

The Keadby Next Generation Power Station Project

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The Keadby Next Generation Power Station Development Consent Order [year]

Land at, and in the vicinity of, the existing Keadby Power Station (Trentside, Keadby, Scunthorpe DN17 3EF)

Outline Lighting Strategy

The Planning Act 2008

The Infrastructure Planning (Environmental Information Assessment) Regulations 2017

Applicant: Keadby Next Generation Limited

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Glossary

Abbreviation	Description
BS	British Standard - business standards based upon the principles of standardisation recognised inter alia in European Policy.
CAA	Civil Aviation Authority - responsible for the regulation of aviation safety in the UK.
CCGT	Combined Cycle Gas Turbine - a highly efficient form of energy generation technology. An assembly of heat engines work in tandem using the same source of heat to convert it into mechanical energy which drives electrical generators and consequently generates electricity.
CCP	Carbon Capture Plant – plant used to capture carbon dioxide (CO ₂) emissions produced from the use of fossil fuels in electricity generation and industrial processes.
CEMP	Construction Environmental Management Plan – a plan to outline how a construction project will avoid, minimise or mitigate effects on the environment and surrounding area.
CIBSE	The Chartered Institute of Building Services Engineers - an international association within the building services industry.
DCO	Development Consent Order - made by the relevant Secretary of State pursuant to The Planning Act 2008 to authorise a Nationally Significant Infrastructure Project. A DCO can incorporate or remove the need for a range of consents which would otherwise be required for a development. A DCO can also include rights of compulsory acquisition.
ES	Environmental Statement – A report in which the process and results of an Environment Impact Assessment are documented.

Abbreviation	Description
ILP	The Institute of Lighting Professionals – a professional body for lighting for the built environment.
MW	Megawatt - unit of power.
NLC	North Lincolnshire Council
NPPF	National Planning Policy Framework - the NPPF is part of the Government's reform of the planning system intended to make it less complex, to protect the environment and to promote sustainable growth. It does not contain any specific policies on Nationally Significant Infrastructure Projects but its policies may be taken into account in decisions on DCOs if the Secretary of State considers them to be both important and relevant.
NPS	National Policy Statement - Statement produced by Government under the Planning Act 2008 providing the policy framework for Nationally Significant Infrastructure Projects. They include the Government's view of the need for and objectives for the development of Nationally Significant Infrastructure Projects in a particular sector such as energy and are used to determine applications for such development.
NSIP	Nationally Significant Infrastructure Project – defined by the Planning Act 2008 and cover projects relating to energy (including generating stations, electric lines and pipelines); transport (including trunk roads and motorways, airports, harbour facilities, railways and rail freight interchanges); water (dams and reservoirs, and the transfer of water resources); waste water treatment plants and hazardous waste facilities. These projects are only defined as nationally significant if they satisfy a statutory threshold in terms of their scale or effect.
SLL	Society of Light and Lighting - an authority on lighting.
SoS	Secretary of State - title typically held by Cabinet Ministers in charge of Government Departments.

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Executive Summary

1. This Outline Lighting Strategy (**Application Document Ref. 5.11**) has been prepared by AECOM on behalf of Keadby Next Generation Limited ('the Applicant') which is a subsidiary of SSE plc. It forms part of the application for a Development Consent Order (DCO) ('the Application'), that has been submitted to the Secretary of State (SoS) for Energy Security and Net Zero under Section 37 of 'The Planning Act 2008'.
2. The strategy document discusses the type and level of lighting requirements and expected application areas for construction and operational phases of the proposed development.
3. Sections within the document set out specific considerations for the application of lighting in these areas. Please note:
 - Section 2 introduces the Outline Lighting Strategy via an overview of the Proposed Development, the Applicant, the technology behind the Proposed Development, high level overview of the area and the DCO Order limits.
 - Section 3 provides an overview of the legislation and policy on light pollution, including that found within National Policy Statements and the National Planning Policy Framework. International and national guidance available on limiting light pollution are also explored. A summary of the relevant technical and environmental lighting documents that are used to inform lighting design and mitigation strategies is also provided.
 - Section 4 provides an overview of the lighting principles, together with the technical and environmental requirements that should be used for managing construction phase lighting as well as when developing the detailed design. Impact avoidance measures and design recommendations are explored.
 - Section 5 outlines the current baseline situation in terms of lighting character and identification of receptors sensitive to light near the Proposed Development Site and surrounding area, including residential, ecological and transport.
 - Section 6 discusses the expected performance outcome for construction and operational phases based on the Outline Lighting Strategy and in summary it is concluded that the Outline Lighting Strategy provides an appropriate outline of the lighting requirements and identifies measures which will be employed as required to support

adequate control of obtrusive light through detailed design of the lighting scheme.

- A summary of references for documents informing this strategy and indicative performance assessment has been provided.

1. Introduction

1.1. Overview

- 1.1.1. This Outline Lighting Strategy (**Application Document Ref. 5.11**) has been prepared by AECOM on behalf of Keadby Next Generation Limited ('the Applicant') which is a subsidiary of SSE plc. It forms part of the application for a Development Consent Order (DCO) ('the Application'), that has been submitted to the Secretary of State (the 'SoS') for Energy Security and Net Zero under Section 37 of 'The Planning Act 2008' ('the 2008 Act').
- 1.1.2. The Applicant is seeking development consent for the construction, operation and maintenance of a new combined cycle gas turbine ('CCGT') electricity generating station on land at, and in the vicinity of, the existing Keadby Power Station, Trentside, Keadby, Scunthorpe DN17 3EF ('the Site').
- 1.1.3. The Keadby Next Generation Power Station ('the Proposed Development') is a new CCGT electricity generating station with a capacity of up to 910MW electrical output. The CCGT electricity generating station will be designed to run on 100% hydrogen and able to run on 100% natural gas or a blend of natural gas and hydrogen and will be located on land to the west of Keadby 1 and Keadby 2 Power Stations. The Proposed Development includes connections for cooling water, electricity, hydrogen and natural gas, and construction laydown areas and other associated development. It is described in full in **Environmental Statement (ES) Volume I Chapter 4: The Proposed Development (Application Document Ref. 6.2)**.
- 1.1.4. The Proposed Development falls within the definition of a 'Nationally Significant Infrastructure Project' under Section 14(1)(a) and Sections 15(1) and (2) of the 2008 Act, as it is an onshore generating station in England that would have a generating capacity greater than 50MW electrical output (50MWe). As such, a DCO application is required to

authorise the Proposed Development in accordance with Section 31 of the 2008 Act.

- 1.1.5. The DCO, if made by the SoS, would be known as 'The Keadby Next Generation Power Station Order' ('the Order').

1.2. The Applicant

- 1.2.1. The Applicant is a subsidiary of the FTSE-listed SSE plc, one of the UK's largest and broadest-based energy companies, and the country's leading developer of renewable energy. Over the last 20 years, the SSE Group has invested over £20 billion to deliver industry-leading offshore wind, onshore wind, CCGT, energy from waste, biomass, battery energy storage, energy networks and gas storage projects. Related SSE companies own and operate the adjacent Keadby 1 and 2 Power Stations and have the benefit of the DCO for Keadby 3 CCS Power Station (herein referred to as the 'Keadby CCS Power Station').
- 1.2.2. The Proposed Development is being developed with Equinor, one of the country's leading energy providers, supplying natural gas, oil and electricity. Equinor is developing multiple low-carbon hydrogen and carbon capture projects in the Humber, working towards transforming the UK's most carbon intensive industrial cluster into a net zero region.
- 1.2.3. SSE Renewables Limited operates Keadby Windfarm, which lies to the north and south of the Site and generates renewable electricity from 34 turbines, with a total installed generation capacity of 68MW.
- 1.2.4. SSE plc has set out a clear commitment to investment in low carbon power infrastructure, working with government and other stakeholders to create a Net Zero power system by 2040. This includes investment in flexible sources of electricity generation and storage for times of low renewable output which will complement other renewable generating sources, either using low carbon fuels and/ or capturing and storing carbon emissions.
- 1.2.5. The design of the Proposed Development demonstrates this commitment and the Proposed Development will be built with a clear route to decarbonisation, consistent with SSE's Net Zero Acceleration Programme Plus and net zero transition plan which committed to the development and

progression of new low carbon flexible power including hydrogen-fuelled generation

1.3. The Proposed Development

1.3.1. The Proposed Development would comprise a high efficiency gas fired power station with an electrical output capacity of up to 910MWe and associated buildings, structures and plant and other associated development defined in Schedule 1 of the **Draft DCO (Application Document Ref. 3.1)** as Work Nos. 1-11 and shown on the **Works Plans (Application Document Ref. 2.3)**.

1.3.2. The Proposed Development will include:

- a new-build CCGT electricity generating station fuelled by hydrogen and/or natural gas with a power output of up to 910MW (**Work No. 1**) including:
 - a CCGT plant;
 - cooling infrastructure;
 - natural gas and hydrogen blending equipment;
 - supporting facilities including administration and control buildings, workshops, storage buildings, effluent treatment facilities, fire water storage tank(s), demineralised water treatment plant including storage tank(s), and permanent laydown areas for operation and maintenance activities;
- a hydrogen supply pipeline, including a gas compound for the hydrogen supplier's apparatus and a hydrogen gas compound for the Applicant's apparatus (**Work No. 2**);
- a natural gas supply pipeline including a compound for the natural gas supplier's apparatus and a natural gas compound for the Applicant's apparatus (**Work No. 3**);
- electrical connection works for the export and import of electricity to and from the generating station and the existing 400kV National Grid Electricity Transmission (NGET) substation located adjacent to the Keadby Power Station site, including works within the substation (which would be undertaken by NGET) (**Work No. 4**);
- water supply connection works to provide cooling and make-up water to the generating station, including intake structures and an underground and/or overground water supply pipeline running between the generating station and the Stainforth and Keadby Canal (**Work No. 5**);

- connections to and use of an existing outfall and associated pipework for the discharge of used cooling water, surface water and treated effluent to the River Trent (**Work No. 6**);
- public water connection pipeline from a new connection on Chapel Lane to provide potable water to the generating station (**Work No. 7**);
- new permanent access to the generating station (**Work No. 8**), comprising:
 - maintenance and improvement of an existing private access road from the A18, including replacement of a private bridge (Mabey Bridge) (**Work No. 8A**);
 - installation of layby and gatehouse with barriers, enclosures, drainage and lighting north of the A18 junction (**Work No. 8B**) and associated utilities connections (**Work No. 8C**); and
 - emergency access route comprising the maintenance and improvement of an existing private track running between the generating station and Chapel Lane and including new private bridge crossing over Glew Drain (**Work No. 8D**);
- temporary construction and laydown areas (**Work No. 9A**);
- maintenance and improvement of the existing access routes running between the A18 and construction laydown areas (**Work No. 9B**); and between Skew Bridge adjacent to the A18 and a temporary construction laydown area associated with Mabey Bridge replacement (**Work No. 9C**);
- retention, maintenance and improvement and subsequent removal of existing temporary haul route from the Waterborne Transport Offloading Facility (**Work No. 9D**) and the inspection and repair of the existing jetty, and temporary placement of mobile cranes including the temporary oversailing of crane arms (**Work No. 9E**); and
- landscaping and biodiversity enhancement measures (**Work No. 10**);
- an allocation of land to meet the requirements of the Carbon Capture Readiness (Electricity Generating Stations) Regulations 2013 (**Work No. 11**).

1.3.3. The Applicant will be responsible for the construction, operation (including maintenance) and eventual decommissioning of the Proposed

Development including the on-site connections to electricity, cooling water, hydrogen and natural gas supplies.

- 1.3.4. The Proposed Development will be capable of operating 24 hours per day, 7 days per week with programmed offline periods for maintenance.
- 1.3.5. Further detail on the components of the Proposed Development is provided in **ES Volume I Chapter 4: The Proposed Development (Application Document Ref. 6.2)**. The areas within which each numbered Work (component) of the Proposed Development are to be built are defined by the coloured and hatched areas on the **Works Plans (Application Document Ref. 2.3)**.
- 1.3.6. The locations of the elements of the Proposed Development described above within the Site are shown in **ES Volume III Figure 3.3: Indicative Parts of the Site Plan (Application Document Ref. 6.4)** and an Indicative Layout Plan is included as **ES Volume III Figure 4.1 (Application Document Ref. 6.4)**.

1.4. The Proposed Development Site

- 1.4.1. The Site (which equates to the 'Order Limits') is located within and adjacent to the boundary of the existing Keadby Power Station site near Scunthorpe, Lincolnshire and falls within the administrative area of North Lincolnshire Council ('NLC') (the 'Site'). The Keadby Power Station site currently encompasses the operational Keadby 1 and Keadby 2 Power Stations. The location of the Site, which is approximately centred on national grid reference (NGR) 481961, 412101.
- 1.4.2. The Site encompasses an area of approximately 77.1 hectares (ha), of which approximately 26.7 ha of land is proposed for construction laydown.
- 1.4.3. The proposal includes multiple land uses, with the different areas described in turn below and shown on **ES Volume III Figure 3.3 Indicative Parts of the Site Plan (Application Document Ref. 6.4)**. These terms have been used to describe land use zones within the Site.
- 1.4.4. The Site is divided into the following areas of permanent and temporary land use (the proposed use is described in more detail in **ES Volume I Chapter 3: Site and Surrounding Area (Application Document Ref. 6.2)**):
 - Main Site;
 - Ancillary Facilities;
 - Water Connections;

- Electricity Connections;
- Waterborne Transport Off-loading Area;
- Construction Laydown Areas;
- Access routes (emergency, permanent and construction);
- Connections to Keadby 1 and Keadby 2 power stations; and
- Additional areas for landscaping and biodiversity provision.

1.5. The DCO Process

- 1.5.1. The Proposed Development falls within the definition of a ‘nationally significant infrastructure project’ (NSIP) under Section 14(1)(a) and 15(2) of the 2008 Act as a ‘generating station exceeding 50 MW’.
- 1.5.2. As a NSIP project, the Applicant is required to seek a DCO to construct and operate the generating station, under Section 31 of the 2008 Act. Section 37 of the 2008 Act also governs the form, content and accompanying documents that are required as part of a DCO application. The requirements are implemented through the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) (‘APFP Regulations’) which state that an application must be accompanied by an ES, where a development is considered to be ‘EIA development’ under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) (as amended).
- 1.5.3. An application for development consent for the Proposed Development has been submitted to PINS acting on behalf of the Secretary of State. Subject to the application being accepted, PINS will then examine it and make a recommendation to the Secretary of State, who will then decide whether to grant a DCO. The acceptance, examination, recommendation and decision stages are subject to fixed timescales and the decision is therefore anticipated to fall in 2026.
- 1.5.4. A DCO, if granted, has the effect of providing planning consent for a development, in addition to a range of other consents and authorisations where specified within the Order.

1.6. The Purpose and Structure of this Document

- 1.6.1. The Proposed Development will require the installation of a number of luminaires to provide visual comfort, safety and operational performance,

which in turn will have the potential to result in obtrusive light at receptor locations.

- 1.6.2. At the time of submission of the Application, the engineering, procurement and construction contractor has not yet been appointed and detailed design work for the Proposed Development has not yet been carried out. Therefore, detailed information on the lighting to be used at the Proposed Development is not yet available. Nevertheless, it is recognised that to prevent potential nuisance from lighting, the Application should set out general proposals as to the purposes, types and levels of lighting required, to allow an appropriate level of control to be secured within the DCO.
- 1.6.3. This Outline Lighting Strategy (the 'Strategy') sets out the approach to the design and management of lighting during the construction and operation of the Proposed Development. It aims to balance safety, functionality, and environmental considerations while mitigating potential impacts on the surrounding environment.
- 1.6.4. The Strategy has been prepared with consideration of technical and environmental requirements. Environmental requirements focus on limiting the effects of 'obtrusive light' and technical requirements advise the overarching operational lighting requirements.
- 1.6.5. The aims of the Strategy are to:
- Identify the requirements of relevant guidance and standards;
 - Identify design principles that will guide the detailed design of the Proposed Development;
 - Provide an overview of the existing conditions within the Order limits
 - Identify relevant light sensitive receptors; and
 - Provided technical and environmental recommendations for lighting during construction and operation of the Proposed Development.
- 1.6.6. The Outline Lighting Strategy is structured as followed:
- Section 3 outlines information on pertinent standards and guidance relating to obtrusive lighting and lighting design;
 - Section 4 sets out a description of the design principles and site lighting requirements for construction and operational phase works, together with a summary of proposed measures to avoid obtrusive light impacts;
 - Section 5 presents an overview of the type and location of the light sensitive receptors in relation to the Proposed Development; and
 - Section 6 provides a summary and conclusions.

2. Standards and Guidance

2.1. Legislative Background

- 2.1.1. Light pollution was first defined in law within the Clean Neighbourhoods and Environment Act (CNEA) 2005 (HM Government, 2005) as a form of statutory nuisance under the Environmental Protection Act 1990 (the 'EPA') (HM Government, 1990) which was amended in 2006 to include the following nuisance definition:

“artificial light emitted from premises so as to be prejudicial to health or nuisance”

- 2.1.2. Although the CNEA describes light as having the potential to cause statutory nuisance, no prescriptive limits or rules were set for impact assessment purposes. Guidance notes for the Reduction of Obtrusive Light produced by the Institute of Lighting Professionals have, therefore, been referred to for the purposes of this assessment.
- 2.1.3. Guidance produced on Section 101 to Section 103 of the CNEA places a duty on local authorities to ensure that their areas are checked periodically for existing and potential sources of statutory nuisances – including nuisances arising from artificial lighting.
- 2.1.4. Local authorities must take reasonable steps to investigate complaints of such nuisances from artificial light. Once satisfied that a statutory nuisance exists or may occur or reoccur, local authorities must issue an abatement notice (in accordance with Section 80(2) of the EPA 1990), requiring that the nuisance cease or be abated within a set timescale.
- 2.1.5. It is a requirement of the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations') (HM Government 2017) that plans, and projects are subject to an Appropriate Assessment if it is likely that they will lead to significant adverse effects on a Natura 2000 site (the collective name for European designated sites).

2.2. Planning Policy Context

National Policy Statements

- 2.2.1. The Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy Security and Net Zero (DESNZ), 2024) advises:

“During the construction, operation and decommissioning of energy infrastructure there is potential for the release of a range of emissions such as... artificial light All have the potential to have a detrimental impact on amenity or cause a common law nuisance or statutory nuisance under Part III, Environmental Protection Act 1990. However, they are not regulated by the environmental permitting regime, so mitigation of these impacts will need to be included in the Development Consent Order.”

- 2.2.2. The NPS also states:

“The applicant should assess the potential for...artificial light to have a detrimental impact on amenity, as part of the Environmental Statement. In particular, the assessment provided by the applicant should describe:

- a) the type, quantity and timing of emissions;*
- b) aspects of the development which may give rise to emissions;*
- c) premises or locations that may be affected by the emissions;*
- d) effects of the emission on identified premises or locations; and*
- e) measures to be employed in preventing or mitigating the emissions.”*

- 2.2.3. The NPS also notes that:

“The Secretary of State should satisfy itself that:

- a) an assessment of the potential for artificial light...to have a detrimental impact on amenity has been carried out; and*
- b) that all reasonable steps have been taken, and will be taken, to minimise any such detrimental impacts.”*

- 2.2.4. This Construction Lighting Strategy for the Proposed Development considers the lighting requirements with reference to relevant standards and guidance, and measures to avoid adverse effects on sensitive receptors, as required by NPS EN-1.

National Planning Policy Framework

- 2.2.5. The National Planning Policy Framework (‘NPPF’) was originally published March 2012 and replaced with the current framework in December 2024

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(MHCLG, 2012). This details the Government's planning policies for England and how these are expected to be applied. Paragraph 191 (c) states:

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site and wider area impacts that could arise from the development. In doing so they should: ...

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”

2.3. International Guidance

- 2.3.1. The Commission Internationale De L'Eclairage (CIE) 150: Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations (the 'CIE 150') (CIE, 2017) refers to the potentially adverse effects of exterior lighting on both natural and man-made environments. The purpose of CIE 150 is to aid in formulating guidelines for assessing the environmental effects of exterior lighting and to provide limits for relevant lighting parameters to control the obtrusive effects of exterior lighting to tolerable levels.
- 2.3.2. CIE 126: Guidelines for Minimising Sky Glow (CIE, 1997) gives general guidance for lighting designers and policy makers on the reduction of sky glow. The report gives recommendations about maximum permissible values for exterior lighting installations. These values are regarded as limiting values. Lighting designers should strive to meet the lowest criteria for the design. Practical implementation of the general guidance is left to national regulations.

2.4. National Guidance

- 2.4.1. The Institution of Lighting Professionals (ILP) Guidance Notes propose lighting guidance and criteria for local authorities with a recommendation that these are incorporated at the local plan level. The ILP Guidance Notes define various forms of light pollution and describe a series of environmental zones. The ILP Guidance Notes provide suitable criteria against which the effects of artificial lighting can be assessed. This assessment has been based upon these criteria.
- 2.4.2. The ILP also provides guidance on lighting and effects on bat species within Guidance Note 08 (ILP, 2023) which is intended to raise awareness

of the impacts of artificial lighting on bats and provides potential solutions to avoid and reduce this harm.

- 2.4.3. The Chartered Institution of Building Services Engineers (CIBSE) Society for Light and Lighting (SLL) provide further guidance in terms of the standard of road lighting used and population density within their guidance document Guide to Limiting Obtrusive Light (SLL, 2012). This provides a more qualitative common-sense consideration for the interpretation of the character of illuminated areas.

[The Society of Light and Lighting](#)

The Society of Light and Lighting Handbook

- 2.4.4. Aimed at lighting practitioners, specifiers and students of lighting, the 'Lighting Handbook' (SLL, 2018) summarises the fundamentals of light and vision, the technology of lighting and guidance on a wide range of applications, both interior and exterior. It is intended to act as a link between the SLL 'Code for Lighting' (2022) and the SLL Lighting Guides such as 'Limiting obtrusive light' (SLL, 2021). The Handbook also includes a chapter dedicated to exterior workplace lighting (Chapter 24) which expands on criteria set out in the previous BS EN and has been referred to in the preparation of this Strategy.
- 2.4.5. It is noted that the SLL Code for Lighting (SLL, 2022) has since been updated and replaces the 2012 revision of the document, and the SLL Limiting obstructive light guide has been superseded by Lighting Guide 21: 'Protecting the night-time environment' (SLL, 2021). Please note that superseded guidance is not explored in detail and the current versions of these documents are set out below.

The Society of Light and Lighting Code for Lighting

- 2.4.6. The SLL Code for Lighting (2022) provides information on three areas of lighting practice and complements the SLL Lighting Handbook. This includes:
- a summary of the effects of lighting on task performance, behaviour, safety, perception, health, and its financial and environmental costs;
 - a compendium of lighting recommendations relevant to the UK; and
 - detailed descriptions of the calculations required for quantitative lighting design.

- 2.4.7. The lighting requirements for workplaces as set out in the SLL Code are very much aligned with those as set out in BS EN 12464-2 (BSI 2024) and so are not expanded on in this section.

The Society of Light and Lighting - Lighting Guide 21

- 2.4.8. The SLL Lighting Guide 21 (SLL, 2021) outlines the causes and consequences of obtrusive light and discusses how good design can minimize obtrusive effects to improve conditions for people as well as the wider nocturnal environment. It's address of the harmful effects of outdoor lighting at night are divided into three categories:

- sky glow;
- light intrusion / light spill (nuisance effects); and
- glare.

2.5. British Standards

- 2.5.1. The British Standards Institute (BSI) provides published standards and guidance for most lighting tasks, adherence to which will help mitigate obtrusive lighting aspects. These are referred to in establishing the expected lighting requirements for the Proposed Development during construction and operational phases.

- 2.5.2. The following sets out the relevant extracts of standards and guidance expected to be used when developing the detailed exterior lighting design for the Proposed Development.

- BS EN 12464-2 'Light and lighting – Lighting of workplaces. Part 2: Outdoor work places'
 - BS EN 12464-2 (BSI, 2024) specifies lighting requirements for outdoor work places, which meet the needs for visual comfort and performance. Requirements set out within BS EN 12464-2 will provide the minimum lighting requirements for Health & Safety unless more rigorous design parameters have been established to support operational requirements.

2.6. Aviation Lighting Requirements

[Civil Aviation Authority \(CAA\) Policy Statement 'Lighting of En-Route Obstacles and Onshore Wind Turbines' \(CAP 764\)](#)

- 2.6.1. The CAA Policy Statement (2010) provides an overview of the more generic need for aviation warning lighting on 'tall structures' and onshore wind turbines as set out at Article 219 of the UK Air Navigation Order 2009

(superseded by Article 222 within UK Air Navigation Order 2016, with further amendments 2017) (HM Government, 2016). The CAA Policy Statement clarifies, 'Notwithstanding the Article 219 (now Article 222 within UK Air Navigation Order 2016) requirements, some structures of a height of less than 150 metres might need aviation warning lights'.

- 2.6.2. Whilst structures of such heights are not routinely lit for civil aviation purposes, it is possible that aviation stakeholders, including the CAA, may make a case for aviation warning lighting where a structure is considered, by virtue of its location and nature, a significant navigational hazard.
- 2.6.3. Article 223 of the Air Navigation Order also provides advice linked to permissions for obstacle lighting and confirms that proposals for additional or alternative lighting arrangements will need to be approved by the CAA. It is not anticipated that an alternative approach would be required to be included as part of the Outline Lighting Strategy.

[The Air Navigation Order 2016 \(HM Government, 2016\)](#)

- 2.6.4. Article 222 of the Air Navigation Order sets out the requirements for the lighting of en-route obstacles and is reproduced below:
 - “(1) The person in charge of an en-route obstacle must ensure that it is fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle and at intermediate levels spaced so far as practicable equally between the top lights and ground level with an interval of not more than 52 metres.*
 - (2) The person in charge of an en-route obstacle must, subject to paragraph (3), ensure that by night the lights required to be fitted by this article are displayed.*
 - (3) In the event of the failure of any light which is required by this article to be displayed by night the person in charge must repair or replace the light as soon as reasonably practicable.*
 - (4) At each level on the obstacle where lights are required to be fitted, sufficient lights must be fitted and arranged so as to show when displayed in all directions.*
 - (5) In any particular case the CAA may direct that an en-route obstacle must be fitted with and must display such additional lights in such positions and at such times as it may specify.*
 - (6) A permission may be granted for the purposes of this article for a particular case or class of cases or generally.*

(7) This article does not apply to any en-route obstacle for which the CAA has granted a permission to the person in charge permitting that person not to fit and display lights in accordance with this article.

(8) In this article, an “en-route obstacle” means any building, structure or erection, the height of which is 150 metres or more above ground level, but it does not include a building, structure or erection:

(a) which is in the vicinity of a national licensed aerodrome or an EASA certificated aerodrome; and

(b) to which section 47 of the Civil Aviation Act 1982 (warning of presence of obstructions near licensed aerodromes) applies.”

2.6.5. Article 224 of the Air Navigation Order sets out the restrictions on lights liable to endanger and is reproduced below:

“(1) A person must not exhibit in the United Kingdom any light which:

(a) by reason of its glare is liable to endanger aircraft taking off from or landing at an aerodrome; or landing at an aerodrome; or

(b) by reason of its liability to be mistaken for an aeronautical ground light is liable to endanger aircraft.

(2) If any light which appears to the CAA to be a light described in paragraph (1) is exhibited, the CAA may direct the person who is the occupier of the place where the light is exhibited or who has charge of the light, to take such steps within reasonable time as are specified in the direction:

(a) to extinguish or screen the light; and

(b) to prevent in the future, the exhibition of any other light which may similarly endanger aircraft.

(3) The direction may be served either personally or by post, or by affixing it in some conspicuous place near to the light to which it relates.

(4) In the case of a light which is or may be visible from any waters within the area of a general lighthouse authority, the power of the CAA under this article must not be exercised except with the consent of that authority’

Article 225 of the Air Navigation Order sets out restrictions on lights which dazzle or distract and states that ‘a person must not in the United Kingdom direct or shine any light at any aircraft in flight so as to dazzle or distract the pilot of the aircraft.”

[CAP 393: Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016](#)

- 2.6.6. CAP 393 (CAA, 2016) provides an overview of various regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016. This will be considered within the detailed design of the Proposed Development Site lighting.

[CAP 1096: Guidance to Crane Operators on Crane Notification Process and obstacle Lighting and Marking](#)

- 2.6.7. CAP 1096 (CAA, 2021) provides guidance on the requirements for aviation warning lighting to cranes and sets out the potential requirement for crane activity to be notified to the aviation community which the Proposed Development will follow.
- 2.6.8. As the details of aviation lighting requirements are set out in legislation and CAA guidance and will be secured by a requirement of the **Draft DCO (Application Document Ref. 3.1)** as necessary, aviation lighting is not discussed further in this Outline Lighting Strategy.

3. Design Principles and Impact Avoidance Measures

3.1. General Design Principles

- 3.1.1. In accordance with the relevant legislation, standards and guidance noted in Sections above, the main overarching lighting design principles for the Proposed Development are:
- to ensure the health and safety of employees and visitors performing normal working duties;
 - to ensure the safe movement of vehicular and pedestrian traffic around the Proposed Development Site and access roads during the hours of darkness;
 - to minimise light pollution in terms of light trespass, sky glow and glare to the identified sensitive receptors; and
 - to ensure the security of the Proposed Development Site and its occupants including lighting suitable for the correct functioning of the preferred CCTV system (if necessary).
- 3.1.2. The overarching philosophy underpinning the design of the lighting for the Proposed Development is to have the minimal amount of lighting required to be provided on Site. Lighting will be restricted to focussed point use where reasonably practicable. Permanent lighting will be for general pedestrian movement, safety and security purposes only. Any lighting that may be required for maintenance purposes will be produced by temporary lighting sets, specific to the required task. Lighting shall be further reduced to only critical lighting from 23:00 to 05:00 hours to reduce the impact of obtrusive lighting on the local environment (i.e. 23:00 hrs as per recommendation from the ILP GN01/21 and 05:00 hrs as per the usual recommendation from local authorities and the MHCLG (2024)).
- 3.1.3. Lighting will be designed so as not to illuminate existing light sensitive receptors including habitats adjacent to the Proposed Development Site, residential properties and other development types which may be sensitive to a change in lighting condition.
- 3.1.4. Lighting required during the construction and operation stages of the Proposed Development will be designed to reduce unnecessary light spill

outside of the Proposed Development Site boundary, in addition to managing glare and sky glow.

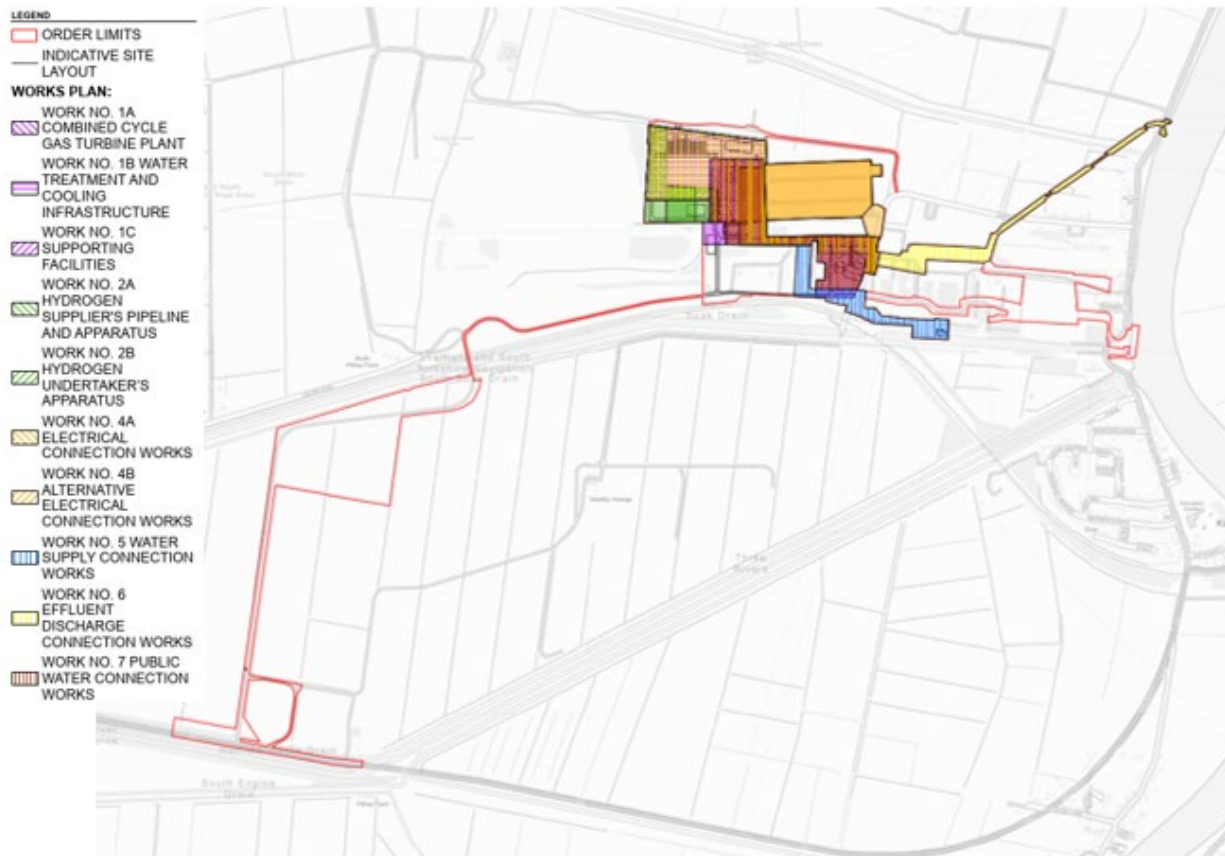
- 3.1.5. External operational lighting has potential to affect bats where it coincides with their foraging and commuting habitats. This Outline Lighting Strategy outlines recommendations from BS EN 12464-2 and the ILP GN08 which will be followed to minimise the impact of lighting adjacent habitats. Such recommendations include:
- the types of lighting to minimise upwards spread of light;
 - the mounting heights and angles to minimise obtrusive glare; and
 - guidance on light limitations for different environments.
- 3.1.6. All luminaires will have the necessary optical control and be appropriately aimed to minimise direct upward light emission. The lighting design will utilise LED lanterns which provide safety (reduced maintenance) and environmental advantages (more control than conventional light sources). Advantages of LED luminaires are:
- low power consumption and long and predictable lifetime;
 - high colour rendering;
 - quick turn on and off;
 - reduced energy consumption (cost saving); and
 - reduced carbon footprint.
- 3.1.7. The luminaires chosen will, wherever practicable, have no light emitted above the horizontal to ensure the lighting is well controlled and will not directly contribute to any sky glow or cause light pollution/ obtrusive light.
- 3.1.8. Luminaires shall also be positioned and aimed so that peak light intensities from any fitting do not unintentionally illuminate any building or structural façade.
- 3.1.9. If overhead lines are present in the vicinity of any proposed lighting, lighting columns will be hinged to be lowered for maintenance purposes.
- 3.1.10. The following design principles will be followed:
- adopting a lighting control strategy that turns lights off or dims as necessary for site safety and security;
 - using photocells as a primary means of control to prevent light from being used when sufficient daylight is available;

- where possible, adopting LED luminaires to control obtrusive light due to their high directionality and accordingly the achievable ratio of useful light to spill light;
- lighting will be designed not to affect aviation activity and where required the Proposed Development will include aviation warning lighting;
- careful consideration of placement of lighting column and luminaire positioning;
- adopting luminaires with minimal upward lighting ratio and full cut-off, where possible;
- not tilting luminaires to have uplift above the horizontal, if this is not possible add shielding, hoods baffles, louvres as necessary to ensure potential upward light is controlled;
- optimising column heights to allow for sufficient light coverage and minimal tilt of luminaires;
- minimising building mounted luminaire heights;
- adopting lamps with similar correlated colour temperatures;
- using lamps with a limited UV spectrum in locations which might affect ecological receptors;
- using shields and baffles to luminaires;
- lighting the site boundaries with low power periphery lighting with an asymmetric forward optic having good back-light cut-off characteristics; and
- directing luminaires away from ecologically sensitive receptors.

3.2. Site Lighting Requirements during Construction

- 3.2.1. A variety of construction activities would be required across the Proposed Development to support on-site security, and health and safety requirements, in addition to undertaking specific tasks safely, efficiently and accurately, and providing for a secure site when insufficient daylight is available.
- 3.2.2. Plate 1 and Plate 2 provides an overview of the Site boundary where construction activities will take place and identifies areas that will be developed during construction phase for operational use in addition to areas that will be used during the construction phase. The areas shown are detailed further in the **Work Plans (Application Document Ref. 2.3)**.
- 3.2.3. **ES Volume III Figure 3.3:** Indicative Parts of the Site Plan (**Application Document Ref. 3.3**) provides an indicative layout of the Site and advises

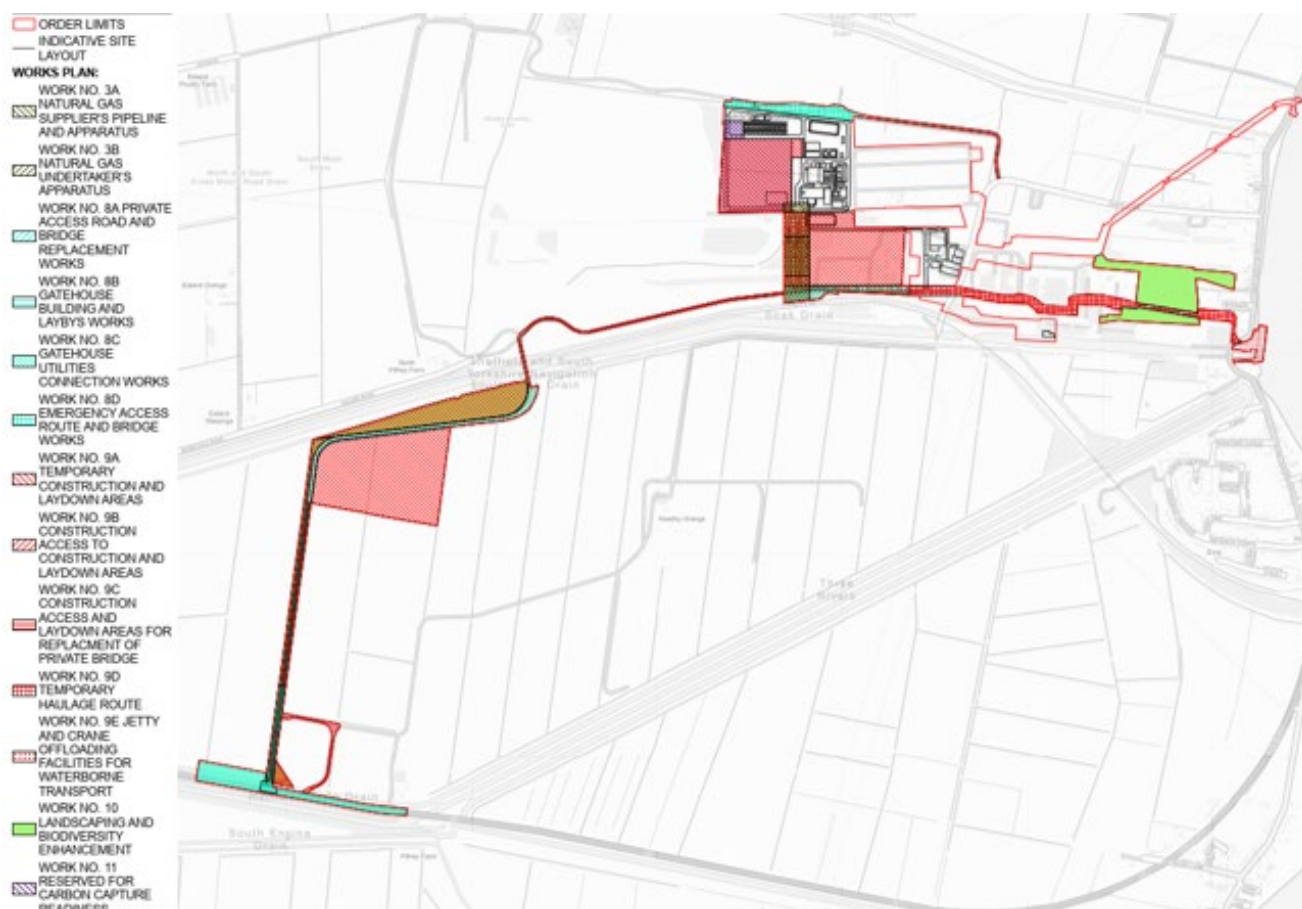
which areas will be developed as part of the proposals and which will be used during the construction phase only



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Plate 1 Works No. 1 to 7 Extracted from Sheet 1 of Works Plans (Application Document Ref. 2.3)

- 3.2.4. A number of areas shown in **Plate 1** are unlikely to require a permanent lighting installation during operation, such as the utility connection works (i.e. Work No. 4 to Work No. 7). If lighting is required in those areas during the construction then mobile task lighting is expected to be required to support the works.



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Plate 2: Works No. 8 to 11 Extracted from Sheet 2 of Works Plans (Application Document Ref. 2.3)

- 3.2.5. Temporary construction site lighting will be required as part of on-site security and health and safety requirements. The associated potential obtrusive light effects towards surrounding receptors would be minimised through the controlled application of lighting in accordance with current best practice. It is anticipated that the key temporary lighting sources during the construction phase will be the following:
- general floodlighting and security lighting associated with meeting health & safety and security requirements in temporary parking areas;
 - security and health & safety lighting associated with specific on-going working areas, where equipment is stored, and safety hazards may be present; and
 - lighting required for operational purposes associated with any construction work around and after sunset or prior to sunrise in winter months.
- 3.2.6. Where hazard warning, screening, lighting and signage are needed, the approach taken would be comparable to the recently constructed intake structure for Keadby 2 Power Station, and engagement with the CRT would be undertaken to provide up-to-date information on activities planned along the Canal as was undertaken for Keadby 2 Power Station.
- 3.2.7. The following stipulations shall be followed with regards to the extent of lighting within the Proposed Development:
- the external lighting installation will adhere to good lighting design practice; and
 - measures will be implemented to minimise the potential for obtrusive glare, upward light spill and light trespass.
- 3.2.8. Lighting would be designed to minimise light disturbance on adjacent sensitive ecological areas including the former Keadby Ash Tip and Stainforth and Keadby Canal, by directing light onto working areas so as to avoid illuminating these features, as far as reasonably practicable.
- 3.2.9. Artificial site lighting can result in obtrusive light if poorly controlled. However, when careful consideration is given to the type, location and aiming of construction lighting, its impact can be considerably reduced.
- 3.2.10. It is the intention that the construction temporary site artificial lighting will only be required at times of darkness during the construction phase. Some

night-time construction work may be required, and lighting during normal working hours will be necessary during winter months.

- 3.2.11. Critical operation infrastructure will be lit to ensure critical maintenance can occur at any time of day.
- 3.2.12. The level of lighting within the works and laydown areas would be sufficient to allow the safe movement of pedestrians and vehicles (using their headlights) in areas that they might reasonably be expected to negotiate at night. It is not intended to facilitate planned or unplanned maintenance activities for which additional localised portable equipment would be required. The lighting in this area to be group switched so the lighting is operated only when required.
- 3.2.13. At the detailed design stage, a computational light modelling exercise is to be undertaken. This will demonstrate that the Site will be adequately lit and allow obtrusive light to be suitably controlled, in accordance with this Strategy.
- 3.2.14. While a primarily daylight schedule is assumed for construction phase works, it is recognised that some activities may take place outside of these core working hours, during hours of darkness. This may include scheduled work in winter months or emergency works taking place at night after standard working hours.
- 3.2.15. Schemes for all external lighting, for both construction and operation are proposed to be secured by a Requirement of the **Draft DCO (Application Document Ref. 3.1)**. These details will be in general accordance with the Outline Lighting Strategy.
- 3.2.16. The lighting strategy for the Site during construction is given in the form of a lighting requirements specification set out in for various relevant construction tasks. Table 1 and Table 2 set out requirements for typical construction activities.

Table 1: General Requirements for Areas and Cleaning of Outdoor Workplaces (Table 7, BS EN 12464-2)

Ref. no.	Type of area, task or activity	E_m lx		U_o	R_{GL}	R_a	Specific requirements
		required ^a	modified ^b				
7.1	Walkways exclusively for pedestrians	5	—	0,20	50	70	
7.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	—	0,40	50	70	
7.3	Regular vehicle traffic (max. 40 km/h)	20	—	0,20	45	70	At shipyards and in docks, R_{GL} may be 50.
7.4	Mixed traffic areas, vehicle turning, stationary loading and unloading points	50	—	0,40	50	70	When the area is non-occupied E_m required may be reduced to 5 lx. Pay attention to the illuminance levels of the surrounding and adjacent areas.
7.5	Cleaning and servicing	50	—	0,25	50	70	At all relevant surfaces
7.6	Recycling centers - areas with rubbish bins and sorting of waste	30	—	0,25	50	70	
^a Required: minimum value.							
^b Modified: considers common context modifiers in 5.3.3.							

Table 2: Building Sites (Table 13, BS EN 12464-2)

Ref. no.	Type of area, task or activity	E_m lx		U_o	R_{GL}	R_a	Specific requirements
		required ^a	modified ^b				
13.1	Clearance, excavation and loading	20	30	0,25	55	70	
13.2	Construction areas, drain pipes mounting, transport, auxiliary and storage tasks	50	75	0,40	50	70	
13.3	Framework element mounting, light reinforcement work, wooden mould and framework mounting, electric piping and cabling	100	150	0,40	45	70	
13.4	Element jointing, demanding electrical, machine and pipe mountings	200	300	0,50	45	70	Can be met with use of local mobile lighting.
^a Required: minimum value.							
^b Modified: considers common context modifiers in 5.3.3.							

3.3. Site Lighting Requirements during Operation

- 3.3.1. A variety of operational activities would be required for key locations across the Order limits to support on-site security, and health and safety requirements, in addition to undertaking specific tasks safely, efficiently and accurately, and providing for a secure site when insufficient daylight is available.
- 3.3.2. **Plate 3** provides an overview of the operational areas that may require lighting associated with Work No. 8A (Private Access Road) and 8B (Gatehouse and Layby). These are expected to be limited to the gatehouse and the layby area, and also the northern end of the access track. It is not expected that there will be a need to illuminate any other parts of the access track.

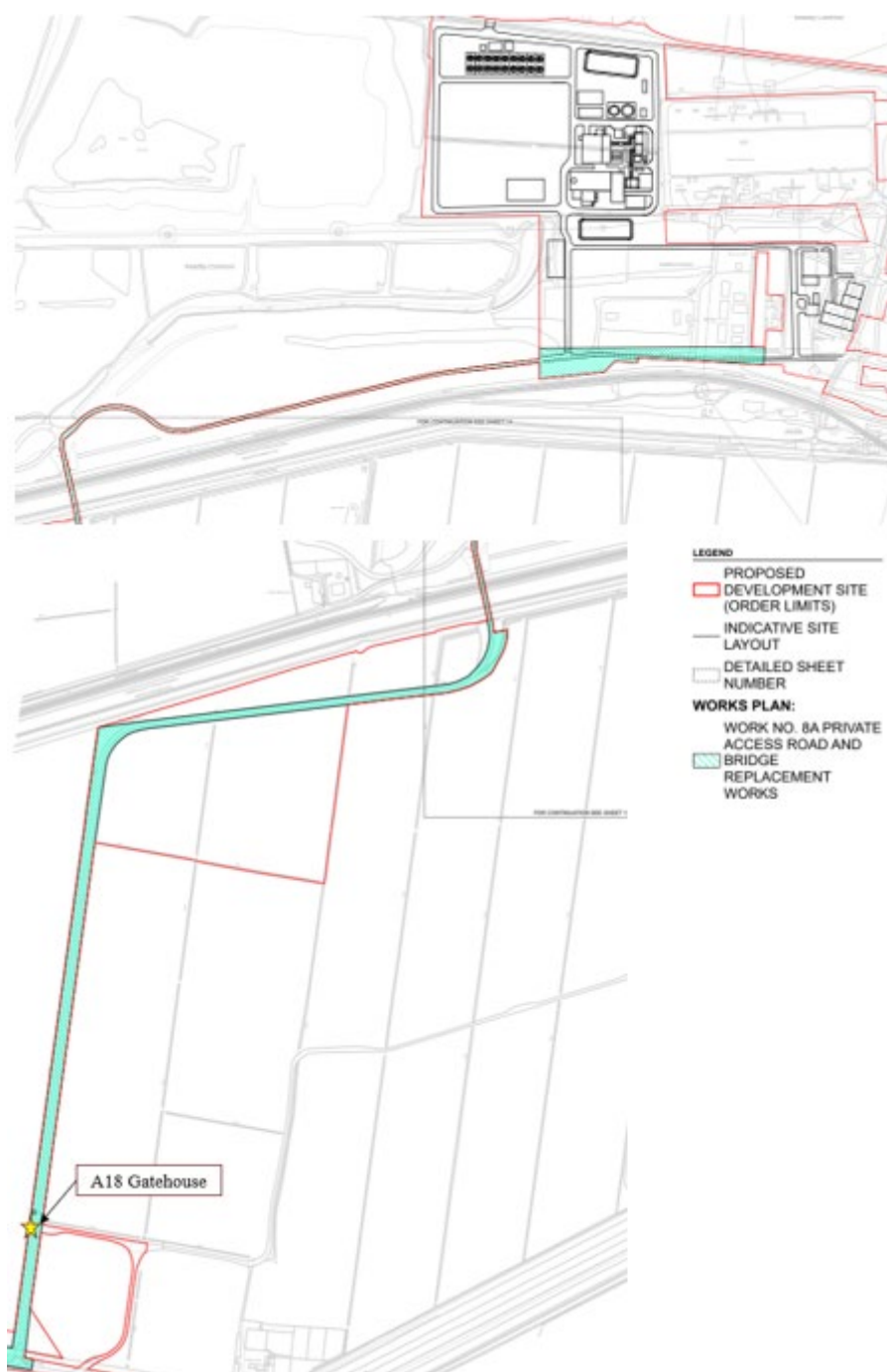


Plate 3: Operational Access (Work No. 8B). (Extracted from Works Plans (Application Document Ref. Figure 2.3))

- 3.3.3. **Plate 4** provides an overview of areas of the Main Site and Ancillary Facilities that may require operational lighting which are associated with Work No.1A (CCGT), 3A (National Grid NG Compound), 3B (Undertaker (SSE) NG Compound), and 11 (Reserved Area for CCP).

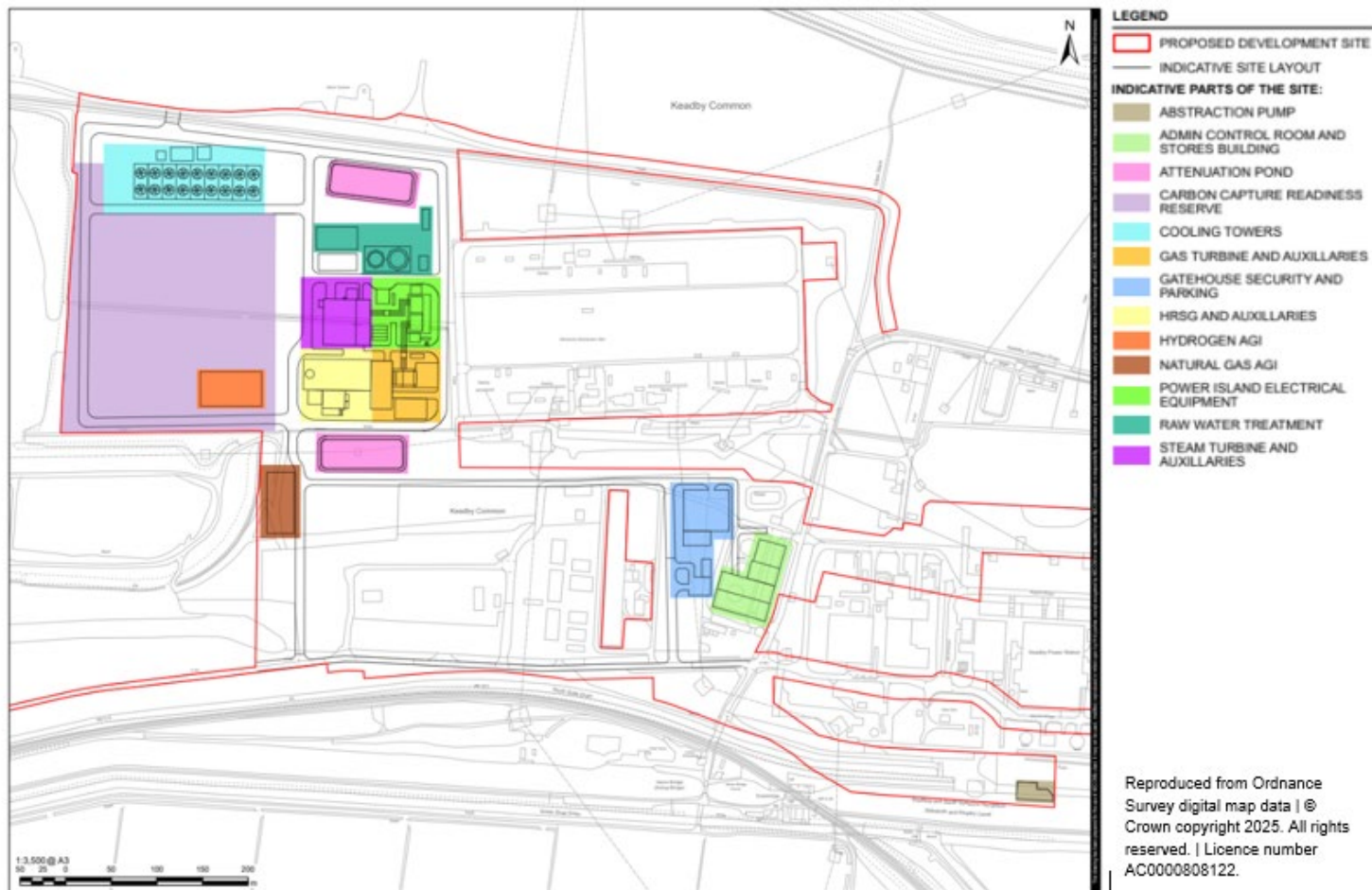


Plate 4: Operational Works Areas Associated with the Main Site and Ancillary Facilities (Work Nos. 1A, 3A, 3B, and 11) Extracted from ES Volume III Figure 4.1(Application Document Ref. 6.4)

- 3.3.4. As with construction lighting requirements, operational lighting is needed to support safe site access and egress, in addition to undertaking specific tasks safely, efficiently and accurately when insufficient daylight is available.
- 3.3.5. **Table 3** sets out key luminaire typologies that are likely to be used in operational areas depicted in Plate 4 - Plate 6 for the identified areas. Please note that crossing elements identified in Plate 6 will need to be considered in developing the Haul Road lighting design.
- 3.3.6. The luminaire types shown are in line with precedent Keadby strategies, however it should be considered that luminaire type, lumen output and specific area mitigation will be finalised as part of design development.

Table 3: Indicative Luminaire Typologies

Indicative Area	Image	Product (or equivalent)	Lamp Details	Installation
		FAEL Domino Street AP	51 W 6109 lm 4000 K CRI 70+	Pole mounted 6-12m height Tilt angle 0° above the horizontal
		CHAMLIT Evolution X	188 W 19197 lm 4000 K CRI 70+	Pole mounted at height 8-10 m Tilt angle maximum 7° above the horizontal
		ABACUS Revati AL60601	5.1 W 642 lm 4000 K CRI 70+	Building mounted at height 2.3 – 3.0 m Tilt angle 0° above the horizontal

- 3.3.7. The quality of light would be as important as the quantity of light provided to task areas, meaning that there would be advisable average light levels

and uniformities that should be provided to support visual comfort, task visibility and eye adaptation.

Recommended Lighting Values

- 3.3.8. Recommendations for maintained average light levels, uniformity, glare and light colour are provided for Outdoor Workplaces in British Standard BS EN 12464-2 for different areas, tasks and activities.
- 3.3.9. Please note that the light levels provided are the industry standard minimum required for the activity or task to prevent overlighting and contributing to obtrusive effects.
- 3.3.10. The following extracts may apply for outdoor operational requirements. **Table 4** to **Table 6** set out requirements for anticipated operational activities.

Table 4: General Requirements for Areas and Cleaning of Outdoor Workplaces (Table 7, BS EN 12464-2)

Ref. no.	Type of area, task or activity	\bar{E}_m lx		U_o	R_{GL}	R_a	Specific requirements
		required ^a	modified ^b				
7.1	Walkways exclusively for pedestrians	5	—	0,20	50	70	
7.2	Traffic areas for slowly moving vehicles (max. 10 km/h), e.g. bicycles, trucks and excavators	10	—	0,40	50	70	
7.3	Regular vehicle traffic (max. 40 km/h)	20	—	0,20	45	70	At shipyards and in docks, R_{GL} may be 50.
7.4	Mixed traffic areas, vehicle turning, stationary loading and unloading points	50	—	0,40	50	70	When the area is non-occupied \bar{E}_m required may be reduced to 5 lx. Pay attention to the illuminance levels of the surrounding and adjacent areas.
7.5	Cleaning and servicing	50	—	0,25	50	70	At all relevant surfaces
7.6	Recycling centers - areas with rubbish bins and sorting of waste	30	—	0,25	50	70	
^a Required: minimum value.							
^b Modified: considers common context modifiers in 5.3.3.							

Table 5: Building Sites (Table 13, BS EN 12464-2)

Ref. no.	Type of area, task or activity	E_m lx		U_o	R_{GL}	R_a	Specific requirements
		required ^a	modified ^b				
13.1	Clearance, excavation and loading	20	30	0,25	55	70	
13.2	Construction areas, drain pipes mounting, transport, auxiliary and storage tasks	50	75	0,40	50	70	
13.3	Framework element mounting, light reinforcement work, wooden mould and framework mounting, electric piping and cabling	100	150	0,40	45	70	
13.4	Element jointing, demanding electrical, machine and pipe mountings	200	300	0,50	45	70	Can be met with use of local mobile lighting.
^a Required: minimum value.							
^b Modified: considers common context modifiers in 5.3.3.							

Table 6 Parking Areas (Table 8, BS EN 12464-2)

Ref. no.	Type of area, task or activity	E_m lx		U_o	R_{GL}	R_a	Specific requirements
		required ^a	modified ^b				
8.1	Light traffic, e.g. parking areas of shops, terraced and apartment houses; cycle parks	5	—	0,25	55	70	
8.2	Medium traffic, e.g. parking areas of department stores, office buildings, plants, sports and multipurpose building complexes	10	—	0,25	50	70	
8.3	Car charging station points in lit areas	20	—	0,25	50	70	At the relevant area approx. up to 3 m from charging point. If the display is not self illuminated, a vertical illuminance of $E_m = 50$ lx at the charging poles should be provided for the time of reading. Vertical illuminance on the car should be considered.
8.4	Car charging station points in unlit areas	10	—	0,25	50	70	If the display is not self illuminated, a vertical illuminance of $E_m = 50$ lx at the charging poles should be provided for the time of reading.
8.5	Heavy traffic, e.g. parking areas of major shopping centres, major sports and multipurpose building complexes	20	—	0,25	50	70	
^a Required: minimum value.							
^b Modified: considers common context modifiers in 5.3.3.							

Table 7 Industrial Sites and Storage Areas (Table 17, BS EN 12464-2)

Ref. no.	Type of area, task or activity	\bar{E}_m lx		U_o	R_{GL}	R_a	Specific requirements
		required ^a	modified ^b				
17.1	Short-term handling of large units and raw materials, loading and unloading of solid bulk goods	20	—	0,25	55	70	When the area is non-occupied \bar{E}_m required may be reduced to 5 lx.
17.2	Continuous handling of large units and raw materials, loading and unloading of freight, lifting and descending location for cranes, open loading platforms	50	—	0,40	50	70	When the area is non-occupied \bar{E}_m required may be reduced to 5 lx.
17.3	Reading of addresses, covered loading platforms, use of tools, ordinary reinforcement and casting tasks in concrete plants	100	—	0,50	45	70	Movement detection control preferred for energy savings.
17.4	Demanding electrical, machine and piping installations, inspection	200	—	0,50	45	70	Can be met with use of local mobile lighting.
^a Required: minimum value.							
^b Modified: considers common context modifiers in 5.3.3.							

3.4. Recommended Lighting Typologies

- 3.4.1. The choice of luminaire should be carefully considered so that the optimal distribution of light from the fitting is provided at the right mounting location and height.
- 3.4.2. The use of full horizontal cut-off luminaires installed at 0° tilt with flat glass lenses, back reflectors and internal baffles designed to limit views of the lamp and glare and direct light in a controlled pattern are recommended.
- 3.4.3. Where full cut-off type luminaires installed at a 0° tilt are not suitable for a particular application, such as floodlighting over large areas, it is

recommended to use shields, hoods, cowls, or baffles to aid in controlling how light is distributed.

Light Sources

- 3.4.4. LED lighting is recommended over traditional light sources. It is prevalent for the majority of current generation lighting types and is typically an efficient source of light, having a good lumen to Watt ratio.
- 3.4.5. LED may also more easily support different lighting control scenarios where dimming is required.
- 3.4.6. LED presents a greater potential to control the spectral composition of emitted light, such as the reduction of blue wavelengths which could have a negative impact on insects and wildlife.

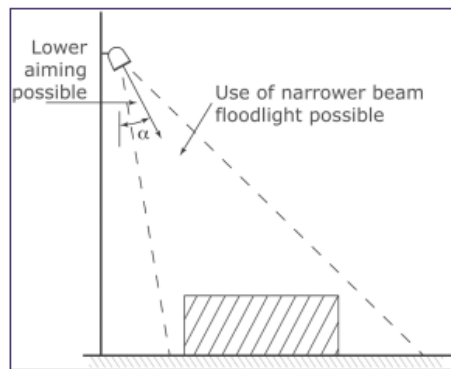
Light Colour

- 3.4.7. Light colour and spectral composition should respond to area character and ecology recommendations. It is expected that this will involve a warmer white, at a maximum of 3000K, although 2700K may be more desirable near areas of particular sensitivity to reduce the overall UV component of new installations through limiting blue spectrum light.
- 3.4.8. The colour of the light and spectral composition is traditionally considered to be less visually intrusive, as well as have a more restricted UV spectrum which limits potential effects to local wildlife or their food sources.
- 3.4.9. In some cases, a whiter light in the region of 4000K may be necessary in areas which have strict requirements for working or space use during the hours of darkness.

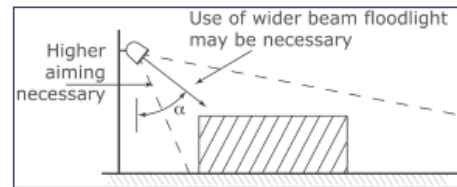
3.5. Recommended Installation Approaches

Mounting Height

- 3.5.1. Using as high a mounting height as possible is normally desirable so that aiming angles to provide sufficient light coverage to task areas without contributing to light spill, sky glow or glare. **Plate 5** provides an overview of good practice approaches to establishing mounting height.



✓ **Figure 2a: Higher mounting height**
 – less spill light and glare



✗ **Figure 2b: Lower mounting height**
 – more spill light and glare

Plate 5: Recommended Mounting Height Configuration (ILP)

Aiming and Orientation

- 3.5.2. The correct aiming and orientation of lighting ensures that obtrusive lighting effects can be controlled and reducing the potential for light spill, sky glow and glare.
- 3.5.3. Luminaires should normally be mounted with no or minimal angle (or tilt) above the horizontal to ensure that all light is provided to task areas, and reducing the potential for light to be contributed to the sky.
- 3.5.4. It is recognised that this may not be possible in all situations and an aiming angle of no more than 70 degrees above the horizontal is

recommended. **Plate 6** provides an overview of recommended aiming angles.

- 3.5.5. Where an angle is necessary, shields, hoods, cowls, or baffles may be necessary.

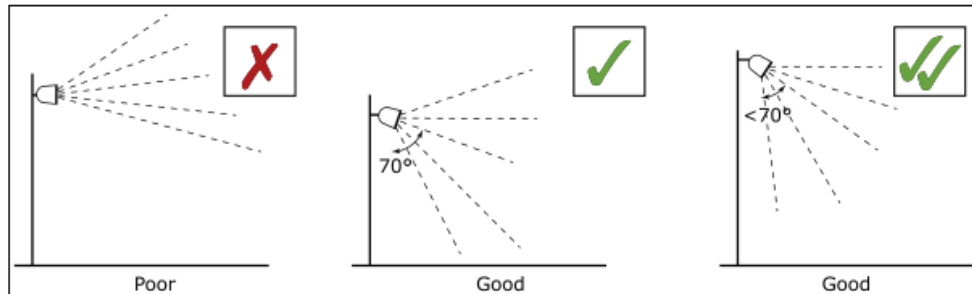


Figure 3: Luminaire aiming angles

Plate 6 Recommended Aiming Angles (ILP)

3.6. Environmental Impact Avoidance Approach

- 3.6.1. Obtrusive light, whether it keeps someone awake through a bedroom window or impedes their view of the night sky, is a form of pollution, which may also be a nuisance in law, and which can be substantially mitigated without detriment to the lighting requirements of the task.
- 3.6.2. Obtrusive light (sometimes referred to as light pollution) is considered to have three direct components which relate to causing nuisance to others, adversely affect fauna and flora, and wasting money and energy. The three components of obtrusive light are as outlined below and illustrated on **Plate 7**, adapted from Figure 1 of 'Guidance Note 01: Guidance Notes for the Reduction of Obtrusive Light' (GN01/21) produced by the ILP:
- sky glow – light that contributes to the brightening of the night sky which may consist of direct upward light and upward reflected light;
 - glare – the uncomfortable brightness of a light source when viewed against a darker background which is considered to be the viewed source intensity; and
 - light spill or light intrusion – consists of spill light or the spilling of light beyond the boundary of the property or area being lit.

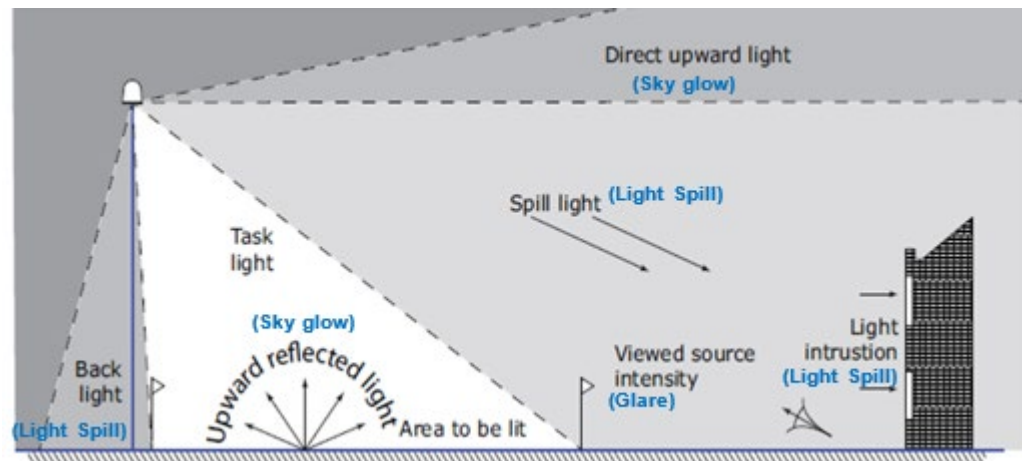


Plate 7: Types of Intrusive Light (ILP)

Environmental Zone Classification

- 3.6.3. The obtrusive lighting constraints for the Site are based on statutory guidance issued by the Department for the Environment, Food and Rural Affairs to support the implementation of the Clean Neighbourhoods and Environment Act 2005 (HM Government, 2005) and non-statutory guidance on obtrusive light limits published by the ILP. The limits are set out in the ILP Guidance Notes.
- 3.6.4. The ILP has developed an Environmental Zone classification system for the categorisation of receptor locations. This is summarised in **Table 8** below.

Table 8: ILP Environmental Zone Classifications (Table 1)

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Intrinsically dark landscapes	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness areas	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity

3.6.5. For each Environmental Zone, obtrusive light limits for exterior lighting installations are specified. These are intended to support decision makers in establishing whether obtrusive lighting is detrimental to local amenity or a potential statutory nuisance. **Table 9** provides an overview of the recommended limiting criteria for sky glow, light spill and glare (source intensity).

Table 9: ILP Obtrusive Light Limits for Exterior Lighting Installations

Environmental Zone	Sky Glow (%)		Light Spill (into windows) (lx)		Source Intensity (kcd)	
	Upward Light Ratio	Upward Flux Ratio (Amenity)	Pre-curfew	Post-curfew	Pre-curfew	Post-curfew
E0	0	0	0	0	0	0
E1	0	0	2	0.1	2.5	0
E2	2.5	6.0	5	1	7.5	0.5
E3	5.0	12.0	10	2	10	1.0
E4	15.0	35.0	25	5	25	2.5

3.6.6. The Outline Lighting Strategy provides sufficient information on design parameters and context considerations so that the lighting installed will be

able to meet technical criteria and meet or improve on environmental criteria. Attention will be given to managing the environmental performance of new lighting to limit obtrusive effects to the local community.

- 3.6.7. Core construction hours will be from 07:00 to 19:00 Monday to Friday and 08:00 to 13:00 on Saturdays with no working on Sundays or Bank Holidays. It is expected that only lighting needed for safety or security will be provided outside of these hours.
- 3.6.8. In exceptional circumstances, works may take place outside of these times, however it is expected that works will need be agreed prior to being undertaken.
- 3.6.9. Equally, operational requirements may also have a need for lighting to operate at various times for the night.
- 3.6.10. There will therefore be the occasional need to provide visual comfort and performance throughout an entire period of darkness or reduced daylighting. For this reason, it is considered that imposing a lighting curfew for obtrusive lighting would be unreasonable and would have the potential to conflict with achieving the required visual performance at the Site for safety, security and operational reasons. This is in line with the ILP Obtrusive Light Guidance, which states:
- ‘the notes are therefore no substitute for professionally assessed and designed lighting, undertaken and assessed by a competent lighting professional, where the various and maybe conflicting visual requirements need to be balanced’.
- 3.6.11. BS EN 12464-2 states the following with regard to obtrusive illuminance pre and post curfew regulations:
- “In case no curfew regulations are available, the higher values shall not be exceeded, and the lower values should be taken as preferable limits”.
- 3.6.12. While industrial development tends to be associated with a lighting environmental zone E3, it is considered appropriate for the purposes of controlling obtrusive light affecting residential and ecological receptors that suitable obtrusive lighting level limits with regard to the ILP Environmental

Zone for the areas surrounding the site would be those as set out in Zone E2 i.e. a rural area of low district brightness.

- 3.6.13. Please note that there may be additional mitigation or light management recommendations set out for ecology receptors that need to be taken into consideration, to be established by the project ecologist.
- 3.6.14. These should also be applied to agricultural receptors, where present, for a consistent night-time environment.

4. Baseline Conditions

4.1. Existing Baseline

- 4.1.1. The Proposed Development is planned to be in close proximity to the existing Keadby 1 and Keadby 2 power stations and is located approximately 4.1km to the west of the town of Scunthorpe. The village of Keadby is the nearest settlement which lies immediately adjacent to the Proposed Development Site boundary. Both Scunthorpe and to a lesser extent, Keadby Village and sources along the River Trent are key sources of lighting emanating from the east of the Site. Areas west of the Site are agricultural and less well lit.
- 4.1.2. Lighting associated with the development for the existing Keadby Power Station forms part of the baseline for the Proposed Development.

4.2. Receptors

- 4.2.1. Lighting may have a variable range of influence depending on how much light is used, where it is used and when it is used. The greatest potential for obtrusive or nuisance effects to occur is within 100 m of the Site boundary.
- 4.2.2. Receptors are identified which fall within 200 m of the Site boundary need to be considered so that the right light is provided in the right place, at the right time. These consist of residential, agricultural, recreational, ecological

4.2.3. **Plate 8** provides an overview of receptors and where they are located, relevant to the Site.

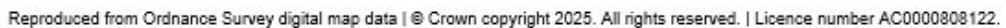


Plate 8: Receptor Locations (Overlay based on ES Volume III Figure 12.5 (Application Document Ref. 6.4))

Residential Receptors

4.2.4. As the Proposed Development Site and surrounding areas of works are considered to fall under an Environmental Zone E2, the proposed permitted obtrusive light level limits for residential receptors are as follows:

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- a source intensity limit when viewed from receptor locations of 5 kcd. If the ILP curfew levels were imposed, then this limit would reduce to 2.5 kcd post-curfew.

Ecological Receptors

- 4.2.5. Directly adjacent to the west and to the south of the Proposed Site, foraging habitats of greater potential value to bats include the Stainforth and Keadby Canal habitat corridor and the former Keadby Ash Tip. Each of these habitats is considered ecologically sensitive to potential lighting effects. Given the wider area covered by ecological receptors with reference to Plate 10, there may be some exposure to existing lighting which is described in the Receptor Locations section and Table 10 below.
- 4.2.6. **ES Volume I Chapter 11: Biodiversity, Ecology and Nature Conservation (Application Document Ref 6.2)** refers to requirements set out in the Outline Lighting Strategy and advises:
- “Lighting impacts on sensitive ecological features would be minimised as far as reasonably practicable, for example, by directing lighting away from adjacent habitats.”
- 4.2.7. Given the relatively low sensitivity of the identified ecological receptors, the following criteria are suggested as being reasonable at the construction stage:
- target illuminance levels of less than 1 lx;
 - an upper limit illuminance level of 3 lx; and
 - source intensity values not to exceed ILP human receptor criteria.
- 4.2.8. The above levels are consistent with previous recommendations for ecological limitations for Keadby CCS Power Station. If the presence of light sensitive ecological receptors has changed, the limiting criteria should be revisited alongside recommendations for additional mitigation or light management measures.
- 4.2.9. Operational lighting should seek to meet or improve on the recommended target criteria if lighting is required near sensitive areas, and refer to further recommendations set out in **ES Volume I Chapter 11: Biodiversity, Ecology and Nature Conservation (Application Document Ref 6.2)**.

Transport Receptors

- 4.2.10. Light spill and sky glow will typically have little influence on transport systems, however the effects of glare will need to be carefully considered to avoid contributing to visual discomfort or visual disability for drivers.

Marine (Human) Receptors

- 4.2.11. Vessels engaged in deliveries are also considered as receptors with reference to the water offloading area. It is recognised that there is potential for unloading during the hours of darkness, technical engagement discussions (post Stage 2) have resulted in a recommendation that this would be non-viable due to an increased health and safety risk, as well as introducing new/increased obtrusive effects to Trentside residential properties. **(ES Volume II Appendix 12C: Navigation Risk Assessment (Application Document Ref. 6.3))**. Therefore, only temporary lighting of the Railway Wharf will be used, as necessary.

Receptor Locations

- 4.2.12. While effects are most likely to occur within 200m of development areas, the closest residential receptors within 1km of the Order Limits and other light sensitive receptors to these areas are identified and include:
- an isolated property at Vazon Bridge, approximately 450m south of the Main Site (40m south of the Proposed Development Site), adjacent to the Stainforth and Keadby Canal;
 - North Moor Farm located approximately 740m north of the Main Site (475m north of the Potential Electrical Connection to the Northern Powergrid 132kV Substation);
 - a pair of semi-detached residential properties 'Holly House' and 'Hawthorn House' located 815m east of the Main Site (0 - 35m west of the Water Discharge Corridor);
 - Keadby Grange, approximately 920m south of the Main Site (510m east of the Construction Laydown Areas, within the agricultural fields north of A18);
 - properties along Chapel Lane, located 1km east of the Main site (50m east of the Water Discharge Corridor);
 - a single residential property (No. 5 Trent Side), approximately 1.3km east of the Main Site (35m east of the Additional Abnormal Indivisible Load Route);

- South Pilfrey Farm, approximately 2.1km south of Main Site (250m east of the A18 junction improvement;
- farms along Bonnyhale Road including Ealand Warpings and North Pilfrey Farm; the latter located 1.6km south-west of the Main Site (225m west of North Pilfrey Bridge); and
- Ealand Poultry Farm, located on Bonnyhale Moor Road, approximately 1.6km west of the Main Site (1.2km north-west of the construction laydown areas).

4.2.13. Some of the associated viewing locations align to the properties identified in the LVIA presented in **Chapter 14: Landscape and Visual Amenity (Application Document Ref. 6.2)** which includes some consideration of existing night-time lighting conditions.

4.2.14. Table 10 below outlines the existing lighting in place at these sensitive receptor locations which are illustrated on **ES Volume III Figure 14.4: Representative Viewpoints (Application Document Ref 6.4)**.

Table 10: Existing Lighting

Viewpoint	Location	Existing Lighting
1	Chapel Lane West, Keadby	Street lighting is present along the eastern section of the road. Existing aviation warning lighting is present on the wind turbines, the stacks associated with Keadby 1 and 2 Power Stations. In general, there are low levels of night-time lighting.
2	Gate Keepers Residence, (Vazon Bridge) Keadby	Existing aviation warning lights on the wind turbines, the stacks of Keadby 1 and 2 Power Stations are visible. In general, there are low levels of night-time lighting at this location.
3	Keadby Lock	There is street lighting and high-level flood lighting associated with the Lock at this location. In general, there are medium levels of night-time lighting visible within Viewpoint 3.
4	PRoW, North of Keadby	Street lighting along Chapel Lane and aviation warning lights on the wind turbines, Keadby 2 Power Station stacks

Viewpoint	Location	Existing Lighting
		are visible. There are low levels of night-time lighting at this location.
5	PRoW, north-east of Gunness	Street lighting from Gunness is visible, creating sky glow to the south-east. The lighting located in the Lock and aviation warning lighting will be visible to the south-west. There are low levels of lighting visible in the night sky from this location.
6	Trunk Road, Keadby	Street lighting from Althorpe is visible as the closest source of lighting. Lighting from Keadby and Keadby Port creates a low-level of sky glow and aviation warning lighting is clearly visible from this location. There are overall low levels of lighting visible in the night sky from this location.
7	PRoW. east of Ealand Poultry Farm	Aviation warning lights on the wind turbines, Keadby 1 and 2 Power Station stacks are visible from this location. Task lighting is present at the nearby industrial unit. There are low levels of night-time lighting at this location.
8	PRoW, Eastoft	Street lighting is present in Eastoft. Distant sky glow is visible from the northern area of Scunthorpe. Overall, there are low levels of night-time lighting at this location.
9	Meredyke Road, Luddington	Street lighting is present in Luddington. Distant sky glow is visible from the northern area of Scunthorpe. Overall, there are low levels of night-time lighting at this location.
10	Middle Lane, Amcotts	Street lighting is present in Amcotts. Distant sky glow is visible from the northern area of Scunthorpe. Overall, there are low levels of night-time lighting at this location.
11	PRoW, accessed off Chafer Lane,	No direct light sources are present. Sky glow from Burton upon Stather and the north of Scarborough would be visible

Viewpoint	Location	Existing Lighting
	Burton upon Stather	from this location. Overall, there are very low levels of night-time lighting at this location.
12	Mill Road, Crowle	Street lighting is present in Crowle. Very distant sky glow is visible from Scunthorpe. Overall there are low levels of night-time lighting at this location.
13	PROW, Isle of Axholme	Street lighting is visible from within Belton. Aviation warning lighting is visible from wind turbines on the horizon. Overall, there are very low levels of night-time lighting at this location.
14	PRoW, Stainforth and Keadby Canal Towpath	The viewpoint is likely to experience ambient artificial lighting from Keadby 1 and Keadby 2 Power Stations and aviation warning lighting is likely to be visible from wind turbines in longer distance views. Overall, there are likely to be moderate levels of night-time lighting at this location.

5. Conclusions

- 5.1.1. This Strategy has been prepared in order to support the Application for the Proposed Development.
- 5.1.2. The contractor(s) have not yet been appointed and detailed design work for the Proposed Development has not been carried out. Therefore, detailed information on the lighting to be used at the Proposed Development is currently unknown. Nevertheless, it is recognised that potential nuisance from lighting of the Proposed Development may be a concern for local communities and certain consultees. Therefore, the Applicant has commissioned this strategy in order to provide some definition to the type and level of lighting that will be employed at the Proposed Development.
- 5.1.3. The overarching philosophy for the lighting design will be to have a reduced light site. This Strategy provides the principles, guidance and the recommended type of equipment that is required to illuminate the Proposed Development Site. When determining the lighting requirements, an indicative site layout has been used to assess the requirements for specific work areas for construction and operational lighting activities.
- 5.1.4. In summary, the key principles that shall be adopted when developing the detailed design include:
- to ensure the health and safety of employees and visitors performing normal working duties;
 - to ensure the safe movement of vehicular and pedestrian traffic around the Proposed Development Site during the hours of darkness;
 - to minimise light pollution in terms of light trespass, sky glow and glare to the identified sensitive receptors; and
 - to ensure the security of the Proposed Development Site and its occupants including lighting suitable for the correct functioning of the preferred CCTV system.

5.2. Expected Impacts of Lighting During Construction

Residential

- 5.2.1. The introduction of construction lighting may influence the nighttime environment in residential areas, particularly where there are direct sightlines to illuminated work zones. Temporary lighting could result in increased brightness, light trespass at residential windows, and localized changes to ambient light levels. These effects will depend on the proximity

of residential receptors, the positioning of light sources, and the existing baseline conditions.

- 5.2.2. As construction present a temporary condition that will take place primarily during daylight hours, and a Lighting Management Plan will be developed which looks at the use and control of lighting, it is expected that lighting effects will be adequately managed and no significant adverse effects as a result of construction are anticipated.

Ecology

- 5.2.3. The introduction of construction lighting may introduce lighting to light sensitive habitat, particularly where there are direct sightlines of the habitat to illuminated work zones.
- 5.2.4. Temporary lighting could result in increased brightness, light trespass into sensitive habitat locations, and localized changes to ambient light levels. These effects will depend on the proximity of ecological receptors, the positioning of light sources, and their current light exposure under existing baseline conditions.
- 5.2.5. There may be some level of disturbance, but this would be temporary in nature, reversible and therefore not significant. Design measures, including directional lighting directed downwards to minimise light.
- 5.2.6. No significant adverse effects on protected or notable species as a result of construction are anticipated.

Transport

- 5.2.7. Construction lighting near road and rail infrastructure will be necessary to ensure safe and efficient operations. This may result in increased illumination along transport corridors, particularly in darker areas where artificial lighting is currently minimal. The presence of additional light sources could alter visibility conditions for road users and train operators, with potential changes in contrast, glare, or light spill onto carriageways and rail tracks.
- 5.2.8. While there is potential for obtrusive effects to occur, lighting used at night will be managed through the Draft DCO requirement for a scheme for all external lighting to be installed during construction to be agreed in

advance of construction. This which will include information regarding light management around transport routes and corridors.

- 5.2.9. It is expected that lighting effects will be adequately managed and no significant adverse effects as a result of construction are anticipated.

5.3. Expected Impacts of Lighting During Operation

Residential

- 5.3.1. Operational lighting will be provided over a reduced area when compared to the Order Limits and will be predominantly used for the Gatehouse and Gatehouse access toward the south and around the Main Site area. These locations are not directly adjacent to residential areas, although the Gatehouse and access are near to Pilfrey Farm.
- 5.3.2. There are likely to be localised instances where brightness and ambient light levels are increased, however, this will be seen against a backdrop that already has a baseline exposure to light.
- 5.3.3. While new lighting will present a noticeable change in the nighttime environment of residential areas and have a perceptible effect on views, it is expected that obtrusive lighting effects will be adequately managed by incorporating the approaches set out within the Outline Lighting Strategy. These will be further refined during the detailed design stage.
- 5.3.4. Light spill and glare are expected to be managed through a combination of implementing the Outline Lighting Strategy and distance from operational installations. There is a greater opportunity for sky glow to be introduced from new lighting, however this will be managed by directing light toward respective task areas and providing light where needed without overlighting. No significant adverse effects are anticipated.

Ecology

- 5.3.5. Areas with ecological sensitivity are on the whole closer to the Order Limits and work areas than residential properties, however the same approaches which aids in limiting obtrusive lighting effects do them will also aid in limiting effects near Local Wildlife Sites, Ramsar sites, Sites of

Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC).

- 5.3.6. There is some baseline exposure to light under current conditions, particularly around the existing Keadby 1 and 2 Power Stations, alongside other nearby industrial development.
- 5.3.7. Operational lighting could result in increased brightness, light spill into sensitive habitat locations, and localized changes to ambient light levels, depending on the proximity of individual receptors to existing and future installations, however effects will be managed through the application of the Outline Lighting Strategy and attention to light management during the detailed design stage. On this basis, no significant adverse effects are anticipated.

Transport

- 5.3.8. Transport receptors have a variable baseline exposure to lighting to some degree from existing lighting near industrial development and existing towns and residential development. This is reduced outside of developed areas.
- 5.3.9. New lighting associated with new Operational areas will be limited when compared to the Order Limits, therefore relatively small areas of both rail lines and adjacent roads, such as the A18, will be carefully considered when implementing the Outline Lighting Strategy during the detailed design stage. As these receptors are not affected by sky glow, light spill and glare are the most likely obtrusive effects which could affect them.
- 5.3.10. While new lighting will present a noticeable change in the nighttime environment, it is expected that obtrusive lighting effects will be adequately managed. No significant adverse effects are anticipated.

5.4. Summary

- 5.4.1. In summary, it is concluded that this Strategy provides for an appropriate outline of the lighting requirements for the Proposed Development as part of the Application and identifies measures which can be employed as required and which would adequately control obtrusive light through detailed design of the lighting scheme.

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