 In addition to proximity to industry and the proposed CCUS network, the Project also requires good connections to the transport network to facilitate the distribution of hydrogen to end customers in the heavy transport sector.

3.3.7 Objectives (c) to (e) relate to the impacts and benefits of the Project in order to address wider legislative and policy requirements.

3.3.8 In relation to Objective (c):

a. Paragraph 3.3.3 of the NPSfP (Ref 3-1) provides that, to help meet the requirements of the Government's policies on sustainable development, new port infrastructure should "*contribute to local employment, regeneration and development; ensure competition and security of supply; preserve, protect and where possible improve marine and terrestrial biodiversity; minimise emissions of greenhouse gases from port related development; be well designed, functionally and environmentally; be adapted to the impacts of climate change; minimise use of greenfield land; provide high standards of protection for the natural environment; ensure that access to and condition of heritage assets are maintained and improved where necessary; and enhance access to ports and the jobs, services and social networks they create, including for the most disadvantaged*."

b. Locally, the spatial development strategy of the North East Lincolnshire Local Plan (Ref 3-2) promotes sustainable development to "*improve the quality of life, bring forward quality development to meet identified needs and which delivers economic, social and environmental benefits*."

3.3.9 A suitable location for the Project therefore requires available land, water, transport and utility connections.

3.3.10 In relation to Objective (d):

a. At Paragraph 4.7.1, the NPSfP (Ref 3-1) requires that projects subject to the Environmental Impact Assessment ("EIA") Directive must be accompanied by an Environmental Statement describing "*the aspects of the environment likely to be significantly altered by the project*". Paragraph 4.7.2 of the NPSfP goes on to state that "*the decision-maker will find it helpful if the applicant also sets out information on the likely significant social and economic effects of the development*." The NPSfP also recognises at Paragraph 4.16.2 that "*Port developments can have direct impacts on health, including increasing traffic, air pollution, dust, odour, polluting water, hazardous waste and pests."*

b. In terms of health and safety in relation to pollution control, the NPSfP (Ref 3-1) explains at paragraph 4.11.2 that "*The planning and pollution control systems are separate but complementary. The planning system controls the development and use of land in the public interest. It plays a key role in protecting and improving the natural environment, public health and safety, and amenity, for example by attaching requirements to allow developments which would otherwise not be environmentally acceptable to proceed, and preventing harmful development which cannot be made acceptable even through requirements*".

c. Whilst not applicable to the determination of applications for nationally significant infrastructure projects, the North East Lincolnshire Local Plan (Ref

3-2) contains strategic policies to safeguard the built, historic and natural environment and more detailed policies that require the consideration of local amenity in terms of noise, air quality, traffic, vibration, dust and visual impact.

3.3.11 The ability to appropriately minimise impacts including on the health and safety of the local community therefore influences the identification of a suitable location of the Project.

3.3.12 In relation to Objective (e):

a. The Ten Point Plan (November, 2020) (Ref 3-8) sets out the Government's ambition for job creation in implementing measures to achieve net zero stating that "*This Ten Point Plan to get there will mobilise £12 billion of government investment, and potentially three times as much from the private sector, to create and support up to 250,000 green jobs*." The Ten Point Plan sets out that delivering the growth of low carbon hydrogen could deliver up to 8,000 jobs by 2030 with the potential to unlock 100,000 jobs by 2050 in a high hydrogen net zero scenario. Similarly investing in CCS could potentially deliver 50,000 jobs by 2030. The Energy White Paper (December 2020) (Ref 3-3) builds upon this ambition with an aim to "*establish the UK as a world leader in the deployment of CCUS and clean hydrogen, supporting 60,000 jobs by 2030*".

b. The Levelling Up the United Kingdom White Paper (Ref 3-7) identifies that the UK's transition to net zero is a future factor driving the UK's economic geography. Chapter 1.4.1 recognises that whilst the transition to Net Zero could be disruptive for places that need to undergo the largest transition (given the level of jobs in carbon-intensive industries), it could also be transformative. It states "*the 'Green Industrial Revolution' will require significant investment in new infrastructure and production processes using new technologies*". The White Paper also highlights how many places outside London and the South East have potential to build on their existing strengths such as *"renewable energy, electric vehicle manufacture, Carbon Capture, Utilisation and Storage, and hydrogen*".

c. Paragraph 3.3.1 of the NPSfP (Ref 3-1) advises that the Government seeks to "*encourage sustainable port development to cater for long term forecast growth in volumes of imports and exports by sea with a competitive and efficient port industry capable of meeting the needs of importers and exporters cost effectively and in a timely manner, thus contributing to long-term economic growth and prosperity; allow judgments about when and where new developments might be proposed to be made on the basis of commercial factors by the port industry or port developers operating within a free market environment; and ensure all proposed developments satisfy the relevant legal, environmental and social constraints and objectives, including those in the relevant European Directives and corresponding national regulations*."

d. Paragraph 4.3.2 of the NPSfP (Ref 3-1) recognises that at a regional and local level, "*economic benefits from port developments include regeneration and employment opportunities. As commercial developments, ports can also generate agglomeration effects by bringing together businesses, with varying*

degrees of mutual interaction, and producing economic benefits over and above those reflected in the value of transactions among those businesses." Furthermore, at paragraph 4.3.3, the NPSfP also recognises that "Ports *can contribute to the enhancement of people's skills and of technology, as embodied in equipment used by ports and port-related activities, with wider longer-term benefits to the economy*."

e. The North East Lincolnshire Local Plan (Ref 3-2) aims to encourage growth and ensure the Borough becomes a sustainable location in the future. The Foreword to the Local Plan sets out that North East Lincolnshire is entering a period of economic growth and that between 2013 and 2032 the Council plan to deliver 8,800 new jobs. It is further stated that a significant proportion of these will be focused around five key economic sectors which includes ports and logistics and renewable energy.

3.3.13 Taking into account the national and local policy above, the Project should seek to enhance the local and regional economy.

3.4 How the Project meets the objectives

3.4.1 A brief explanation is provided below of how the Project meets the objectives.

Objective (a): To provide essential port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone

3.4.2 The Project will provide additional capacity at the Port of Immingham to serve the energy sector, on the Humber, close to existing industries seeking to decarbonise and customers within the energy sector.

Objective (b): To provide capacity to support the import and export of a range of liquid bulk energy products including (i) ammonia (NH3) (to produce green hydrogen) to support the decarbonisation of industrial activities and in particular the heavy transport sector and (ii) carbon dioxide (CO_2), to facilitate carbon capture and storage, both of which will assist the UK's transition towards net zero.

3.4.3 Air Products BR Ltd ("Air Products") would be the first user of the Terminal, importing ammonia for processing to hydrogen at a new hydrogen production facility forming part of the Project. Immingham is a deep-water port and therefore suitable for the very large gas carriers used to import ammonia. The Project also allows the construction of the ammonia storage tank in close proximity to the Terminal, minimising the length of pipeline being used to transport the ammonia, and a suitable distance from non-industrial and residential land uses.

3.4.4 Air Products initially intends to produce the ammonia at NEOM in Saudi Arabia where wind and solar energy is abundant. The production plant is under construction and is anticipated to be operational in 2027, such that ammonia imports from NEOM are anticipated to be received in northern Europe in 2027. Other import terminals in Europe are also under development in Rotterdam and Hamburg and those terminals are planned to be operational by this time. Air

Products is also considering additional locations for the production of ammonia including Oman.

3.4.5 The first phase of the Project (including the jetty and all necessary buildings and structures to render the hydrogen production facility operational) is planned to commence in early 2025 (subject to obtaining necessary consents) and last for between two and a half and three years – at which point ammonia will be available from NEOM. The opportunity to secure the benefits arising from the production of hydrogen will arise on completion of the first phase and the Applicant and Air Products are working together in order to ensure that those benefits can be delivered as early as possible.

3.4.6 As set out in **Chapter 1: Introduction [TR030008/APP/6.2]**, the Project is anticipated to produce up to 300 MW of hydrogen per annum once fully built out and operational. Depending on market demand, this could meet up to 3% of the Government's hydrogen production target. The Project would therefore make a contribution to the Government's aim of achieving 10GW of low carbon hydrogen production capacity by 2030, as defined in the British Energy Security Strategy (Ref 3-6).

3.4.7 The hydrogen produced could be used for general industrial uses on the Humber, helping to decarbonise heavy industry in one of the UK's main industrial clusters and CO_2 emitters. Neighbouring sites could take the hydrogen directly via new pipelines which could be separately consented.

3.4.8 In particular, the Project would contribute to the decarbonisation of hard to abate transport emissions. Immingham provides easy and central access to the UK's road network to facilitate wider distribution of liquidised hydrogen. By way of context, if all the hydrogen produced was used to fuel Heavy Goods Vehicles ("HGVs"), in substitution of other fuels used in road transport, this could eliminate approximately 704,634 tonnes of greenhouse gas emissions each year, totalling 21,757,414 tonnes over 25 years. (see **Chapter 19: Climate Change [TR030008/APP/6.2]** for the impact on greenhouse gas emissions).

3.4.9 As set out in **Chapter 2: The Project** of this ES **[TR030008/APP/6.2]**, the Terminal would operate 24 hours a day, seven days a week and 365 days a year. It is anticipated that around 12 of the vessel calls would be associated with the hydrogen production facility. The remaining jetty capacity provides substantial flexibility for any expansion by Air Products or import/export of other liquid bulk energy products, including in connection with the carbon capture sector.

3.4.10 The location of the Project would enable it to support the delivery of CCUS. The developer of the Viking CCS project (Harbour Energy) and ABP are collaborating around the potential to develop a facility for the discharge of liquefied CO_2 cargoes from vessels at the Terminal into the Viking CCS project infrastructure for storage. The Project could facilitate the transfer of liquified CO_2, from dispersed industrial and power industries along the coast which do not have direct access to the Viking CCS pipeline.

3.4.11 The facilities for landside connection of the Terminal to the Viking CCS pipeline would require separate future consents as necessary. However, the Project reserves a pipeline corridor from the Terminal to the public highway in order to facilitate future connections.

3.4.12 Future energy cargoes that would contribute to the transition to net zero would also be accommodated and enable the port developer to have available port infrastructure and capacity in place to respond speedily to new technologies and requirements. This market led approach accords with the NPSfP (Ref 3-1) which seeks to enable the ports industry to respond to the needs of the market but in a way that delivers sustainable development.

Objective (c): To deliver and operate new port infrastructure, and its first users hydrogen production facility, in a safe, efficient and sustainable manner by making effective use of available land, water, transport and utility connections which exist in and around the Port of Immingham.

3.4.13 ABP and Air Products have sought to minimise land take, using no more land than is necessary to deliver the Project. Part of the Project is located on land allocated for development within the North East Lincolnshire Local Plan (ELR001 is a strategic proposed employment allocation for the ports and logistics sector on Kings Road and ELR025a is a site reserved for long term business expansion) (Ref 3-2).

3.4.14 **Section 3.8** provides more detail on the water, transport and utility connections that are available to the Project at the Port of Immingham.

Objective (d): To minimise adverse impacts on the environment and safeguard the health, safety and amenity of the surrounding community.

3.4.15 The Applicant has minimised the impacts of the Project to appropriate levels through the process of scheme design and environmental assessment. The likely significant environmental effects of the Project, including noise, air quality, landscape and visual, socio-economics and health, have been assessed and reported in this ES.

3.4.16 **Chapter 26: Summary of Likely Significant Effects [TR030008/APP/6.2]** summarises the outcomes of the EIA. The number of residual significant adverse effects is relatively limited in scale and local in nature and relates to:

a. Landscape character to the Site and its immediate setting during construction;

b. The views of recreational users of Bridleway 36 and the proposed England Coast Path at two viewpoints during construction and operation, and residential receptors at Queens Road at one viewpoint during construction;

c. The loss of residential properties on Queens Road;

d. The loss of part of the Long Strip woodland during construction;

e. In-combination effects to residential and commercial properties on Queens Road, Bridleway 36 and the proposed English Coast Path and the Long Strip woodland; and

f. Cumulative effects relating to landscape effects to the site and surrounds during construction, visual effects on three viewpoints at construction and two viewpoints at operation.

3.4.17 Importantly, the assessment also identifies that there are significant beneficial effects relating to a reduction in greenhouse gas emissions during operation,

employment creation and generation of gross value added, including cumulative benefits when considered in conjunction with other developments.

3.4.18 A number of temporary, short-term significant effects are reported during the construction stage in relation to noise and vibration, terrestrial ecology, traffic and transport and landscape and visual. These effects will be managed through controls set out in the Development Consent Order ("DCO") including the Construction Environmental Management Plan that will be based on the **Outline Construction Environmental Management Plan [TR030008/APP/6.5]** which accompanies the Application for development consent.

3.4.19 The Project also requires a Hazardous Substance Consent from North East Lincolnshire Council and will be regulated in accordance with the The Control of Major Accident Hazard ("COMAH") Regulations 2015 (Ref 3-14).

3.4.20 In terms of health and safety, **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** concludes that, although it is not possible to eliminate risks entirely, risks can be appropriately managed by a comprehensive safety and environmental protection programme implemented via engineering design, operational measures and management to achieve a level as low as reasonably practicable, as required by the COMAH Regulations (Ref 3-14). Therefore, the Project would comply with all relevant safety and environmental legislation for the management of risks on industrial facilities, from the design and construction phase, through operation and eventual decommissioning.

3.4.21 Control during operation will be via an Environmental Permit, which would only be granted by the Environment Agency when they are confident that the Project has been designed in accordance with Best Available Technology ("BAT").

Objective (e): To enhance both the local and regional economy through direct investment in and around the Port of Immingham and by partnering with the supply chain, provide opportunities for training, upskilling, apprenticeships and local employment.

3.4.22 The Project is anticipated to provide an average of 627 net jobs during the construction period, with the likely peak workforce anticipated to be 1,012 jobs during Phase 1 (792 landside jobs and 220 marine jobs). During operation, the total net employment is anticipated to be 207 jobs.

3.4.23 The gross value added (growth added through employment opportunities) during the construction period is £35m, of which over £24m is projected to remain in North East Lincolnshire.

3.4.24 Support for the generation of local employment opportunities has been evidenced during pre-application consultation and is considered further in the **Consultation Report [TR030008/APP/5.1]**.

3.4.25 Post consent, opportunities to partner with the supply chain, provide training and recruitment opportunities working with local organisations such as CATCH will be considered further to provide opportunities for skills and training in the local area.

3.5 Alternatives

3.5.1 This section has been prepared to address the requirements of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) ('the EIA Regulations') (Ref 3-9). These state at Regulation 14(2)(d) that the Environmental Statement should contain *"a description of the reasonable alternatives studied by the application, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment*". Paragraph 2 of Schedule 4 'Information for Inclusion in Environmental Statements' of the EIA Regulations requires inclusion of *"A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects"*.

3.5.2 Paragraph 4.9 of the NPSfP (Ref 3-1) sets out that whilst *"the relevance or otherwise to the decision-making process of the existence (or alleged existence) of alternatives to the proposed development is in the first instance a matter of law, detailed guidance on which falls outside the scope of this NPS".* Further, *"From a policy perspective this NPS does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option."*

3.5.3 It acknowledges however the above requirement to include in the ES factual information about the main alternatives which have been studied and notes that this should include "*an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility"* (paragraph 4.9.2 of the NPSfP) (Ref 3-1).

3.5.4 The NPSfP (Ref 3-1) also notes that, in some circumstances, there are specific legislative requirements, notably under the Habitats Directive (Ref 3-15), for the Applicant and decision-maker to consider alternatives and "*these should also be identified in the ES by the applicant*". In the case of this Project, as set out in the **Shadow Habitats Regulation Assessment ("HRA") [TR030008/APP/7.6],** it has been concluded that the Project has no adverse effect on the integrity of protected sites and therefore there is no reason to consider alternatives. However, a **Without Prejudice Shadow HRA Derogation Report [TR030008/APP/7.3]** has been submitted to address the possibility that the Secretary of State's Appropriate Assessment reaches a different conclusion.

3.5.5 This chapter of the ES and the **Without Prejudice Shadow HRA Derogation Report [TR030008/APP/7.3]** both consider alternatives; however, it should be noted that:

a. This chapter of the ES describes reasonable alternatives that have been studied by ABP and the main reasons for choosing the proposed development having regard to environmental impacts, in accordance with Regulation 14 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 3-9); and

b. The **Without Prejudice Shadow HRA Derogation Report [TR030008/APP/7.3]** goes further, demonstrating that there are no alternative solutions to the Project as proposed and, that there are imperative reasons of overriding public interest for the project to proceed and compensatory measures which shall be secured (if required).

3.5.6 The following sections of this Chapter therefore address the reasonable alternatives considered by the Applicant in relation to location of the Project and design evolution (by reference to size, scale, design and environmental effects of the Project). It also addresses the main reasons for selecting the Project by reference to those factors.

3.5.7 In order to ensure a robust assessment of the likely significant environmental effects of the Project, the EIA has been undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate. This involves assessing the maximum (or where relevant, minimum) parameters for the elements where flexibility needs to be retained (dimensions or operational modes for example). As such, this ES represents a reasonable worst-case assessment of the potential impacts of the Project at this current stage of design.

3.5.8 The consideration of alternatives and design evolution has been undertaken in the context of selecting the location of the Project with the aim of avoiding and/ or reducing adverse environmental effects where appropriate (following the mitigation hierarchy of avoid, reduce and, if possible, remedy), while maintaining operational efficiency and cost-effectiveness, and considering other relevant matters such as available land and planning policy.

3.5.9 The steps involved in the consideration of alternatives are as follows:

a. Step 1 – Consideration of the broad options, i.e., whether to build or not to build the Project in the Humber.

b. Step 2 – Consideration of other port locations around the Humber Estuary, concluding that the Port of Immingham is an appropriate place.

c. Step 3 – Consideration of the appropriate location for the Project within the Port of Immingham.

d. Step 4 – Design refinement, taking into account site constraints and the need to minimise harm to the extent appropriate.

3.5.10 Further detail in relation to these steps is set out below.

3.6 Step 1 - Consideration of the broad options

3.6.1 Step 1 of the assessment of alternatives considers the broad options, either to do nothing or to develop the Project outside of the Humber. The consideration of alternative technologies for hydrogen production is also considered.

Option 1 - Do nothing

3.6.2 If the Project were not constructed, the consequence would be that the need for the Project and the Project objectives would not be met. This would mean that the demand from the energy sector for port infrastructure to help meet the Government's net zero obligations and the decarbonisation of the Humber Estuary would not be met.

3.6.3 The do nothing alternative would also mean that a UK first of a kind Green Energy Terminal including facilities to enable production of green hydrogen from ammonia would not be developed, with the result that a key development to assist the UK in meeting its net zero target by 2050 would not be brought forward. For these reasons, the do-nothing scenario is not considered appropriate.

Option 2 – Development outside of the Humber

3.6.4 The development of the Project at a location outside of the Humber Estuary is not and cannot be an alternative solution to meeting the identified need, given that a primary objective for the Project is the provision of additional capacity within the Humber. Consequently, locating the facility outside the Humber would mean that the need and objectives which have been identified would not be met.

3.6.5 The NPSfP (Ref 3-1) sets out that '*suggested alternative proposals which mean the primary objectives of the application could not be achieved … can be excluded on the grounds that they are not important and relevant to the decision*' and therefore, the option to develop the Project outside of the Humber has been discounted.

Option 3 – Alternative technologies for hydrogen production

3.6.6 The need for a green hydrogen production facility was identified as an essential part of the Project at an early stage, to align with the Government's ambition to scale up low carbon hydrogen production during the 2020s, deliver 10GW of low carbon hydrogen by 2030 and to help decarbonise heavy industry and in particular the UK transport sector.

3.6.7 Large scale global deployment of refrigerated green ammonia is emerging as the safest and most efficient way to transport bulk quantities of green hydrogen from world locations where sustainable solar and wind energies are more available than in the UK. While transport of green hydrogen could be achieved in other ways, such as direct shipping of hydrogen, the transport risks, costs and scale achievable make alternative transport methods less viable.

3.6.8 Facilities to store ammonia and subsequently produce and temporarily store green hydrogen from the ammonia are therefore required. Whilst hydrogen can be produced using locally sourced renewable energy, this would require a greater number of new wind and solar farms to be constructed (whose operation is weather dependant and therefore more intermittent in the UK), with the associated land take. There would also be requirements for higher quality, potable water. The technology proposed is considered suitable in terms of its environmental impact, efficiency and the technical maturity of the technology.

3.6.9 Critically, however, the Project responds to a policy need for a range of hydrogen production facilities to come forward encompassing different technologies and therefore alternatives to the production of low carbon hydrogen from ammonia are not considered further.

3.6.10 The final decision has not yet been made on the detailed design of the hydrogen production facility. The proposed parameters for the Project reflect the necessary scale of the Project in terms of land requirements and heights following preliminary design and engineering work but incorporate a degree of flexibility in the dimensions and configurations of buildings and structures to facilitate the final detailed design.

3.7 Step 2 - Consideration of alternative port locations within the Humber Estuary

3.7.0 Step 2 of the assessment of alternatives identifies a list of potential locations which could potentially meet the Project objectives of providing port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone and to provide capacity to support the import and export of a range of liquid bulk energy products in the form of the additional berth capacity and landside storage and processing facility.

3.7.1 In identifying alternative locations, it is first necessary to understand the principal requirements for the Project to ensure that the identified need and objectives of the Project are met. As identified above, these are:

a. Suitable marine access;

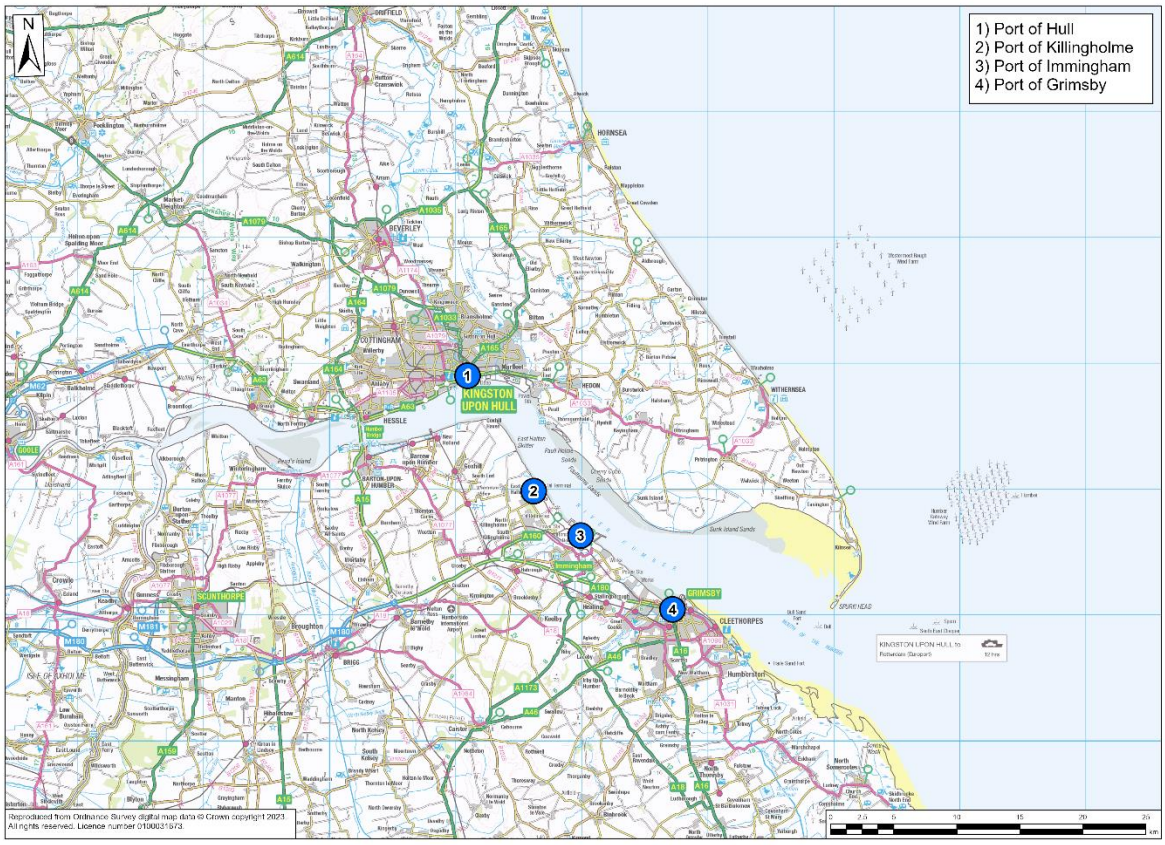
b. Suitable berth location and capability;

c. Available and suitable land for storage and processing capability; and

d. Suitable transport connections.

3.7.2 The Humber Estuary is centrally located on the eastern UK coastline and has the deepest water between the River Thames and the River Tees. **Plate 3-1** identifies the existing Port locations within the Humber Estuary which include the Port of Immingham, the Port of Hull and the Port of Grimsby and a smaller port at Killingholme.

Plate 3-1: Existing Port location within the Humber Estuary



Suitable marine access

3.7.3 As explained above, the new liquid bulk import and export capacity has to be in a location within the Humber Estuary where it can be accessed by the VLGC vessels typically used to import and export liquid bulks.

3.7.4 This means that the proposed jetty must be able to accommodate a maximum sized vessel with a length overall ("LOA") of approximately 250m, beam of 45m and a draught of 12.8m (referred to as the 'design vessel'). In addition, the facility needs to have capability to support smaller vessels, to provide flexibility.

3.7.5 When considering viable locations within the Humber Estuary, the starting premise from a marine accessibility point of view is prevailing water depths. The Humber is an estuary with a tidal range that varies from approximately 6m to 7m. It also has natural and stable deep-water channels which have largely dictated the locations where port facilities have been developed.

3.7.6 Having regard to the vessel design parameters, a berth pocket of around 14m below Chart Datum is required to keep these vessels afloat at low water. Movements would be restricted by tides, with the Humber's main fairways only navigable for deep sea shipping at high water periods – bearing in mind its 6/7m tidal range. Smaller merchant vessels with shallower drafts would cope better with the Humber's main channels at times other than high water, with coastal vessels accessing the ports of Immingham and Hull at all states of the tide. Given

the need for the Terminal to operate at all hours and receive a large number of vessel calls, this factor is important, particularly for CO_2 transfer operation.

3.7.7 A review of the bathymetry of the estuary demonstrates, as shown in **Figure 3.1 Water Depths of 7m Below Chart Datum [TR030008/APP/6.3]** that there are very few potential sites which meet this marine access requirement and affords sufficient navigability and manoeuvrability.

Suitable berth location and capability

3.7.8 None of the 'in dock' port areas along the Humber Estuary (located at the ports of Grimsby, Immingham Hull and Killingholme) would be able physically to accommodate the design vessel specified above. The lock entrances into these in dock areas are not big enough to accommodate such a vessel. On this basis, additional berth capacity able to accommodate the design vessel would need to be located at an 'in river' lock free location.

3.7.9 Furthermore, the water depths at all "in river" locations upriver from Immingham are not sufficiently deep to allow navigation of the design vessel at sufficiently large portions of the tidal cycle for operational flexibility, without a substantial programme of capital dredging.

3.7.10 A single berth able to accommodate the design vessel is required, but the berth should also accommodate smaller vessels for flexibility.

3.7.11 There is existing liquid bulks infrastructure at the Port of Immingham, but it is not suitable for the handling of bulk ammonia, in terms of equipment capability and compatibility with other products already handled. The existing infrastructure is also at capacity in regard to both throughput, berth availability and storage and is not necessarily available nor has the flexibility to be available at the times required for the ammonia process i.e. it cannot be relied upon to be available at the times needed by Air Products. In order to provide the berth availability, berth capacity and operational functionality required for ammonia import and CO_2 import/export, it is therefore necessary to develop new berth infrastructure within the Port of Immingham. The location and definitions of this new infrastructure within the Port of Immingham are discussed in Step 3 below.

Available and suitable land for storage and processing capability and suitability

3.7.12 As explained above, liquid bulk berth capacity has to be supported by landside connections and tankage located as close as possible to the berths to enable efficient and effective transfer and storage of the cargo. If the tankage is located too far from the berth and/or separated from other related operational areas by other uses, then it becomes increasingly complex and costly - and consequently less feasible - to transfer the cargo to the storage tank.

3.7.13 Sufficient land is also required for the construction of the hydrogen production plant in close proximity to the ammonia storage, to minimise transport of the product to the process infrastructure for reasons of safety.

3.7.14 Air Products has determined that the new berth would need to be supported by approximately 30 hectares of for land for storage, hydrogen production operations and administrative activities. That land must be in close proximity to the jetty.

3.7.15 In terms of the suitability of the landside area for storage and processing, both the tankage and process infrastructure are industrial in character and aesthetic and therefore should be located in an industrial environment. The Port of Immingham already has several developments of very similar nature within its boundaries and the area immediately around the port is home to similar large-scale oil refining, chemical manufacturing and power generation infrastructure.

Suitable transport connections

3.7.16 In order to facilitate the onward transport and distribution of green hydrogen to customers in the UK from this central location the Project needs to be in a location that benefits from good road access (suitable for HGVs) both in terms of local access (i.e. from the port facility to the strategic network) and strategic access (i.e. good accessibility on the strategic network between the port location and the source of destination).

Alternative port locations within the Humber Estuary

3.7.17 The following Port locations have been considered by ABP as potential alternative locations for the Project, against the principal requirements:

a. Port of Hull;

b. Port of Grimsby; and

c. Port of Killingholme.

3.7.18 Other locations within the Humber Estuary are not considered suitable due to:

a. the lack of suitable marine access - for example, providing a facility further upstream of the main Port of Hull complex for use by the type of vessels envisaged would require a very significant capital dredge within the Humber Estuary; and

b. the undeveloped nature of the location – where, in addition to any marine dredge requirements, it would be very challenging to create a new port facility with the necessary suitable landside facilities and connections.

3.7.19 Further analysis of the initial locations identified above against the requirements identified in the preceding paragraphs and environmental considerations has then been carried out. This analysis is reported in the following paragraphs.

3.7.20 For each of the locations identified, the provision of a potential solution to meeting the need would require the provision of new marine infrastructure and/ or dredging within the Humber European Marine Site (“EMS”) (consisting of the Humber Estuary Special Conservation Area (“SAC”), Special Protection Areas (“SPA”) and Ramsar site). As such, no distinction has been made in respect of the implications for the Humber EMS.

3.7.21 Only if more than one of the locations is deemed capable of providing an initial solution to meeting the need is it considered necessary to then look at this issue in further detail.

Port of Hull

3.7.22 The Port of Hull is owned and operated by ABP. The river frontage at the main port complex at Hull is located in a part of the Humber Estuary where consistent minimum water depths of 10m below chart datum are maintained (over high water periods), this is substantially less than the water depths required to allow navigation at most tidal states.

3.7.23 From a review of the current land use and activities within the Port, however, ABP consider that the only potential location for a new river frontage liquid bulk facility would be at the eastern end of the port estate close to Saltend Power Station. A substantial quantity of dredging would still be required to enable such marine infrastructure to operate and provide navigational access in water depths of around 14m (over high water) from downstream reaches of the Humber.

3.7.24 However, even if a marine facility of suitable scale could be developed in the location identified in an acceptable way, there is insufficient appropriately located land that is available or could be made available in and around the port estate to provide the necessary supporting landside facilities. The land immediately to the rear of the location identified is either in existing port use and subject to existing long term user agreements or is development land identified by ABP for use by other existing important port activities. The landside facilities need to be situated in close proximity to the jetty to minimise the length of pipework for the operations to be undertaken efficiently. Introducing longer sections of pipes increases operational demands and reduces efficiency.

3.7.25 A further issue is that, through its position on the north bank of the Humber, a facility at Hull is not as well located in terms of the relevant hinterland as, a facility on the south bank of the Humber. Air Products, whose specific requirements are a key aspect of the overall need identified, have confirmed to ABP that the Port of Hull, even if it were possible to provide what was physically required, does not represent a location able to satisfactorily meet its requirements as the depth of water is not sufficient and there is an absence of land necessary for the landside facilities.

3.7.26 Having regard to the requirements outlined earlier and the analysis undertaken, it has been concluded that the Port of Hull is not a suitable alternative as it would not be able to provide a solution to meeting the project need and objectives which have been identified.

Port of Grimsby

3.7.27 The Port of Grimsby, owned and operated by ABP, does not currently handle liquid bulk cargo, but is rather a facility that handles automotive cargo, is a major hub for the offshore wind industry and services the fishing and food industries.

3.7.28 The entrance into the commercial docks at Grimsby is located, via the existing Grimsby approach channel, a significant distance from that part of the Humber Estuary where consistent minimum water depths of 14m below chart datum are maintained. The approach channel to the Port of Grimsby is advertised at a depth of 2m below chart datum and, therefore, does not currently provide sufficient water depths to be able to accommodate the VLGC design vessel at any state of the tide. A significant deepening of some 8m (and therefore also widening) of this existing marine access channel would be required in order to provide the necessary marine access for the VLGC design vessel to access the river frontage at the Port of Grimsby at high water periods.

3.7.29 Although no detailed modelling or calculations have been undertaken, it is estimated that such deepening of the approach channel to the Port of Grimsby would alone require the removal in excess of 5 million cubic metres of material. Furthermore, once created a channel of such a depth and length would, as a result of the dynamic nature of the estuary in this location, be very difficult to maintain. Very frequent maintenance dredging of the channel would be necessary.

3.7.30 In addition to this fundamental issue, ABP does not consider that there is a suitable location along the river frontage at Grimsby where new marine infrastructure could be developed to provide the additional berth identified as the minimum requirement. Even if a suitable location could be found, further localised dredging would be required to enable such newly created river berths to be developed and to continue to operate.

3.7.31 The Port does have existing ‘in river’ berths, in the form of the Grimsby River Terminal that provides two main berths. These berths, however, still lie in insufficiently deep water and would require substantial capital dredging. They are also not, in their own right, sufficient to meet the amount of additional berthing considered to be required since these berths are already utilised by vessels that import trade cars and vehicles, which is a key trade for the Port of Grimsby.

3.7.32 Even if, however, these significant marine access constraints could be overcome there is insufficient appropriately located landside space available or able to be made available at the Port of Grimsby to support the required level of additional marine capacity identified as being required. The land that is potentially available is spaced out around the Port estate and is therefore not suitable for the development of marine infrastructure nor for the hydrogen production facility, due to the insufficient size and discrete nature of the land parcels, and their close proximity to commercial and residential property. Available land is not, therefore, sufficient to meet the need which has been identified.

3.7.33 Having regard to the requirements outlined earlier and the analysis undertaken, the Port of Grimsby would not be able to provide a solution to meet the need and objectives which have been identified.

Port of Killingholme

3.7.34 The Port of Killingholme, operated by CLdN Ports Killingholme, is an existing established facility with six berths that handles both Ro-Ro freight cargo (both accompanied and unaccompanied cargo) as well as trade vehicle imports.

3.7.35 From available information, it is understood that five of the six available berths at the Port of Killingholme are currently heavily used, and that one berth that is currently unused is within the fabric of the active Ro-Ro terminal and is wholly unsuitable for use by VLGC-type vessels.

3.7.36 Even if, however, these significant marine access constraints could be overcome there is insufficient appropriately located landside space available or able to be made available at the Port of Killingholme to support the required level of additional marine capacity identified as being required. The land that is potentially available is spaced out around the Port estate and is therefore not suitable for the development of marine infrastructure nor for the hydrogen production facility due to the dispersed nature of the potentially available land. Available land is not, therefore, sufficient to meet the need which has been identified.

3.7.37 In addition to the above matters, large parts of the Port of Killingholme form part of the site on which there is an existing Development Consent Order approval for a thermal generating station Nationally Significant Infrastructure Project – the North Killingholme Power Project. This project was approved in 2014 with non-material amendments subsequently approved in 2021. Commencement of the development is required to have begun by 2 October 2026.

3.7.38 As well as the above DCO consent, a 28-hectare area of the south / south-western part of the facility (including areas which overlap with the above DCO consent) and adjacent land benefit from planning permission granted in November 2021 for the construction of an additional vehicle storage area and associated on-site infrastructure (North Lincolnshire Council planning application reference PA/2020/1483).

3.7.39 Furthermore, as set out in Appendix D of the **Planning Statement [TR030008/APP/7.1]**, there are other Nationally Significant Infrastructure Projects in the vicinity of the Port of Killingholme, including the already consented Able Marine Park and the Humber Low Carbon Pipelines NSIP which is due to be submitted to the Planning Inspectorate in Q3 2023. As such, there are limited opportunities for development within close proximity of the Port of Killingholme.

3.7.40 For the reasons summarised it is not considered able to provide a solution to the specific, immediate and pressing need and objectives which have been identified.

Step 2 Conclusions

3.7.41 From the analysis carried out, which is summarised in the preceding paragraphs, the conclusion reached by ABP is that the only potential solution to meeting the Project need and objectives is the provision of a new multi-user green energy terminal at the Port of Immingham.

3.8 Step 3 - Consideration of the Project location at the Port of Immingham

3.8.1 Step 3 of the assessment of the alternatives considers the location of the jetty and associated landside infrastructure at the Port of Immingham. This has taken into account the Project objectives that relate to making effective use of available land, water, transport and utility connections in and around the Port of Immingham.

Location of the jetty at the Port of Immingham

3.8.2 Development within the current operational boundaries of the Port of Immingham is heavily constrained by existing infrastructure, including on the marine side by existing jetties and on the landside by both operational buildings and structures and an extensive network of pipelines and other services, both above and below ground.

3.8.3 There is no spare capacity on the existing deep-water jetties at the Port of Immingham to facilitate the import and export of additional liquid bulk cargoes and therefore a new jetty is required.

3.8.4 Placing new marine infrastructure significantly further to the east of the Port of Immingham, for example, much further to the east of the Immingham Oil Terminal, would not be feasible. The distance to the deep water channel is greater, meaning that the provision of any marine infrastructure would require either a longer jetty approach to reach the deeper water (which would increase Project cost and technical complexity, and present challenges relating to navigation and associated operations of adjacent facilities), or a large capital dredging programme in order to berth vessels closer to the shoreline (which would have adverse environmental and economic consequences) and also have adverse effects on operations of adjacent facilities.

3.8.5 Furthermore, river frontage areas to the west of the Immingham Oil Terminal are heavily developed. There is a proposal to develop this area as a new Ro-Ro facility, known as the Immingham Eastern Ro-Ro Terminal. Unlike a liquid bulk operation, a Ro-Ro facility has to be able to operate to a timetable, and therefore needs marine accessibility at all states of the tide. Deep sea access is therefore required so that the shallower drafted Ro-Ro vessels can still access their berths over low water periods just as easily as they can over high water periods. Therefore, this area is not available.

3.8.6 It is therefore necessary to locate the new jetty outside the existing operational Port, but as close to it as possible to benefit from the existing deep water approach channels, supporting infrastructure and port services, and also in a location with sufficient land to support the establishment of a new pipeline corridor and storage and production facilities.

3.8.7 The preferred jetty location lies to the east of the Port (to the immediate east of the Immingham Oil Terminal Jetty), since this is the only location that provides sufficient space for navigation and manoeuvring of the design vessels without severe impact on the adjacent facilities, and also provides adequate connection to sufficient landside area for development of the hydrogen production facility. In addition, the chosen location places the jetty outside the widest intertidal areas, reduces the capital dredge for the berth and should minimise the requirements for ongoing maintenance dredging.

3.8.8 The proposed jetty location, just to the east of the existing boundary of the Port, is therefore considered to be the most suitable for the Project, given the need to reach the deep-water channel.

3.8.9 Whilst the location provides suitable land for the hydrogen production facility as explained below, it also benefits from allocated land for future expansion.

Location of the hydrogen production facility at the Port of Immingham

3.8.10 Having identified the location of the jetty, a suitable location for the ammonia storage and hydrogen production facility was considered taking into account available space proximate to the jetty, the Port's existing development plans, ground conditions, presence of existing structures and services including existing transport corridors and proximity to residential conurbations.

3.8.11 The East Site and the West Site were selected as suitable for the following reasons:

a. They are predominantly brownfield sites suitable and available for the hydrogen production facility including land for terrestrial pipelines to connect to the pipelines on the jetty trestle;

b. The West Site is allocated for employment use in the North East Lincolnshire Local Plan;

c. They are close to the jetty to minimise onshore transport distances for ammonia, for safety reasons and to minimise heat leak;

d. There is a limited residential population in the vicinity;

e. Ground conditions are suitable for installation of process plant; and

f. There is local access to existing gas and grid connections and HGV access to the strategic road network.

3.9 Step 4 – Design Refinement

3.9.1 Step 4 of the assessment of alternatives sets out the design refinements that have been undertaken to minimise adverse impacts on the environment.

3.9.2 It is highlighted in paragraph 4.10.3 of the NPSfP (Ref 3-1) that, given the importance which the Planning Act 2008 (Ref 3-10) places on good design and sustainability, *"the decision maker needs to be satisfied that port infrastructure developments are sustainably designed and, having regard to regulatory and other constraints, are as attractive, durable and adaptable … as they can be"*. The design of the Project has been informed by relevant standards and guidelines for port infrastructure to ensure they are fit for purpose. Chapter 7 of

the **Planning Statement [TR030008/APP/7.1]** identifies where opportunities have been taken to incorporate sustainable design features into the Project.

3.9.3 The design of the Project has evolved in response to feedback from statutory consultation and the EIA. The following paragraphs set out the design refinements considered in respect of the Project.

Consideration of alternative jetty layouts

3.9.4 The jetty design has been informed through iteration and has evolved over the design stage of the Project. Initial designs identified that there was an underlying basic arrangement of the jetty which would be incorporated across all options; the requirement for a 1.1 to 1.2km approach jetty that crosses the southern shore of the Humber to a jetty head situated in, or adjacent to the natural deep water channel of the Humber Estuary. The use of the adjacent Immingham Oil Terminal for access was also considered however discounted due to the required design life of the Project.

3.9.5 The consideration of options therefore focused on the variations to the jetty head and presented a number of layouts as part of a longlist. The alternative designs were driven by the potential flexibility of the berth to accommodate future users, including a variety of vessel sizes, the number and spacing of berths, safety exclusion zones and clearance from adjacent facilities. At the time of long listing options a number of assumptions were adopted based on uncertainties over proposed design, e.g. required exclusion zones, future vessels and “ship fit[4]” requirements on a single berth.

3.9.6 Preliminary Navigation Simulation (“NavSim”) was undertaken to shortlist three of these options. This assessed each option in terms of vessel interaction with the jetty head, tidal flow, safety, and the operation of the layout with other maritime traffic. The requirement for capital and maintenance dredging was also considered at the longlist stage, considering both the environmental and economic effects of different dredge requirements. No major navigation hinderances to any option development was reported from the NavSim models.

3.9.7 With the location of the jetty head confirmed there was a review of the jetty approach within the envelope of the works area (Work No. 1). Various options were considered for the approach jetty, with respect to alignment, pile size and diameter and deck span. Alternative approach jetty designs have been tested, with estuarine flow modelling undertaken to assess the direct and indirect loss of intertidal habitats. This was used to identify the approach jetty parameters that would result in the smallest environmental impact on the European Marine Site.

Consideration of layout of hydrogen production facility

3.9.8 A primary consideration for the layout of the facility is the construction of the ammonia storage tank as close as possible to the jetty (and so as to facilitate as

[4] Ship fit studies relate to the assessment of the berth infrastructure and appurtenant equipment to ensure its disposition and arrangement is safe, suitable and robust for the proposed operations for the given range of vessels to be accommodated, under the design conditions determined"

direct a pipeline connection as possible) and an appropriate distance from non-industrial, including in particular residential, land uses.

3.9.9 Whilst the assessment of the Project is based on parameters to allow for design refinement and finalisation, detailed consideration has been given to the potential layout of the hydrogen production facility to ensure that it is deliverable within those parameters and will be functional and efficient from an engineering perspective. The work undertaken has ensured that the land required for the facility has been minimised so far as possible.

3.9.10 The relationship of the proposed layout of the facility and surrounding land uses and buildings and the storage and use of hazardous substances within the facility has been carefully considered and modelled (as described in **Chapter 22: Major Accidents and Hazards [TR030008/APP/6.2]**) in determining that a suitable layout can be provided within the proposed parameters.

Consideration of alternative locations for the jetty access road, pipe-rack and electrical control building

3.9.11 The jetty access road and pipe-rack are located together in a corridor through and adjacent to the Long Strip woodland, the boundary of which is defined by the extent of Work No. 2 as shown on the **Works Plans [TR030008/APP/4.2]**. The electrical control building is also located within Work No. 2 as well as a reserve corridor for pipelines in relation to future cargoes to connect to the public highway at Laporte Road.

3.9.12 The jetty access road provides vehicular and pedestrian access from Laporte Road to the jetty structure, including security facilities to enable adherence to the International Ship and Port Facility ("ISPS") Code[5]. The start and end points are fixed by the jetty structure and Laporte Road. The pipe-rack supports pipelines and utilities, linking the jetty structure with the refrigerated ammonia storage tank and therefore also has fixed start and end points. Furthermore, the length of the pipe-rack has been kept to a minimum and as straight as possible for efficiency and safety requirements. The electrical control building has an operations function and houses electrical equipment as well as welfare facilities and is needed close to the jetty access road alignment to service the utilities associated with the jetty. An initial location was identified near the sea wall although given the presence of a veteran tree, a more suitable location was identified within the area of overlap between Work Nos. 2 and 5.

3.9.13 Due to the presence of the Long Strip woodland between Laporte Road and the jetty structure, alternative designs were considered in order to minimise tree loss.

3.9.14 At the preliminary environmental information stage, it was reported that the pipe-rack and jetty access road would lead to the loss of a large part of the Long Strip woodland. Since this stage, the design has been informed by a detailed tree assessment, set out in **Appendix 8.F Arboricultural Impact Assessment [TR030008/APP/6.4].** The tree survey concludes that the highest value tree in

[5] The ISPS Code is a comprehensive set of measures designed to strengthen the security of ships and port facilities, as stated in Ship Security guidance provided by the Maritime and Coastguard Agency, first published in October 2012 and last updated in June 2021.

the Long Strip Woodland is located in the north east corner of the woodland close to the sea wall (a veteran ash tree), with high and moderate quality trees distributed throughout the remainder of the woodland.

3.9.15 Through the design development a number of alternative designs for the jetty access road have been reviewed. Road alignments placed outside of the Long Strip woodland both to the east and west have been considered. The options reviewed vary in terms of the alignment of the road in respect of the Long Strip woodland, implications for land ownership and environmental impact. It should be noted that all options reviewed would require some diversion or culverting of existing watercourses and therefore this was not a defining factor in the selection of the preferred design.

3.9.16 An option to place the road entirely to the west of the Long Strip woodland on a combination of APT leased land (forming part of the Immingham Oil Terminal) and Air Products' land would not be viable due to operational, security and safety reasons. The Immingham Oil Terminal is essential to the operations of the Humber Refinery and the Lindsey Oil Refinery. The Humber Refinery is a nationally significant piece of infrastructure, providing 11% of UK road fuel demand and 20% of all UK demand for petroleum products. Any material impairment to the operation of the Immingham Oil Terminal would therefore not be in the public interest. In this context, there is an existing firewater pond on APT land which would likely conflict with an access road in this location. The firewater pond would therefore need to be modified to accommodate both the construction and operation of the jetty access ramp, which would impact on operations at the Immingham Oil Terminal. The tenant also requires the land, where the road would need to be located for existing emergency access purposes.

3.9.17 A jetty access road to the west of Long Strip woodland would also require a longer jetty approach trestle which would have a greater impact on the intertidal zone than the preferred design that has been taken forward. Whilst this option would not result in tree loss within Long Strip woodland nor impact on Public Rights of Way, these reasons together were considered sufficient to discount this option.

3.9.18 An option to place the road to the east of Long Strip on third party (Tronox) land also has a number of constraints. Again, this would require a longer jetty approach trestle which would have a greater impact on the intertidal zone than the preferred design that has been taken forward. A jetty alignment in this location would also likely pass over two existing Anglian Water outfalls located in the intertidal zone which would need to be relocated. This relocation would lead to further impact on the intertidal zone during the construction process.

3.9.19 Other constraints with an option to the east include the presence of the veteran ash tree which may be impacted by the design and impacts on the Public Right of Way. Where the Public Right of Way would be impacted it would either need to be wholly relocated to the east of the access road, or, diverted at a high level across the jetty access road (and pipe racks). Both options could have potential safety and security issues relating to the need to restrict public access to the Project site when operational. The former option would also mean there would be no public access to, or enjoyment of the Long Strip Woodland.

3.9.20 A crossing through the woodland would still be required with this option to access the East Site. This would result in tree loss within the Long Strip woodland and the severance of the woodland with potential impacts on biodiversity caused by habitat fragmentation. The existing emergency pedestrian access from the APT site would also need to be diverted. Owing to the constraints of the other options reviewed, ABP then focussed on how options that ran through its own land could minimise tree loss in the Long Strip woodland. In light of this, two options were reviewed, one option that went straight through the Long Strip woodland wholly on ABP's land and an alternative option that utilised both ABP's land and land within East Site to reduce the loss of trees in the Long Strip woodland. The latter would initially pass through the western section of the Long Strip woodland on ABP's land before diverting to the west, outside of the Long Strip woodland onto the East Site. This option would not require the diversion of any part of the Public Right of Way and would continue to allow public access to the woodland; the other option that runs straight through the woodland would require a small diversion of the Public Right of Way on the approach to the junction with Laporte Road to avoid a clash with the alignment. Neither option would lead to severance of the Long Strip woodland. Both options would require the diversion of the existing APT emergency pedestrian access.

3.9.21 As there are more constraints associated with an alignment that runs straight through the Long Strip Woodland, the option that would result in the loss of fewer trees, avoiding the veteran ash tree and less impact on the Public Right of Way was taken forward and now forms part of this application for development consent.

3.10 The Sequential Test

3.10.1 Consideration of the sequential test is set out in the **Planning Statement [TR030008/APP/7.1]** which concludes that the appropriate area of search can only be the Humber in order to meet the Project objectives. The appropriate location for the Project within the Humber has been ascertained to be the Port of Immingham.

3.10.2 Only two sites of a suitable size have been identified that are at a lower risk from flooding than the Site - Immingham landfill site and land at the operational Port of Immingham. Although these sites are at a lower risk from flooding, they are in use and not available. The land within the Port is already developed and in active employment/port-related uses. The development of the Immingham landfill site for a hydrogen production plant would prevent the restoration of the waste site following cessation of its use contrary to the approved planning permission. Furthermore, it would not be possible to redevelop this site for a hydrogen production plant for several reasons:

a. The landfill generates ground gas and is therefore incompatible with piling, foundations and excavations;

b. The ground is not level, is uncompacted and unsuitable for civil foundations;

c. The landfill site is likely contaminated; and

d. Taking any material offsite defeats the original purpose of the landfill.

3.10.3 For these reasons, there are no other sites available or suitable for the Project that are a lower risk of flooding.

3.11 Summary and Conclusion

3.11.1 There is an imperative and urgent need for the Project to provide port infrastructure for the import and export of liquid bulk energy products in the Humber to support the transition to net zero and the decarbonisation of the Humber industrial cluster, and other locations.

3.11.2 The need for the Project is established by the NPSfP (Ref 3-1), which explains that it is for port operators and developers such as ABP to bring forward infrastructure in response to market demand, providing additional capacity, competition and resilience in the sector and delivering wider economic benefits in the public interest.

3.11.3 In particular, there is a national need for port infrastructure to support the energy sector in producing clean energy, specifically hydrogen production and CCS, in order to meet the aims of the Government's decarbonisation strategy and 2050 net zero obligations. The Humber industrial cluster emits more CO_2 than any other industrial cluster in the country and therefore decarbonising this region is essential to achieve net zero. The Project also helps to improve Britain's energy security and supports the Levelling Up agenda.

3.11.4 The Project is an appropriate solution to meet the need for new port infrastructure and landside facilities at the Humber. The Port of Immingham is considered to be the only appropriate site for the development of a Green Energy Terminal on the Humber, given its location and access to deep water. The layout of the Project has sought to minimise adverse effects and make effective use of appropriately designated available land.

3.12 References

Ref 3-1 Department for Transport (2012). The National Policy Statement for Ports.

Ref 3-2 North East Lincolnshire Council (2018). North East Lincolnshire Local Plan.

Ref 3-3 Department for Business, Energy & Industrial Strategy (2020) Energy White Paper: Powering our net zero future

Ref 3-4 Department for Business, Energy & Industrial Strategy (2022) UK Hydrogen Strategy

Ref 3-5 Department of Energy & Climate Change (2011). Overarching National Policy Statement for Energy (EN-1)

Ref 3-6 Department for Business, Energy & Industrial Strategy (2022) British energy security strategy

Ref 3-7 Department for Levelling Up, Housing and Communities (2022) Levelling Up the United Kingdom

Ref 3-8 Department for Business, Energy & Industrial Strategy (2020) The ten point plan for a green industrial revolution

Ref 3-9 The Stationery Office Limited (2017). The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Ref 3-10 The Stationery Office Limited (2008). Planning Act 2008.

Ref 3-11 Department for Energy Security and Net Zero (2023). Draft Overarching National Policy Statement for Energy (EN-1).

Ref 3-12 Department for Energy Security and Net Zero (2023). Powering Up Britain: Energy Security Plan.

Ref 3-13 Department for Energy Security and Net Zero and Department for Business, Energy and Industrial Strategy (2021). Net Zero Strategy: Build Back Greener.

Ref 3-14 The Stationery Office Limited (2015). The Control of Major Accident Hazard (COMAH) Regulations 2015.

Ref 3-15 The European Union (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora