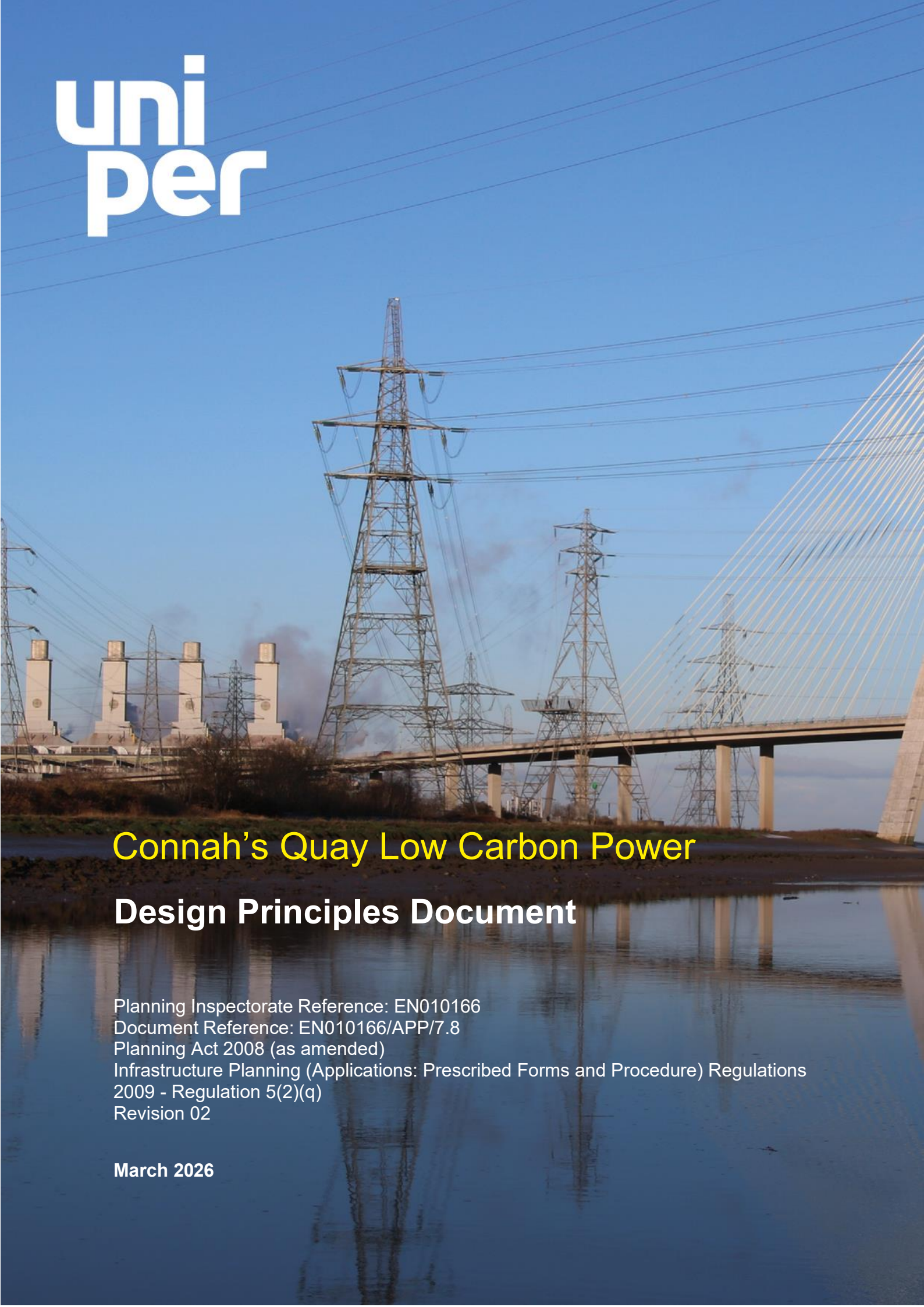

Connah's Quay Low Carbon Power

Design Principles Document

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Prepared for:
Uniper UK Limited

Prepared by:
AECOM Limited

Table of Contents

Tables

1. Introduction

1.1.1 This Design Principles Document sets out the maximum and fixed design parameters (**Table 1-1**) and design principles (**Table 1-2**) that will inform the detailed design of the Connah's Quay Low Carbon Power (CQLCP) Abated Generating Station and supporting infrastructure (the Proposed Development).

1.1.2 This Design Principles Document should be read in conjunction with the **Draft DCO** (**EN010166/APP/3.1**), **Works Plan** (**EN010166/APP/2.4**) and **Parameter Plans** (**EN010166/APP/2.5**), which are other documents that will also control the parameters of the detailed design of the Proposed Development.

1.1.3 For completeness, this Design Principles Document sets out all design principles; those secured elsewhere, as well as those design principles only secured through this document. For clarity, those design principles secured elsewhere are shown with a grey background in **Table 1-2** below. Those design principles only secured in this document are shown with a white background. **Table 1-2** also clarifies where each of the design principles is secured within the Application.

Table 1-1: Maximum Design Parameters

Zone (see Maximum Parameters (Site Layout and Elevations) (EN010166/APP/2.5))	Component of the Proposed Development	Maximum Footprint (metres squared (m^2)) / Maximum Diameter (metres (m))	Maximum Height (m) Above Ground Level (AGL)	Maximum Height (m) Above Ordnance Datum (AOD)
1A	Combined cycle gas turbine (CCGT) Buildings	6,700 (per Train)	50	57.4
1B	Heat Recovery Steam Generator (HRSG) Buildings	3,450 (per Train) 6,900 (both Trains)	50	57.4
1B	HRSG Stack(s)	8 (internal diameter (ID))	130	137.4
1C	Control, Administration Buildings and Workshops	3,500	16	23.4
1D	Carbon Capture Plant (CCP) Absorbers	375 per absorber	92	99.4
1D	CCP Absorber Stack	7 (ID)	145 (including stack)	152.4 (including stack)
1E	CCP Carbon Dioxide (CO_2) Stripper	180	65	72.4
1E	CCP CO_2 Stripper external diameter	15		
1F	Cooling and CO_2 Compression Infrastructure	26,450	25	32.4

Zone (see Maximum Parameters (Site Layout and Elevations) (EN010166/APP/2.5))	Component of the Proposed Development	Maximum Footprint (metres squared (m^2)) / Maximum Diameter (metres (m))	Maximum Height (m) Above Ground Level (AGL)	Maximum Height (m) Above Ordnance Datum (AOD)
1G	Proposed CO_2 Above Ground Installation	2,800	6	13.4
1H	Other Ancillary Buildings and Structures within the Connah's Quay Low Carbon Power Abated Generating Station and Maintenance Laydown Area	64,470	10	17.4

Table 1-2: Design Principles

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
Project Wide					
1.	**Value**	**Design Champion**	A Design Champion will be appointed to oversee the detailed design of the Proposed Development following the grant of development consent. The design champion will ensure the delivery of good process and quality sustainable good design outcomes. The Design Champion will: • ensure that the requirements of this document are included within the brief for the detailed design team; • establish a collaborative way of working with the detailed design team; • enable clear articulation and discussion about design quality and sustainable design between design team members, and externally with the local community, local authority, and stakeholders; • provide a single point of contact regarding design process and outcomes during the detailed design phase of the Proposed Development; • ensure good design both in terms of the design process and design outcome; • ensure that the process and design commitments set out within this document are complied with during the detailed design stage; and • manage and coordinate the preparation of materials that are appropriate for the Design Review Panel sessions.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
2.	**Value**	**Shared Infrastructure**	The Proposed Development will be designed to enable the repurposing of purging ponds, cooling water abstraction and discharge infrastructure and, where possible, other existing infrastructure of the existing Connah's Quay Power Station (as shown on the **Existing station shared infrastructure drawing** (**EN010166/APP/7.10**)).	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
3.	**People and Place**	**Minimise impacts on human health and ecological receptors**	The design will conform with the pollutant emission limits assessed within **Chapter 8: Air Quality** of the ES Volume II (**EN010166/APP/6.4**). The emission limits are shown in Table 3 of **Appendix 8-D: Air Quality Operational Assessment** of the ES Volume IV (**EN010166/APP/6.4**).	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
4.	**People**	**Minimise noise and disturbance**	The potential for the Proposed Development to generate sounds of a tonal, impulsive, intermittent or low frequency nature will be minimised by the selection of appropriate plant, building cladding, louvres, and silencers/attenuators, as necessary.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
5.			Noise from the operation of the Proposed Development will not exceed 8 decibels (dB) higher than the background sound levels as set out in Table 9-8: Baseline Sound Survey Results of **Chapter 9: Noise and Vibration** of the ES Volume II (**EN010166/APP/6.2.9**) unless otherwise approved by the relevant planning authority.		

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
6.	**People**	**Minimise impacts on residential amenity**	The Proposed Development will be designed to reduce unnecessary light spill beyond the Main Development Area to minimise visual impact.	Construction.	**Lighting Strategy** (**EN010166/APP/7.22**) (Requirement 3: detailed design).
7.			The Proposed Development will be designed to reduce unnecessary light spill beyond the Main Development Area to minimise visual impact.	Operation.	**Appendix 4-A: Operational / Maintenance Mitigation Register** of the ES Volume IV (**EN010166/APP/6.4**) (Requirement 13: operational and maintenance management plan).
8.			Lighting proposed as part of the detailed design will be developed in accordance with the principles identified in the **Lighting Strategy** (**EN010166/APP/7.22**).	Detailed design stage.	**Lighting Strategy** (**EN010166/APP/7.22**) and **Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
9.	**Place**	**Minimise impacts on terrestrial and aquatic ecology**	The design of the Proposed Development will consider Important Ecological Features (IEFs) and will incorporate measures to reduce the potential for adverse effects.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: Detailed design.)
10.			Lighting will be sited or screened in such a way as to reduce illumination on adjoining sensitive habitats to minimise effects on receptors sensitive to light impacts in accordance with the principles identified in the **Lighting Strategy** (**EN010166/APP/7.22**).	Construction.	**Lighting Strategy** (**EN010166/APP/7.22**) (Requirement 3: detailed design).
11.			Lighting will be sited or screened in such a way as to reduce illumination on adjoining sensitive habitats to minimise effects on receptors sensitive to light impacts in accordance with the principles identified in the **Lighting Strategy** (**EN010166/APP/7.22**).	Operation.	**Appendix 4-A: Operational / Maintenance Mitigation Register** of the ES Volume IV (**EN010166/APP/6.4**) (Requirement 13: operational and maintenance management plan).
12.			Planting within the Order limits in advance of construction activities will be provided where possible in accordance with the **Outline Landscape and Ecology Management Plan** (**LEMP**) (**EN010166/APP/6.9**).	Construction.	**Outline Landscape and Ecological Management Plan** (**EN010166/APP/6.9**) (Requirement 10: LEMP).

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
				Operation.	**Outline Landscape and Ecological Management Plan** (**EN010166/APP/6.9**) (Requirement 10: LEMP).
13.			Net Benefit for Biodiversity (NBB) will be provided on-site and will need to be in general accordance with the **Outline LEMP** (**EN010166/APP/7.11**) and the **Off-site Net Benefit for Biodiversity and Green Infrastructure Strategy** (**EN010166/APP/6.14**).	Construction.	**Outline Landscape and Ecological Management Plan** (**EN010166/APP/7.11**) and **Off-site Net Benefit for Biodiversity and Green Infrastructure Strategy** (**EN010166/APP/6.14**) (Requirement 18: Net benefit for biodiversity).
				Operation.	**Outline Landscape and Ecological Management Plan** (**EN010166/APP/7.11**) and **Off-site Net Benefit for Biodiversity and Green Infrastructure Strategy** (**EN010166/APP/6.14**) (Requirement 18: Net benefit for biodiversity).
14.	**Place**	**Landscaping, biodiversity enhancement measures and boundary treatment**	The Proposed Development and construction laydown areas will be designed to include a minimum 30 m ecological safeguard zone as shown on **Figure 5-3: Construction Areas** of the ES Volume III (**EN010166/APP/6.3**). Habitats in these areas would be retained during construction and protected from any damage during the construction phase. These areas will include acoustic fencing to the north of the Main Development Area and Construction and Indicative Enhancement Area (C&IEA) and acoustic fencing to the western side of the Main Development Area.	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).
15.			As detailed in the **Framework CEMP** (**EN010166/APP/6.5**) and shown on **Figure 5-3: Construction Areas** of the ES Volume III (**EN010166/APP/6.3**), a 3 m high acoustic fence will be erected on the boundary of the ecological safeguard zones.		
16.	**Climate**	**Sustainable Drainage Systems (SuDs)**	The SuDS Manual Simple Index Approach (CIRIA C753) will be used to inform the design of the surface water drainage system so that it provides adequate treatment of run-off.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
17.	**Place**	**Surface water outfall**	Detailed modelling will be undertaken to assess the viability of splitting the surface water discharge across the existing piped surface water systems. If it is deemed viable by	Detailed design stage.	**Design Principles Document**

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
			the undertaker and the relevant local authority, it will be the preferred drainage solution as it will avoid the loss of qualifying habitat features of the Special Area of Conservation/saltmarsh. Details of the preferred drainage solution shall be incorporated into and included within the detailed design for the relevant stage of the authorised development to be submitted to and approved by the relevant local authority.		(**EN010166/APP/7.8**) (Requirement 3: detailed design).
18.		**Detailed drainage design**	As part of the drainage design, appropriate pollution measures will form part of the detailed design, be implemented and in place within the drainage network in the form of full retention fuel interceptors, shut-off valves, and fire suppression / contaminated water tanks.		
19.			Drainage systems will be designed such that surface water and chemical spills will be appropriately retained onsite to prevent release to environmental receptors.		
20.	**Climate**	**Reduce flood risk from future sea level rise**	Land raising to 7.4 m above ordnance datum (AOD) will be undertaken within the operation footprint of the Main Development Area with critical infrastructure raised to have a finished floor level of 7.7 m AOD to provide sufficient freeboard from predicted future sea levels identified in **Appendix 13-F: Hydraulic Modelling Report** of the ES Volume IV (**EN010166/APP/6.4**).	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).
21.	**Place**	**Water protection**	The currently permitted abstraction and discharge parameters for the existing Connah's Quay Power Station in relation to cooling water will be maintained throughout the life of the Proposed Development. Abstraction will be intermittent and limited to no more than three hours abstraction per tide around high water (one hour before and two hours after).	Operation.	**Appendix 4-A: Operational / Maintenance Mitigation Register** of the ES Volume IV (**EN010166/APP/6.4**) (Requirement 13: operational and maintenance management plan).
22.			Purge discharge will be consistent with the existing Connah's Quay power station, with no more than three hours commencing on the ebb tide one hour after high water.		
23.	**People**	**Safety**	The detailed design will include the provision of a new fire suppression system including storage tanks and suitable protection measures for surface water drainage in the event of its use.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
24.			Design engineering standards will be incorporated into the Proposed Development for the provision of lightning protection systems on buildings and structures, such as lightning protections (rods) built into structures, will be earthed.		
25.	**People and Place**	**Geology and Ground Conditions**	Secondary containment of operational materials, including chemicals, fuels, and oils, appropriate to the level of risk will be included in the detailed design.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design)

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
			Secondary containment of operational materials, including chemicals, fuels, and oils, appropriate to the level of risk will be included in the detailed design.	Operation.	**Appendix 4-1: Operational / Maintenance Mitigation Register** of the ES Volume IV (**EN010166/APP/6.4**) (Requirement 13: operational and maintenance management plan).
26.			The design of the Proposed Development will include measures that will contain and control any releases of contaminants to ground and surface and foul drainage network.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
27.	**Appearance and Visual Impact**	**Landscape and visual**	The layout of the Proposed Development will follow a broadly linear configuration, with the massing of the main built elements 'centralised' and sited in proximity to the existing Connah's Quay Power Station.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
28.			Suitable materials will be used in the construction of structures to reduce reflections and to assist with breaking up the massing of the buildings and structures.	Procurement.	
29.			The Proposed Development will apply lighter colours at high level and darker colours at low level. The choice of colour is to be developed in general accordance with the completed Environmental Colour Analysis contained in **Appendix 15-F: Colour Analysis** of the ES Volume IV (**EN010166/APP/6.4**) to minimise the overall scale and appearance of the Proposed Development.	Detailed design stage.	
30.	**Climate**	**Climate Change**	Due to anticipated extreme heat events, controls will be incorporated within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted. Controls include that the cooling provisions for both the plant and the gas turbine will comprise a hybrid cooling system, in addition to a CO_2 cooling and compression plant, and an exhaust gas cooling and conditioning plant.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
31.		**Climate Change**	Due to extreme anticipated cold temperatures, snow loading and freezing liquids will be accounted for within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted.		
32.			The materials proposed for the detailed design will be durable and heat-resistant.		
33.	**Place**	**Veteran Trees Materials and waste**	The Proposed Development will be designed to ensure the protection and retention of all veteran trees located within the Order limits.	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
34.			The Proposed Development will ensure the protection and retention of all veteran trees located within the Order limits through the implementation of tree protection measures during any maintenance during operation.	Operation.	**Appendix 4-A: Operational and Maintenance Mitigation Register** of the ES Volume IV (**EN010166/APP/6.4**) (Requirement 13: operational and maintenance management plan).
35.	**Climate**	**Climate Change**	The Proposed Development will be designed for materials optimisation which will maximise the use of prefabricated structure and components.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
36.	**Climate**	**Material Reuse and Recovery**	The Proposed Development will be designed for reuse and recovery and will identify materials that already exist on site or can be sourced from other projects (e.g. reuse of excavated soil for landscaping).	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
Work No. specific design principles					
37.	**Value**	**Generating station (Work No. 1)**	The detailed design of each relevant stage of Work No. 1 will be subject to a design review by the Design Commission for Wales prior to submission of details for that stage to the relevant planning authority for approval pursuant to Requirement 3 of the **Draft DCO** (**EN010166/APP/3.1**).	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
38.	**People and Place**	**Generating station (Work No. 1)**	Chemicals and materials that could pose a risk to the environment through uncontrolled release (e.g., surface water drains) will be stored within appropriate containment facilities including impermeable concrete surfaces, isolated drainage areas and appropriately designed and sized bunds.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
39.			Chemicals and materials that could pose a risk to the environment through uncontrolled release (e.g., surface water drains) will be stored within appropriate containment facilities including impermeable concrete surfaces, isolated drainage areas and appropriately designed and sized bunds.	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).
				Operation.	**Appendix 4-A: Operational and Maintenance Mitigation Register** of the ES Volume IV (**EN010166/APP/6.4**) (Requirement 13: operational and maintenance management plan).

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
40.	**Climate Change**	**Generating station (Work No. 1)**	Design of the Proposed Development will be based on Best Available Technique (BAT) Reference Document (BRefs) for CCGT plants and UK Guidance on Emerging Techniques for Post-Combustion Carbon Capture, including energy efficiency requirements.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
41.	**Place**	**Water supply works (Work No. 3)**	The detailed design will ensure that Work No. 3 does not interact with the riverbed.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
42.		**Construction of surface water discharge (Work No. 5)**	Work No. 5 will include an extension to the existing headwall to create the Proposed Surface Water Outfall.	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).
43.			The design of the new outfall will include modular structures and/ or allow for prefabrication of structures to minimise the presence of wet concrete within the Surface Water Outfall Area.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
44.	**Place**	**Construction of surface water discharge (Work No. 5)**	Should open excavation as part of Work No. 5 be required it will be limited to areas to the edge of the saltmarsh and outside of the existing mudflat habitat and undertaken either by hand or through use of mini diggers. In addition, any large plant required for the lifting of trench support panels, such as cranes and/or long reach excavators, will also be located on the access road to the northern side of the existing Connah's Quay Power Station fence line and will not enter areas of saltmarsh.	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).
45.			Materials storage and location of plant associated with Work No. 5 will be limited to the area between the existing headwall and the existing access road to the northern side of the existing Connah's Quay Power Station fence line or this access road itself within the Surface Water Outfall Area, or otherwise within the Main Development Area.		
46.			Potential impacts to below ground archaeological remains that cannot be avoided by design will be mitigated through a proportionate programme of archaeological investigation, recording and reporting, as detailed in the **Overarching Written Scheme of Investigation for Terrestrial and Marine Heritage Mitigation (EN010166/APP/6.8**).	Construction.	**Overarching Written Scheme of Investigation for Terrestrial and Marine Heritage Mitigation (EN010166/APP/6.8)** (Requirement 9: Archaeology).
47.	**Place**	**Construction of an underground Carbon Dioxide**	A working corridor of 32 m around the route (not necessarily centered) of the Proposed CO_2 Connection Corridor will be applied in which the construction of the Proposed CO_2 Connection pipeline will be undertaken, including all plant movements, material storage, and remediation of ground post-construction.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**)

Ref No.	Design Objective Topic linked to Design Approach Document (EN010166/APP/7.7)	Design Principle Description/Work No.	Design Principle	When the principle is to be implemented	Secured
		(CO_2) pipeline (Work No. 7)			(Requirement 3: detailed design).
48.			The dimensions and extents of temporary haul roads within Work No. 7 will be minimised and the shortest possible straight-line distances will be used where reasonably practicable outside of the proposed temporary compound and the working corridor.	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).
49.			No construction work will occur within a buffer of at least 10 m from the top of bank of the Allt-Goch Tributary.	Construction.	**Framework Construction Environmental Management Plan** (**EN010166/APP/6.5**) (Requirement 4: construction environmental management plan).
50.			Potential impacts to below ground archaeological remains that cannot be avoided by design will be mitigated through a proportionate programme of archaeological investigation, recording and reporting, as detailed in the **Overarching Written Scheme of Investigation for Terrestrial and Marine Heritage Mitigation (EN010166/APP/6.8**).	Construction.	**Overarching Written Scheme of Investigation for Terrestrial and Marine Heritage Mitigation (EN010166/APP/6.8)** (Requirement 9: Archaeology).
52.	**Place**	**Works to provide site access (Work No. 10)**	Work No. 10 will include the provision of new temporary access off the A548 into the Proposed Development.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
53.	**Place**	**Accommodation Works (Work No. 11)**	The existing pedestrian railings (kerbside, at the outer edge of the footpath) within Flint Conservation Area will not be removed or altered for any duration as part of Work No. 11 in order to avoid impacts to the historical character.	Detailed design stage.	**Design Principles Document** (**EN010166/APP/7.8**) (Requirement 3: detailed design).
54.	**Place**	**Landscaping, Biodiversity Enhancement Measures and Boundary Treatment (Work No. 13)**	Work No. 13 will include the creation of open mosaic habitat and saltmarsh habitat as detailed in the **Outline LEMP** (**EN010166/APP/6.9**).	Construction.	**Outline LEMP** (**EN010166/APP/6.9**) (Requirement 10: LEMP).
55.			Work No. 13 will include the management and maintenance of open mosaic habitat and saltmarsh habitat as detailed in the **Outline LEMP** (**EN010166/APP/6.9**).	Operation.	**Outline LEMP** (**EN010166/APP/6.9**) (Requirement 10: LEMP).