Cory Decarbonisation Project

Design Approach Document

Planning Inspectorate Reference: EN010128

Application Document Number: 5.6

April 2025

Revision B

Part 2 of 3

CORY

QUALITY CONTROL

Document Reference		5.6			
Document Owner		Cory Environmental Holdings Limited			
Revision	Date	Comments	Author	Check	Approver
Revision A	March 2024	-	SM	KH	AK
Revision B	April 2025	Updated to account for errata (as requested by the Examining Authority)	SM	KH	AK

Contents

4.0 The Scheme Proposal

4.1 Introduction

This section provides an overview of the Carbon Capture Facility proposal including the operational layout and the wider Site area. This section provides an explanation of the parameters-based approach, mitigation and enhancement, the Illustrative Masterplan; the environmental and access and recreation proposals that will be delivered via the OLaBARDS; and provides an explanation of the 4 main zones of the masterplan.

Parameters-Based Approach and Justification for Flexibility

The DCO application is based on a set of Parameters and the limits of deviation set out on the Works Plans.

The Proposed Scheme would comprise up to two carbon capture plants (one per EfW facility) each with compression, conditioning, and liquefaction plants. There would also be liquefied CO_2 storage tanks.

An alternative single carbon capture plant configuration is also being considered but is not shown in the illustrative masterplan, where two plants was assumed to demonstrate worst-case visual impact.

Cory requires sufficient flexibility in the application to permit the design of the carbon capture project to be progressed by the Carbon Capture Technology Vendor (specialist delivery partner) when selected, while providing sufficient specificity to adequately inform the Environmental Impact Assessment and provide LBB and stakeholders with sufficient project certainty.

Carbon capture technology is well established with several projects of scale currently in operation globally.

Cory has defined the parameters within which the DCO application should be considered based on a technical design that establishes the nature of the processes and scale and nature of infrastructure required to deliver the project.

Flexibility for the approach to the existing Belvedere Power Station Jetty (disused) is retained in the DCO application as a variety of environmental benefits could be provided in either scenarios, and there is little difference in adverse impacts such as to require its removal.

The level of flexibility is controlled through:

- The Parameters set out in the draft DCO submitted with the application, duplicating those set out in Chapter 2 of the Environmental Statement. (Document Reference 6.1.2).
- Works Plans (Document Reference 2.3).
- Draft Requirements submitted within the draft DCO submitted with the application and the outline documents submitted referred to by them, such as the OLaBARDS (Document Reference 7.9).
- Design Principles (section 2.3).
- Design Code (section 6.0).

Approach to Mitigation and Enhancement

The development of the environmental mitigation and enhancement proposals set out in this document and secured through the DCO, is informed by consultation feedback, an understanding of the direct and indirect impacts of the proposal on the natural environment including: impacts on terrestrial fauna and flora, the visual environment; current access to and use of the land; landscape/townscape character and general amenity considerations identified as part of the Environmental Impact Assessment process; and in the light of planning policy considerations.

The mitigation proposals have been structured to follow the mitigation hierarchy (avoid, reduce, remedy/mitigate, compensate) with the project proposal clearly structured to indicate the nature of the mitigation, with much addressed through avoidance through consideration of Development Zone alternatives (described in the TSAR) and reduction and remedy/mitigation embedded in the design proposals described in this document.

The project has also committed to meeting a minimum 10% BNG requirement, in line with emerging legislative and policy intent.

Enhancement proposals are informed by the project impacts and resulting mitigation and the BNG commitment. The enhancement proposals provide betterment beyond mitigation and BNG delivery and have been developed in response to opportunities identified during the project evolution, consultation and in response to wider social value outcomes identified.

Enhancement proposals include:

- Nesting boxes and platforms
- Tree planting
- Hides and viewpoints
- Interpretation and wayfinding
- Car parking and cycle parking
- Access improvements
- Ditch maintenance

Alternatives

As described in the Design Development section (section 5.0), various Development Zones were explored as part of a structured Terrestrial Site Alternatives Report (TSAR) (Document Reference 7.5) for the terrestrial elements of the proposals, and Jetty locations as part of the Jetty Site Alternatives Report (JSAR) (Document Reference 7.6). These studies explored the likely impacts of alternatives to inform the selection of the preferred Development Zone.

4.2 Illustrative Masterplan

The Masterplan illustrates how the Proposed Scheme could be delivered based on the Parameters, Works Plans, Design Principles (section 2.3), and Design Code (section 6.0) within the chosen Development Zone for the Carbon Capture Facility.

The key elements of the illustrative masterplan are highlighted in the annotated plan and masterplan diagram that comprise 4 zones:

- Zone 1 - Carbon Capture Facility which includes a full description of the components of the operational carbon capture facility and the relationship to the proposed project parameters.
- Zone 2 – Nature Reserve and Open Land
- Zone 3 – Thames Path and Jetties
- Zone 4 - Norman Road

Figure 4.1 Illustrative masterplan in context

Figure 4.2 Illustrative masterplan proposals

4.3 Environmental Proposals

The Environmental Proposals have been developed in response to the planning policy and strategy, project opportunities and constraints identified in the earlier stages of design development and environmental appraisal. Priorities include:

- Mitigating the loss of Local Nature Reserve area and habitats within the Site.
- Mitigating visual impact of the development through landscape proposals which will establish a buffer zone comprising planting of appropriate character associated with an enhanced ditch habitat that will minimise the impact on visual openness arising from the CCF and integrate the CCF into its setting.
- Securing the beneficial use of Metropolitan Open Land (MOL) supporting the promotion of public access, outdoor recreation, retaining and enhancing landscapes, visual amenity, biodiversity or to improve damaged or derelict land.
- Protecting Open Space, avoiding loss of accessible open land.
- Protecting land where possible, that forms part of the Southeast London Green Chain as important environmental, recreational, and educational resource and seeking to improve public access to and through the area and promoting it as a recreational resource and visual amenity.
- Protecting and enhancing the biodiversity, heritage, and value of open spaces, through habitat enhancement and creation, and the enhancement of the proposed open space through the development of an expanded CLNR.
- Supporting the creation of new cycling and walking routes to connect publicly accessible open spaces, through the access proposals.
- Protecting existing amenity space that has been provided as part of a development, through the provision of an extended CLNR to address loss of area required for the CCF.
- Delivery of enhanced ecological value through a minimum 10% Biodiversity Net Gain (BNG)
- The Green Infrastructure Strategy detailed in section 5.2 underpins the Environmental Proposals and details the habitat creation and enhancement plans illustrated in Figure 5.5 bringing forward proposals for creating and improving habitat, implementing priorities for the recovery of nature. These habitats and improvements would be delivered through the Outline LaBARDS. The habitats comprise:
    - Proposed nesting habitat
    - Proposed vegetation enhancement
    - Works to enhance existing ditches and reed habitat
    - Proposed ditches and habitat
    - Proposed wetland areas
    - Proposed attenuation basins
    - Enhanced grazing marsh
    - Proposed wood pasture
    - Proposed woodland
    - Proposed grassland
    - Proposed trees
    - Proposed meadow
- Consultation with Friends of Crossness Nature Reserve has identified further opportunities for enhancement following formal consultation which would be subject to ongoing scoping as part of the development of the detailed LaBARDS and include:
    - Establishment of bird and owl boxes
    - Enhanced habitat
    - Boardwalks
    - Water level controls
    - Hides
    - Ditch vegetation management

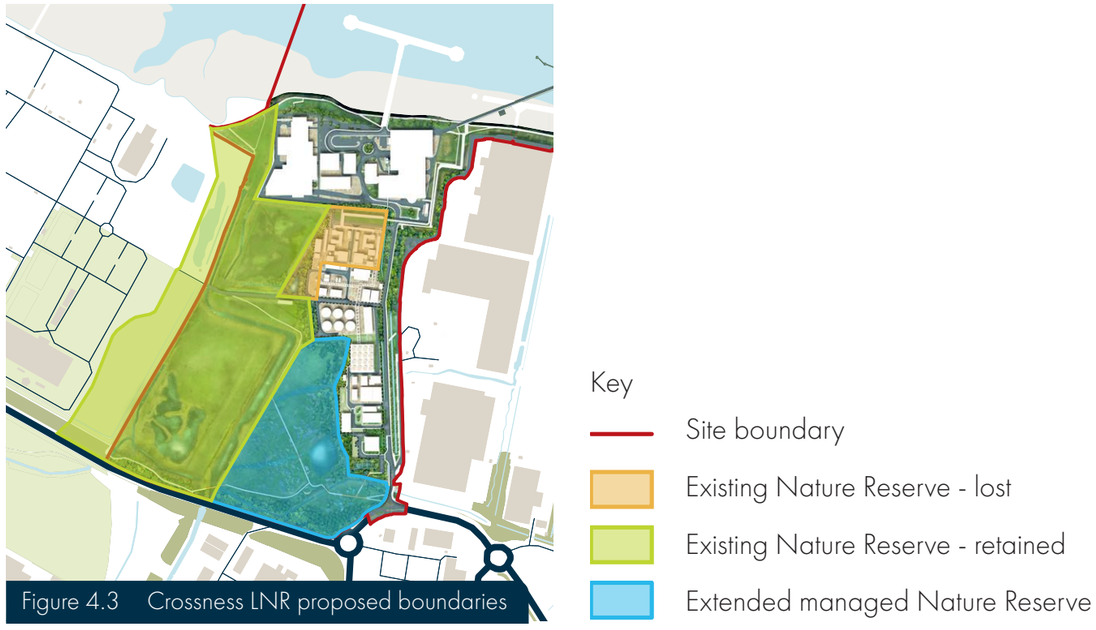


Figure 4.3 Crossness LNR proposed boundaries

Figure 4.4 Crossness Local Nature Reserve

The Environmental Proposals are underpinned by 3 main elements:

One Nature Reserve

Expand the existing Crossness Local Nature Reserve into Norman Road Field (the land immediately south and west of the CC Facility) providing a gain of 5-6ha for land under CLNR management shown in Figure 4.3.

Diverse Grazing Marsh and Biodiversity

Improving the distinctiveness and condition of existing valued flood plain grazing marsh habitats, delivered by raising water table and managed grazing densities, delivering direct mitigation for the physical loss of grazing marsh habitat.

Offsite Compensation

Areas of habitat lost due to the development to be re provided for and delivered on site where possible. Thamesmead Golf Course, amongst other offsetting options, has been identified as a possible opportunity to deliver Biodiversity Net Gain (BNG) equating to 10%.

The Environmental proposals will be delivered pursuant to the development of the Outline LaBARDS submitted with the DCO application.

Key

- Site boundary
- 1 Existing ditch relocation associated with flue gas ductwork
- 2 Attenuation basin
- 3 Potential relocation of stable block
- 4 Tree planting screening
- 5 Enhanced grazing marsh
- 6 Wetland habitat
- 7 Boardwalk over wetland habitat
- 8 Attenuation basin/water storage

Figure 4.5 Illustrative environmental proposals

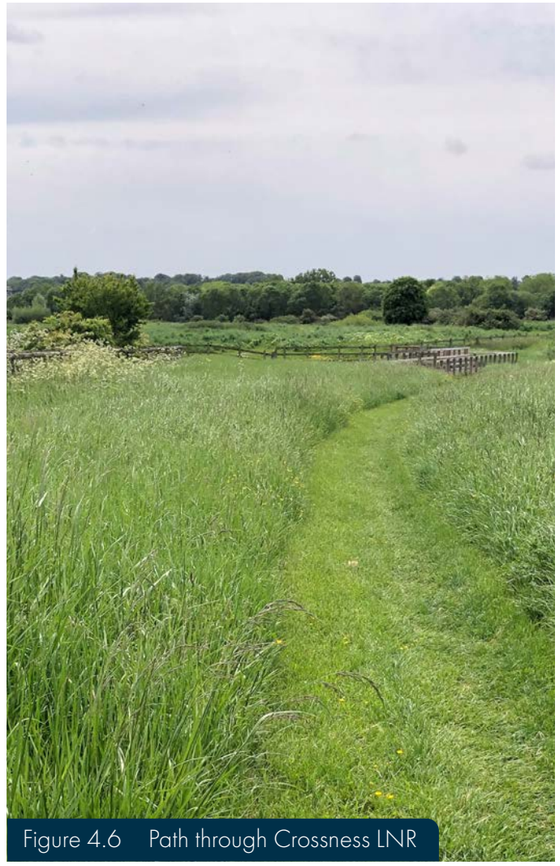


Figure 4.6 Path through Crossness LNR

Figure 4.7 Dipping pond and structure

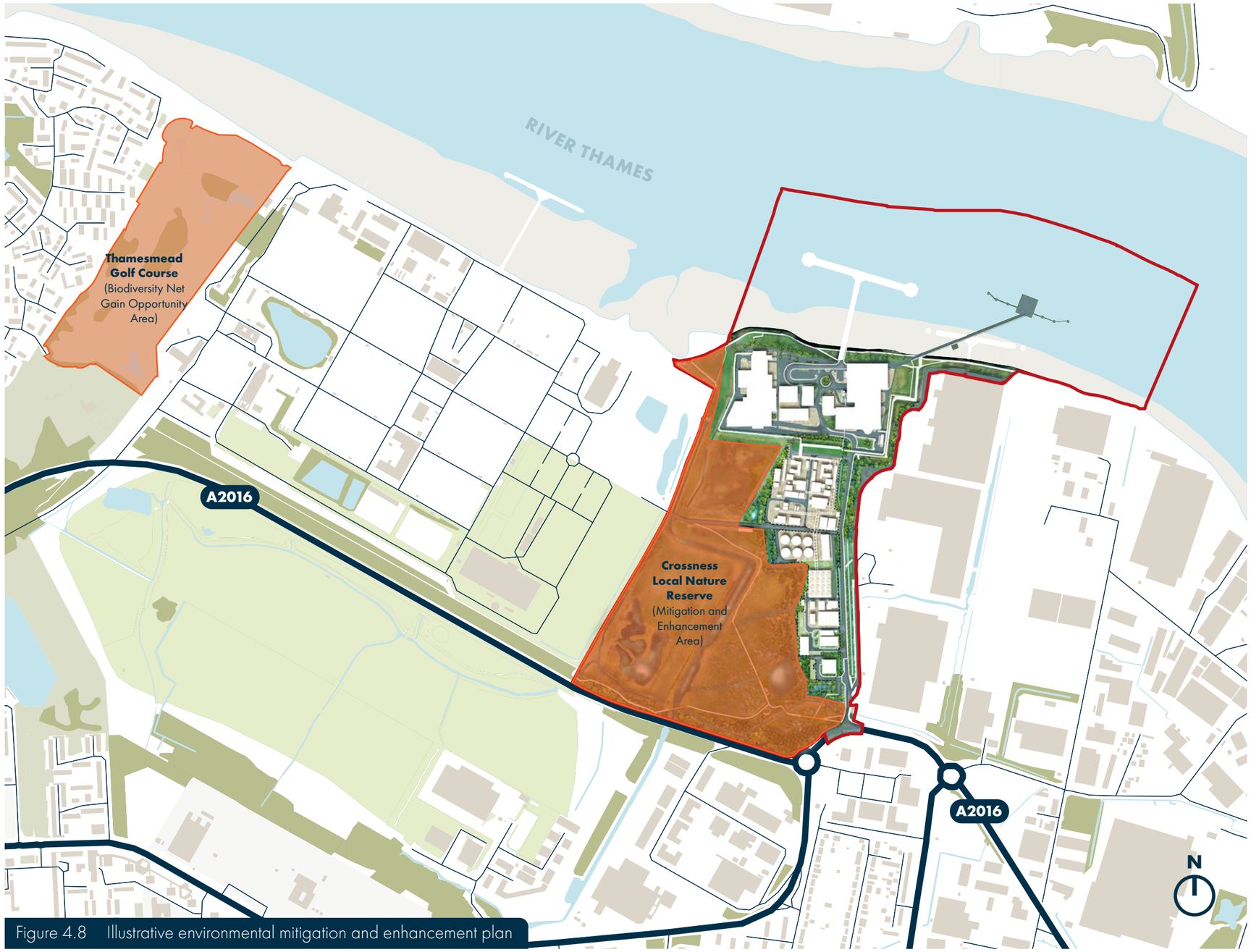


Figure 4.8 Illustrative environmental mitigation and enhancement plan

4.4 Access and Recreation Proposals

The principle of improving access to open space for the community and user groups, and enhancing public right of way routes and connectivity, including the quality and safety of routes, are defined in several Design Principles detailed in section 2.3 and are illustrated on illustrative plans within this document.

The masterplan delivers new local footpath connections and circular recreation routes of varying lengths, linking around the Cory Campus itself via the Thames Path and to and from Thamesmead and beyond including improvements to the existing designated routes (see Figure 4.9), enhanced wayfinding, strengthened CLNR identity, accessibility, surveillance, and safety for users.

The existing PRoW where opportunities have been identified for enhancement comprise:

- Establishing a generous new entrance to Norman Road Field and the proposed expanded CLNR at the southern end of Norman Road setting back the existing field boundary to allow for a wide paved entrance and orientation signage.
- FP1 - the existing route extending west towards Thamesmead and parallel to Eastern Way (offsite) including improved signage and vegetation management.
- FP2 - improved footpath construction through wetter areas for year-round accessibility, lifting levels and utilising boardwalks and causeways where necessary without causing detrimental effect to grazing marsh habitat.
- FP3 - improvement in the existing context of the Thames Path including possible removal of redundant/dilapidated river wall structures, improvements in river wall access openings (gates etc) provision of quality signage.
- FP4 - improvement in the quality of the public realm associated with the existing PRoW extending east of Riverside 1.

New PRoW connections have been identified, comprising:

- Establish a link connecting FP2 to FP1 forming a connection from Norman Road Field to Thamesmead.
- Establish a link between FP3 Thames Path to the CLNR approaching from the east and as an arm extending off the existing FP2.

Key

- Site boundary
- Hide/wildlife viewing area
- Rationalisation of fencing
- Bird nesting habitat feature
- Outdoor education area
- Improved and new pedestrian connections
- Biodiversity enhancements
- Woodland management improvements
- Improved signage strategy
- Visitor parking opportunity

Figure 4.9 Illustrative access and recreation proposals

The recreation proposals include provision of way finding, visitor and education facilities as part of the enlarged CLNR and through improved visitor interpretation facilities with clear information to support full use of accessible open land to support an enhanced appreciation and enjoyment of the recreational amenity.

These proposals will improve access to Open Space for the local community and user groups in close proximity to the local community, in the vicinity of the existing rights of way and road crossing facilities and local public transport connections.

The proposal also includes features to improve public awareness of local nature including bird hides and learning facilities within the CLNR and along the Thames Path, and interpretation boards at points of interest such as the Belvedere Power Station Jetty (disused) and information on the history of horse grazing and how to behave as a walker in the presence of horses.

The masterplan delivers long term/sustained improvements in the local environment through an enlarged and comprehensive masterplan approach, unified management, and enhanced public access strategy.

The Access and Recreation proposals are delivered via the Outline Landscape, Biodiversity, Access, and Recreation Delivery Strategy – Outline LaBARDS which is submitted for approval as part of the DCO application.

Figure 4.10 Illustrative sketch of an outdoor classroom

4.5 Masterplan Zones

The masterplan consists of 4 zones:

- Zone 1 - Carbon Capture Facility
- Zone 2 - Nature Reserve and Open Land
- Zone 3 - Thames Path and Jetties
- Zone 4 - Norman Road

Figure 4.11 Masterplan zones

Zone 1 - Carbon Capture Facility

The operational Carbon Capture Facility (CCF) comprises a long broadly rectangular site that extends from Riverside 1 and 2 in the north, through the East Paddock within the existing Crossness Local Nature Reserve (CLNR) and the designated industrial land west of Norman Road, towards the existing ditch to the south.

Zone 2 - Nature Reserve and Open Land

This zone comprises the land immediately south and west of the CCF known as Norman Road Field, and a portion of the Crossness Local Nature Reserve (CLNR) east of the protected area of the CLNR, both of which are designated as Metropolitan Open Land. This land area forms the Mitigation and Enhancement Area.

Zone 3 - Thames Path and Jetties

Northeast of Riverside 1 a new Jetty for CO_2 export is proposed within the River Thames, extending beyond the existing Belvedere Power Station Jetty (disused). The Proposed Jetty provides connection to Riverside 1 for access and carry's ducts back toward the CCF spanning across the Thames Path, foreshore, and Belvedere Power Station Jetty (disused). The ducting is carried in a framework structure at high-level allowing for adequate clearance beneath, whilst reaching the required levels at the Jetty to allow for docking vessels.

Zone 4 - Norman Road

Norman Road forms the main access to the Riverside Campus and the proposed CCF with a number of new points of access along its length and connection to the public right of way providing access to the Thames Path. This zone also includes the Utilities Connections Corridor.

Zone 1 - Carbon Capture Facility

The Terrestrial Site Alternatives Report (Document Reference 7.5) provides a reasoned case for the preferred Development Zone (South 1) based on a structured process and this document, the DAD, sets out the finer grained layout/shape design development process summarised in section 5.0 of this document.

The Carbon Capture Facility results in the loss of 2.5ha of semi-natural grazing marsh habitat that forms part of the existing Crossness Local Nature Reserve and Metropolitan Open Land, and the removal of the existing Munster Joinery works.

The shape and layout of the Carbon Capture Facility is ultimately informed by 4 key drivers referred to in section 5.1 of this DAD:

- Carbon Connections
- Access and Edges
- Buffering
- Generous Main Point of Arrival

The Thames Water Access Road will either be retained or subject to a small diversion to allow it to continue to be used during operation of the CCF.

The layout of the operational facility comprises 5 areas and the content of each area is described in subsequent pages of this section of the DAD. The 5 areas comprise:

1. Flue Gas Carbon Capture/Absorption

2. Compression/Liquefaction and Storage

3. Cooling

4. Transformers, Switch Rooms, and Water Treatment

5. Maintenance, Welfare, and Heat Transfer

Figure 4.13 illustrates the Carbon Capture Facility process diagram identifying the nature and movement of CO_2 during its processing and the different processes within the facility. The heavier industrial process structures lie within areas 1 – 3.

The Design Principles (in section 2.3) propose the reduction in height and density of the facility 'dismantling' from north to south reflecting the transition from the industrial river to the community at Belvedere.

Large overhead ducting will connect to the flues of Riverside 1 and 2, passing over the ditches on south side of the Riverside 2 facility's south and western boundaries.

The tallest elements of the CCF, comprising the absorber columns and flue stacks, are located in the north portion of the Site, grouped with existing tall industrial features which characterise stretches of the river.

The liquified CO_2 storage vessels and liquefaction plant are located immediately to the south of the Thames Water Access Road and comprise multiple spherical or cylindrical vessels which lie within their own ground level containment area. The cooling system lies to the south of the storage and liquefaction plant.

Areas 4 and 5 are characterised by a more organised collection of buildings with a mix of functions including offices, control room, welfare, water treatment, heat transfer and substations. These structures provide opportunities for less operationally constrained design solutions and more flexible material finishes. Opportunities for 'responsive' building design and elevational treatment, responding to the proposed new entrance to the Crossness Nature Reserve will be explored.

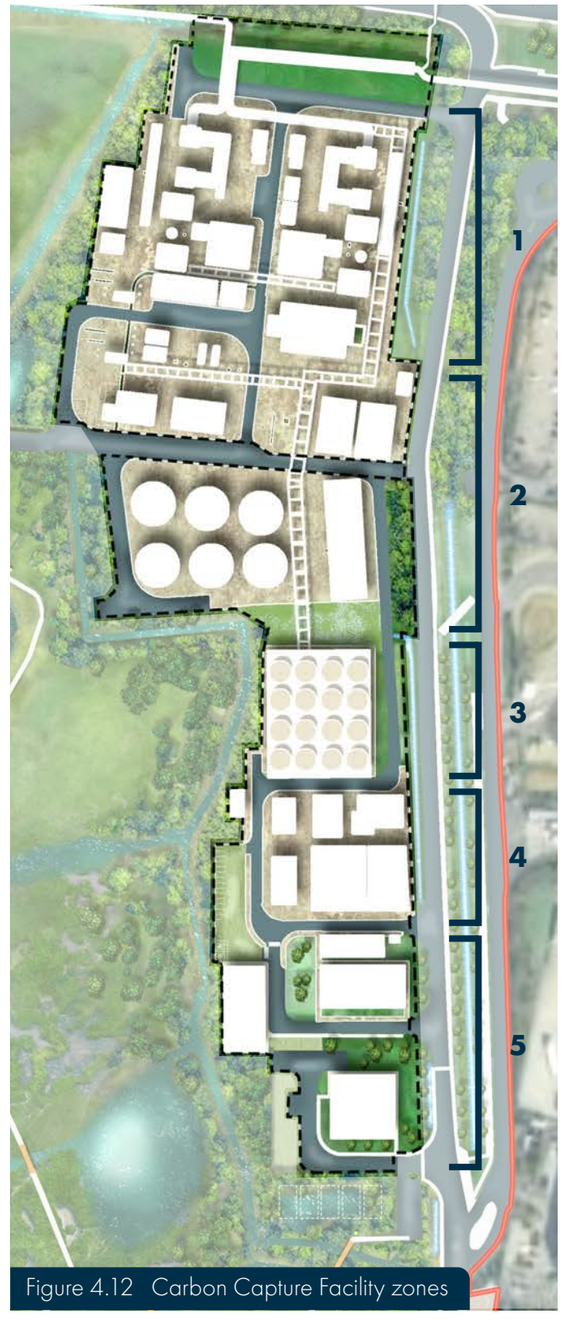


Figure 4.12 Carbon Capture Facility zones

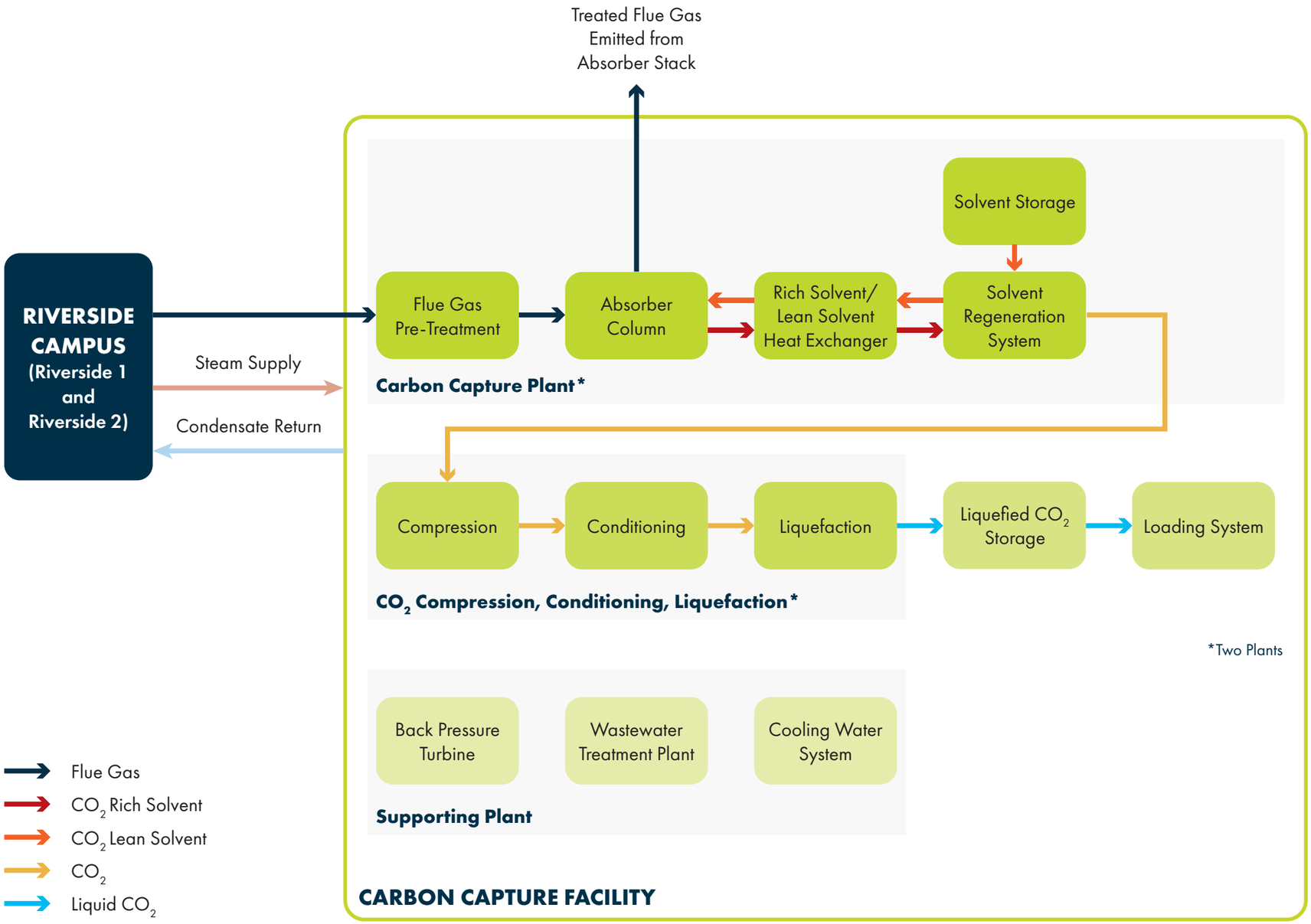


Figure 4.13 Carbon Capture Facility process diagram

Carbon Capture Process

Flue Gas Pre-Treatment

A new connection into the existing flue gas lines of Riverside 1 and Riverside 2 will be required, prior to the connection reaching their existing exhaust stacks, to route the flue gas through new ducting into the Carbon Capture Plant(s).

Flue gas conditioning is achieved through a Direct Contact Cooler. This cools and condenses water out of the saturated flue gas and treats residual components (sulphuric and nitric acids) within the flue gas prior to it reaching the Absorber Column.

Absorber Column and Stack

In the Absorber Column, as the cooled flue gas moves upwards, the CO_2 within the flue gas will be absorbed by an amine-based solvent. Post CO_2 absorption, the flue gas will continue upwards to the water wash component of the Absorber Column. This will maintain the flue gas water balance, recover chemical vapour and control chemical emissions.

The treated flue gas will be re-heated and then emitted into the atmosphere, via a new Absorber Stack at the top of the Absorber Column. There will be a stack on each Absorber Column, adding up to two new stacks to the Riverside Campus. The overall stack height may be slightly greater than the height of the existing Riverside 1 and future Riverside 2 stacks.

The flue gas emissions will be continuously monitored via a Continuous Emissions Monitoring System (CEMS).

The CO_2 rich amine-solvent will accumulate at the bottom of the Absorber Column, separate from the now treated flue gas. The CO_2 rich amine-solvent will be pumped through a solution heat exchanger to the Regenerator Column.

Solvent Regeneration System

The Solvent Regeneration System consists of the Regenerator Column and Solvent Processing System.

In the Regenerator Column, low-pressure steam indirectly heats the CO_2-rich amine-based solvent solution, stripping the CO_2 from the amine-based solvent solution. A condenser then condenses the solvent vapours, releasing (wet) CO_2-rich stream to be sent for downstream CO_2 Compression and conditioning.

Rich Solvent/Lean Solvent Heat Exchanger

The CO_2-lean solvent is required to be cooled prior to being sent back to the Absorber Column to absorb CO_2 once again from the incoming flue gas.

A Rich Solvent/Lean Solvent Heat Exchanger is utilised. This acts to:

- cool the CO_2-lean solvent at the Regenerator Column outlet before it is further cooled via the Cooling Water System.
- heat the CO_2-rich solvent at the Regenerator Column inlet.

CO_2 Compression, Conditioning and Liquefaction Plants

In order to export the captured CO_2, Cory will engage in a contract with a CO_2 Transport and Storage operator. The operator will, at a minimum, operate the underground CO_2 storage site that the CO_2 is transported to, but may also operate the ships for transport of CO_2 to the storage site. The CO_2 storage operator will have a specification that all emitters using the service must adhere to. This requires the captured CO_2 to undergo compression, dehydration, removal of contaminants and liquefaction to meet the stipulated conditions.

Compression

The captured (wet) CO_2 will be transferred from the Regenerator Column to the Compression Plant, using above ground pipelines. The compressed CO_2, at around 16 bar pressure and a temperature of 40°C, will be routed via above ground pipelines for Conditioning.

Conditioning

After compression, the CO_2 stream will need to be dehydrated prior to liquefaction, as it will still be water saturated, in order to avoid the water freezing in the liquefaction plant.

Solid desiccant dehydration will be used; this is a process utilising adsorption to retain water on the surface of the desiccant particles (such as molecular sieve or silica gel), typically within adsorber vessels. The dehydrated dry CO_2 will be routed for liquefaction and refrigeration via above ground pipelines.

Liquefaction and Refrigeration

The liquefaction process consists of passing the dry CO_2 stream to be cooled; this can be undertaken via expansion of the gas to a liquid-vapour state via a control valve or turbine (open-cycle), or through a heat exchange system.

Further conditioning equipment will be required (such as a distillation column) to remove non-condensable components, such as oxygen and nitrogen, so that the CO_2 export specification can be met.

Venting

There will be a requirement of operational and emergency venting of CO_2. Operational venting occurs during start-up and shutdown (during maintenance outages or emergency shutdown scenarios) of the Carbon Capture Facility, and emergency venting in the event of any unscheduled shutdowns.

Liquefied CO_2 Storage and Loading System

Onshore Buffer Area

Buffer onshore storage is required to store the LCO_2 prior to onwards ship export via the Proposed Jetty. This will be stored in insulated, pressurised, above ground storage tanks. Spherical tanks were used to inform the extent of the Carbon Capture Facility as to retain flexibility within the design.

Marine Loading and BOG Processing

The LCO_2 will be pumped from the LCO_2 storage tanks to the Proposed Jetty via above ground pipelines. The pipelines will follow a route on the landside Elevated Process Pipe and Duct Bridge, leading to the Elevated Process Pipe Bridge on the Proposed Jetty, delivering the LCO_2 into storage tanks within the vessels via a Marine Loading Arm.

Supporting Plant

Cooling System

A hybrid approach consisting of reducing demand by treating potable water, supplemented by the internal recycling of the process wastewater, has been assessed to be the optimum solution for the Carbon Capture Facility. This will comprise Wet-Dry Cooling Towers, a cooling water circuit and cooling water supply pumps.

Flue Gas Supply Ductwork

A new connection into the flue gas lines, known as flues, for Riverside 1 and Riverside 2 will be required, prior to their respective exhaust stacks, to route the flue gas via new ducting to each of the Carbon Capture Plants.

Stream Extraction and Steam Processing

Steam is required for several processes within the Carbon Capture Facility. Predominantly, steam is supplied for indirect use in the Solvent Regeneration System, in which heat is dissipated to release the CO_2 from the CO_2-rich amine based solvent.

For the Carbon Capture Plants, steam will be extracted from Riverside 1 and Riverside 2 respectively and supplied to the required process via above ground pipelines.

Back Pressure Turbine and Generator

To maximise process efficiency, the Carbon Capture Plants will be supported by one Back Pressure Turbine and one Pressure Reducing De-Superheating Station. The Back Pressure Turbine will maximise the extraction of energy within the steam. The Pressure Reducing De-Superheating Station will refine the temperature and pressure of the steam exiting the Back Pressure Turbine, to make it suitable for use in the Solvent Regeneration System.

In addition to conditioning the steam required for the carbon capture process, the Back Pressure Turbine will also supply an amount of the electrical power required for the Proposed Scheme.

Chemical Storage and Distribution Handling Facilities

Chemical Storage and Distribution Handling Facilities are necessary to process the amine-based solvent required for both of the Carbon Capture Plants and for the Water Treatment Plant.

All liquid chemicals stored on site will be kept in bunded controlled areas, with a minimum volume of 110% of storage capacity and be segregated, in order to minimise the risk of contamination to process and surface water.

Solvent Storage

Amine Solvent Storage tanks will be located within the Carbon Capture Facility, to store a supply of fresh amine solvent for both plants within the Carbon Capture Facility.

Water Treatment Plant – Process Water Supply

A Water Treatment Plant is required within the Carbon Capture Facility to provide process water for the evaporative cooling, wash water and chemical makeup systems. The feed water supply will likely use a combination of potable water from Thames Water and recycled treated effluent from the Carbon Capture Facility.

The condensate from the flue gas Direct Contact Cooler will be cooled before treatment, by ultrafiltration, to remove particulate matter. The filtered flue gas condensate will then either:

- be blended with potable water for use in the Cooling System; or
- undergo further treatment by reverse osmosis to produce the demineralised water used in the flue gas water wash (Absorber Column).

Wastewater Treatment Plant

Wastewater will be generated by the Water Treatment Plant itself. This will include backwash water from the ultrafiltration membrane process, concentrate from the nanofiltration membrane process and membrane cleaning solutions. Backwash water will be treated and recycled back into the cooling water supply. Membrane cleaning solutions will be neutralised.

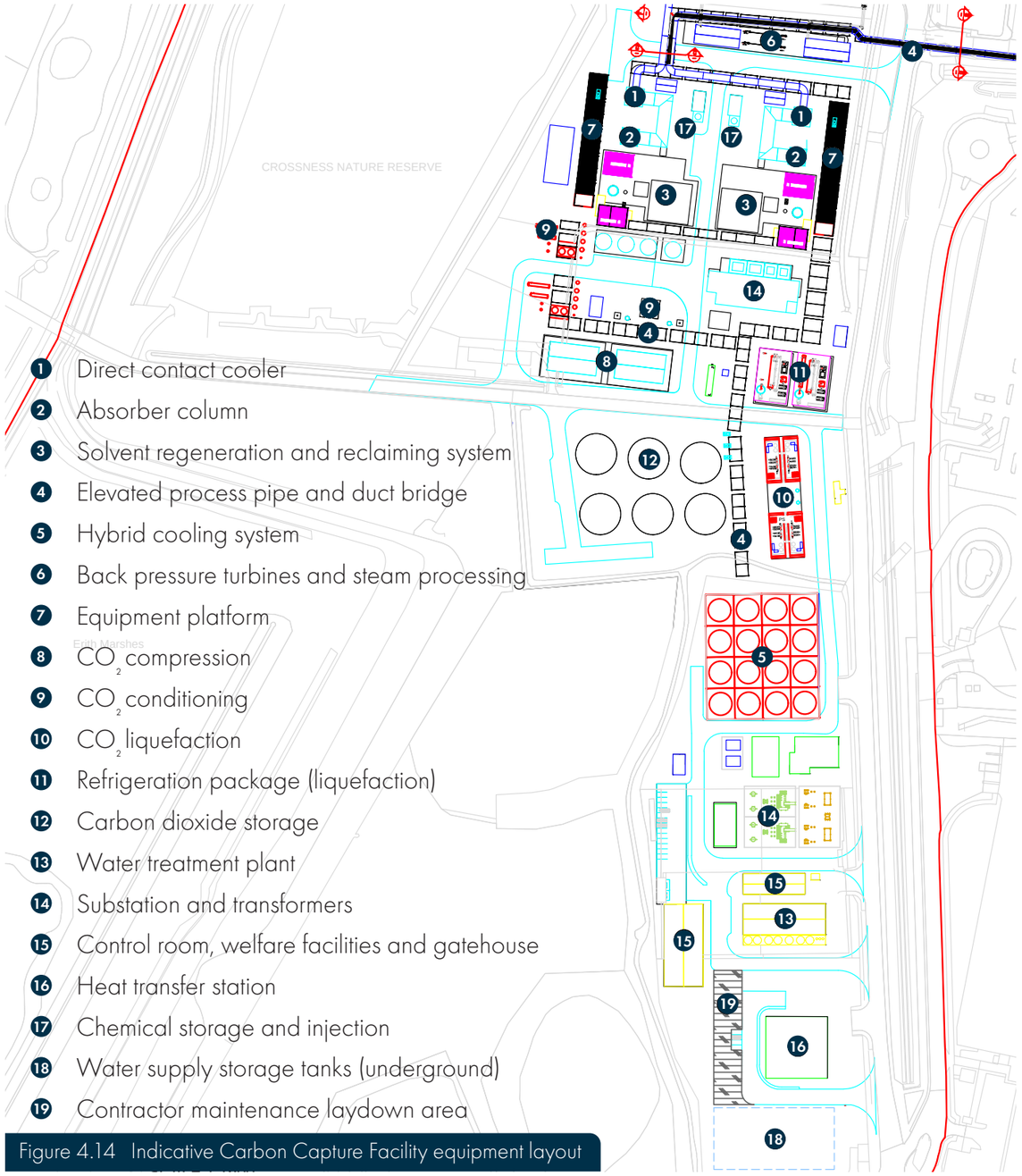


Figure 4.14 Indicative Carbon Capture Facility equipment layout

Zone 1 - Works Plans and Project Parameters

The Project Parameters and the Works Plans describe the extents of the Proposed Scheme, which form the Rochdale Envelope that is being assessed in the Environmental Impact Assessment. The Project Parameters for each Zone of the masterplan are described below.

The operational design for the Proposed Scheme for each masterplan zone, is described in subsequent pages with the images representing what a proposal could look like delivered under control of these Works Plans and Project Parameters, whilst accounting for the Design Principles and Design Code.

The lateral extents of the different parts of the Zone 1 of the Masterplan are shown on the Works Plans: Work No. 1, 1A – 1E and are concerned with control of the extents of the Carbon Capture Facility, whilst allowing for future design development, flexibility in procurement of systems and allowing for innovation.

For boundary treatments of these extents, refer also to section 5.2 of this document: Edges and Interfaces that deals with the relationship of the CCF to the west and the CLNR and east in relation to Norman Road.

The Project Parameters step down in height from north to south, reinforcing the Design Principles defined in section 2.3 which require a stepping down of height from the northern industrial area towards the Belvedere community in the south. Together the vertical and lateral limits enable a flexible parameter to support ongoing design refinement.

The height parameters are expressed as five main blocks of height. Some parameter extents overlap and three are of similar height:

- Absorber Column - 116m AOD
- Carbon Capture Plant - 53m AOD
- CO_2 Processing - 50m AOD
- CO_2 Storage - 48m AOD
- Supporting Plant - 35m AOD

Key

- Work No. 1 - Carbon Capture Facility
- Work No. 1A - Carbon Capture Plant(s)
- Work No. 1B - Absorber(s) and Stack
- Work No. 1C - CO_2 Processing Plant
- Work No. 1D - Liquid CO_2 Storage
- Work No. 1E - Supporting Plant

Figure 4.15 Work No. 1 - 1E

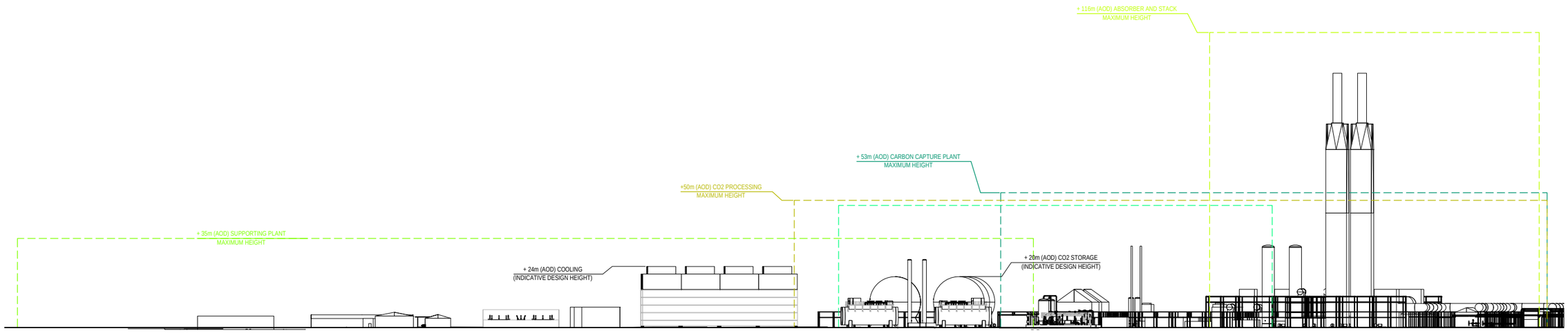


Figure 4.16 East elevation - height parameters

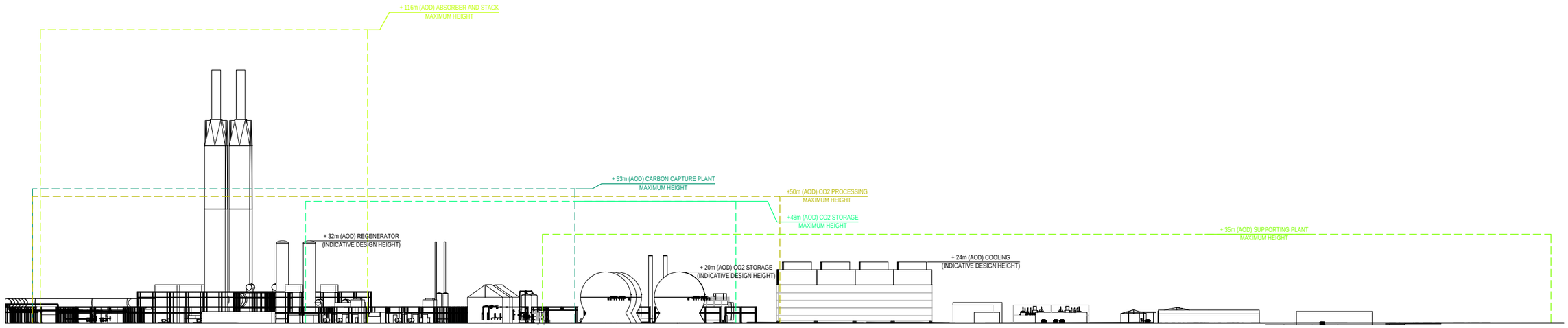


Figure 4.17 West elevation - height parameters

Zone 2 - Nature Reserve and Open Land

The proposal uses Norman Road Field to provide mitigation for the loss of flood plain grazing marsh and ditch habitat resulting from the CCF proposals, creating new and enhanced grazing marsh habitat. In addition, the integration of the CCF will be supported with ditch habitat enhancement works that tie into the boundary planting proposals for the CCF itself.

To mitigate and compensate for habitat loss, and provide real enhancement to the habitat network on site, the following measures are being developed as relevant for terrestrial biodiversity:

- Enhancement of existing floodplain grazing marsh onsite.
- Creation of new ditch and reedbed habitat both on and offsite.
- Creation of new neutral grassland habitat on and offsite.
- Creation of open mosaic habitat offsite.
- Habitat creation would replace supporting habitat for other protected and notable species, foraging, and commuting habitat for bats, nesting habitat for breeding birds, foraging habitat for wintering birds, habitat for reptiles and invertebrates.
- Open water and reedbed creation will be a key feature to provide replacement habitat for water voles due to loss of such habitats within the footprint of the proposed Carbon Capture Facility.

Other mitigation and enhancement measures in this zone include:

- Capture and displacement/translocation of water voles to newly created replacement open water/reedbed habitat provided out of the Carbon Capture Facility construction footprint. This may involve an intermediate step of captive breeding. Capture and translocation will be undertaken under an appropriate Natural England licence.
- Increasing the biodiversity value of deciduous woodland habitat within the Site through a programme of management .
- Increasing the value of offsite neutral grassland habitats by a mixture of changes in management and seeding/planting.
- Management of ditches and watercourses to improve aquatic planting species diversity and ultimately macroinvertebrates and fish.
- Control of American mink (an invasive species and significant predator of water vole) through survey and trapping to ensure water vole populations are not predated by this species.
- Controls on timing of maintenance activities to avoid them occurring during sensitive periods, such as at night during the bat active season, early morning during the bird breeding season, and during dusk/dawn feeding periods during the season when wintering birds are present.
- Pollution control measures to avoid effects of surface water run-off on habitats and species.
- Control of operation phase lighting to focusing on the Carbon Capture Facility, the Proposed Jetty, and Ancillary Infrastructure and to maintain dark corridors around designated sites and key habitats.
- Additional environmental enhancement proposals are identified in section 4.3.

Cory's proposal is to support the delivery of an enlarged Crossness Local Nature Reserve under a single management plan providing wider amenity and biodiversity benefits across a larger land area.

The CLNR land identified within the red line boundary has been included to provide opportunities for further enhancement works, including habitat creation/improvement, improved public rights of way connections and to improve interpretation/visitor experience works. The existing CLNR Management Plan identifies objectives and a 'Wish List' for improvement and management for the reserve. Our proposals provide opportunities for some of the remaining objectives to be delivered, including provision of:

- year-round accessibility.
- learning/education opportunities.
- control of water levels crucial to sustaining grazing marsh in a healthy condition.

Zone 2 - Works Plans

Zone 2 of the Masterplan is controlled with Work Plan: Works No. 7. Work Plan 7 describes the proposed works in the Mitigation and Enhancement Area, located to the south and west of the Carbon Capture Facility to deliver enhanced habitats through works to support the re wetting of the existing flood plain grazing marsh and to enhance the recreation potential of the area. No new operational infrastructure associated with the Carbon Capture Facility is proposed to be located on the land within the Mitigation and Enhancement Area.

At the edge of this area, Work No. 2 describes the alignment of the pipework required to connect to Riverside 1 and 2 which fringes the existing CLNR and Riverside 2 site and also defines the proposed relocation of the existing CLNR perimeter ditch to the south and west of the pipework to form the redefined edge of the CLNR. Refer also to section 5.2 Edges and Interfaces for illustrative material that illustrate the relationship of the connecting pipework to the CLNR and FP4.

Within this area there will be a permanent diversion of an existing PRoW Footpath FP2. This PRoW realignment is required to provide a sufficient safety offset from the CCF, whilst allowing for appropriate levels of screen planting.

An explanation of the reasoning for the proposals being considered for the Mitigation and Enhancement Area is set out in the Outline Landscape, Biodiversity, Access, and Recreation Delivery Strategy (OLaBARDS) (Document Reference 7.9).

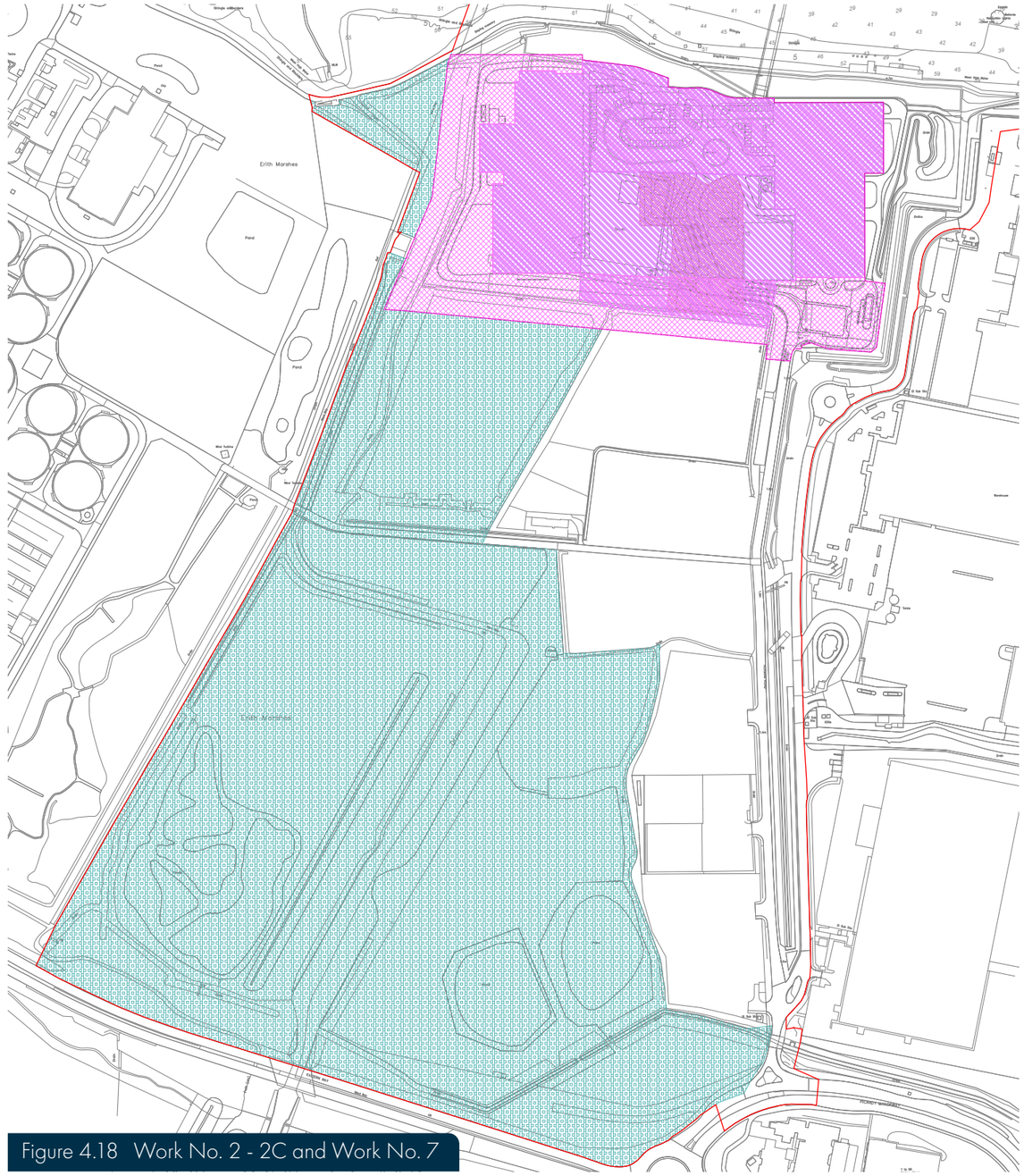


Figure 4.18 Work No. 2 - 2C and Work No. 7

Zone 3 - Thames Path and Jetties

The new dedicated export jetty structure supports the export of the Liquid CO_2 to the final deep sea storage site. The proposed jetty will sit approximately 130m downstream of the existing Middleton Jetty, with its front face at a distance of approximately 140m from the southern bank of the River Thames. This structure has been positioned within an appropriate distance from the landside facilities to achieve optimum balance between dredging volumes and access trestle/piping infrastructure length while taking into consideration navigational requirements.

The proposed jetty has been designed to accommodate vessels ranging from 130m to 180m in length, with a draft of up to 9m, and is able to safely handle the berthing and mooring loads which would be imposed on it. The jetty will feature a central loading platform to facilitate the loading of Liquid CO_2 into the tanks within the vessels and will house the main operations equipment featuring Marine Loading Arm and Vapour Return Arm, pipe racks, lighting, fire suppression systems.

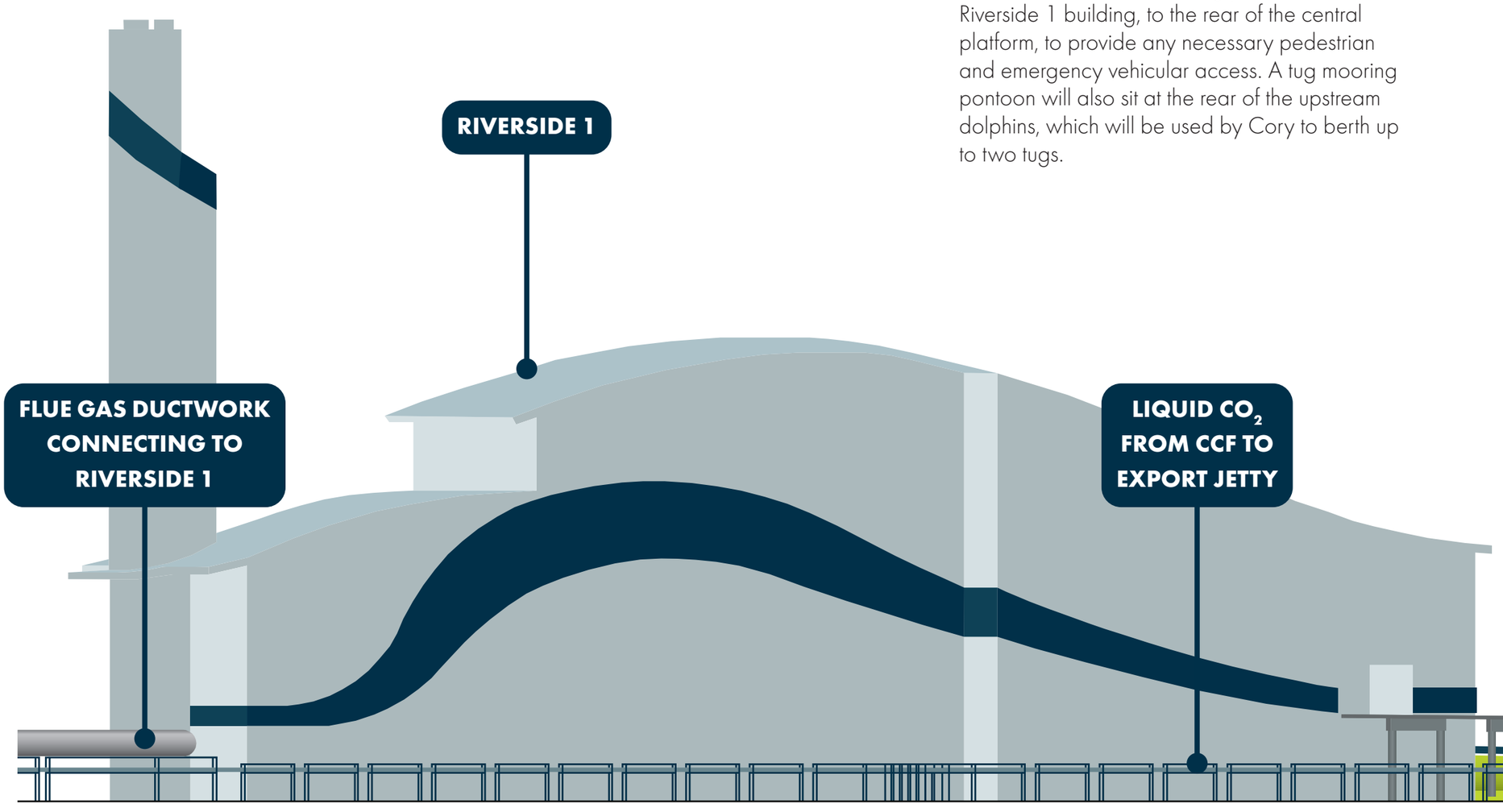


Figure 4.19 Illustrative section of Riverside 1 and the Proposed Jetty

The loading platform is flanked by 2 No. berthing dolphins and 6 No. mooring dolphins. These mooring dolphins will be connected via a series of access catwalks, and an access trestle, which supports the pipework and access routes, will run from a landing point at the Riverside 1 building, to the rear of the central platform, to provide any necessary pedestrian and emergency vehicular access. A tug mooring pontoon will also sit at the rear of the upstream dolphins, which will be used by Cory to berth up to two tugs.

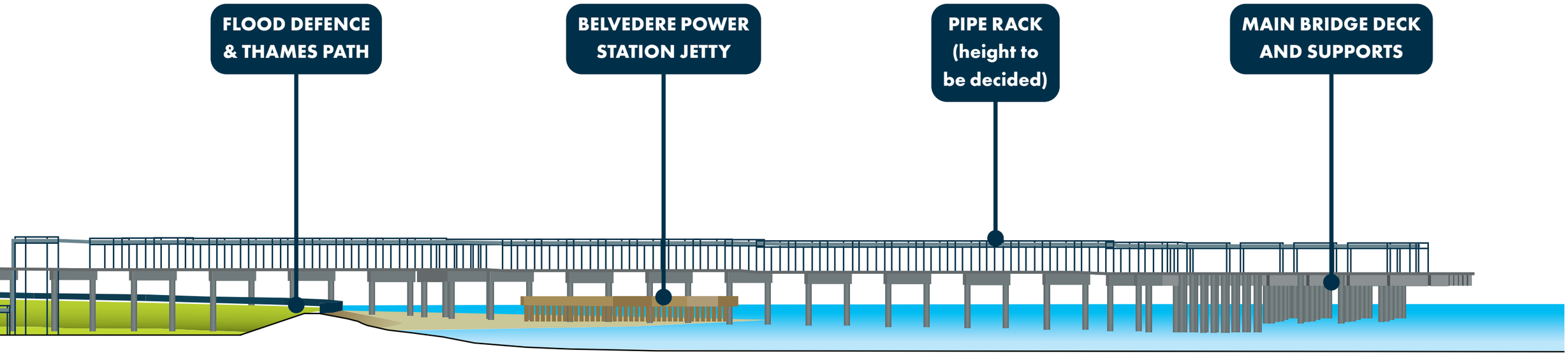
The jetty will be formed of a concrete reinforced deck supported by tubular steel piles.

The Thames Path to the north of Riverside 1 and 2, provides opportunities for localised amenity improvements and some ecological enhancement which are in part, constrained due to the need to protect the integrity of the Thames flood wall and the river embankment. Proposals comprise enhancements and placemaking measures including improved connectivity, wayfinding and interpretation, and maintenance of marginal areas of riverside embankment and Thames path verges for wildlife, focused especially in on proposed areas of improved connection to the Local Nature Reserve.

These measures are described in the Access and Recreation Proposals and the design and delivery of these measures would be defined in the OLaBARDS as a DCO requirement.

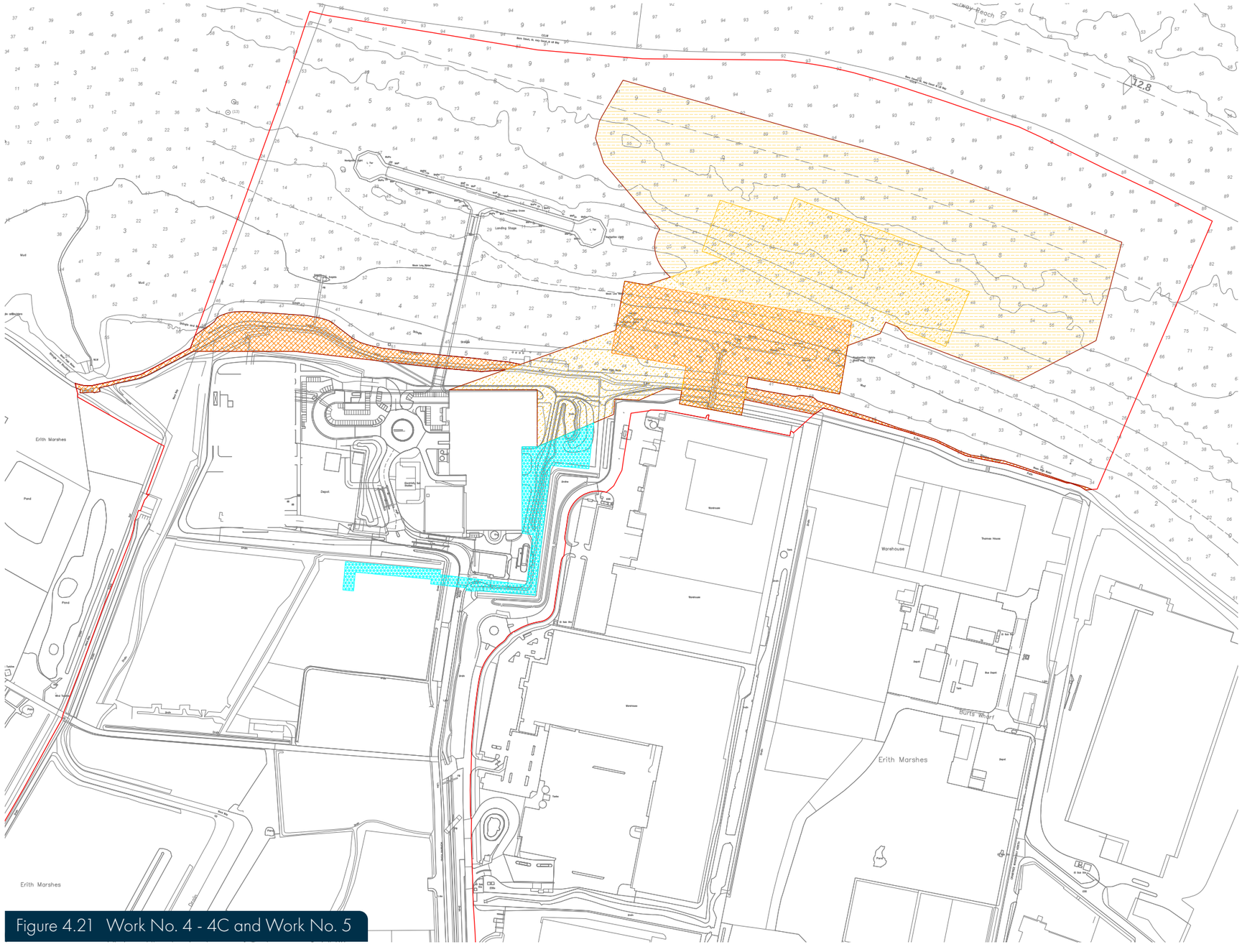
The existing Belvedere Power Station Jetty (disused) may be retained or removed under the DCO proposal.

Figure 4.20 Disused Belvedere Power Station Jetty



Zone 3 - Works Plans

Zone 3 of the Masterplan is controlled by Works Plan Work No. 4. These works define the maritime works below the water and structures above the water. Work No. 4A allows for the retention and modification or removal of the Belvedere Power Station Jetty. Work No. 4B defines the limits of deviation for the Proposed Jetty and Work No. 4C allows for associated dredging.



Key

- Work No. 4 - Maritime Works
- Work No. 4A - Belvedere Power Station Jetty Modifications or Removal
- Work No. 4B - Jetty
- Work No. 4C - Proposed Dredging
- Work No. 5 - LCO_2 Piping and Utilities Connections to the Jetty

Figure 4.21 Work No. 4 - 4C and Work No. 5

Zone 4 - Norman Road

Zone 4 of the Masterplan is controlled by Work Plan Work No. 3 and allows for utilities connections and access to the CCF. In relation to access, the Works description allows for multiple access points to be secured to the west and connected to the adopted highway, in cases allowing for the possible retention of existing access locations (existing permanent or temporary) including crossings over the existing retained watercourses.

The boundary of the new CC Facility will define a new interface with Norman Road, with enhanced ditch habitats and planted boundary treatment controlling views into the operational facility. New illuminated signage is proposed to the west of the highway boundary and new or repurposed existing road junctions off the road are also proposed.

The Design Code provides design control to the quality of the infrastructure and buildings visible from the road and public right of way including planting to provide a defined sense of place and approach to the Riverside Campus.

The presence of new CC Facility and proposed uplift in management of the ditch habitats and passive surveillance from staff working at the operational facility will help to improve safety and general cleanliness of the route supporting the control of possible anti-social behaviour.

Zone 4 - Works Plans

Figure 4.22 Work No. 3

Key

Work No. 3 - Utilities Connections and Site Access Works

5.0 Design Development

5.1 Design Iterations: The Optioneering Process

Reference should also be made to the following in support of the consideration of alternatives:

- Terrestrial Site Alternative Report (TSAR) (Document Reference 7.5)
- Jetty Site Alternative Report (JSAR) (Document Reference 7.6)
- Planning Statement which records the consideration of Metropolitan Open Land and Open Space policy (Document Reference 5.2)
- Environmental Statement (Document Reference 6.1) including Chapter 3.

The Terrestrial Site Alternative Report (TSAR) describes the process by which the Preferred Development Zone (South 1) for the CC Facility was identified. This alternatives process was structured and informed by the Project Principles and Optioneering Principles with a final validation then made against the Design Principles. The alternatives process explored various footprints for the CCF based on the required land take area, and explored Development Zone opportunities north, south, east, and west of Riverside 1 and 2.

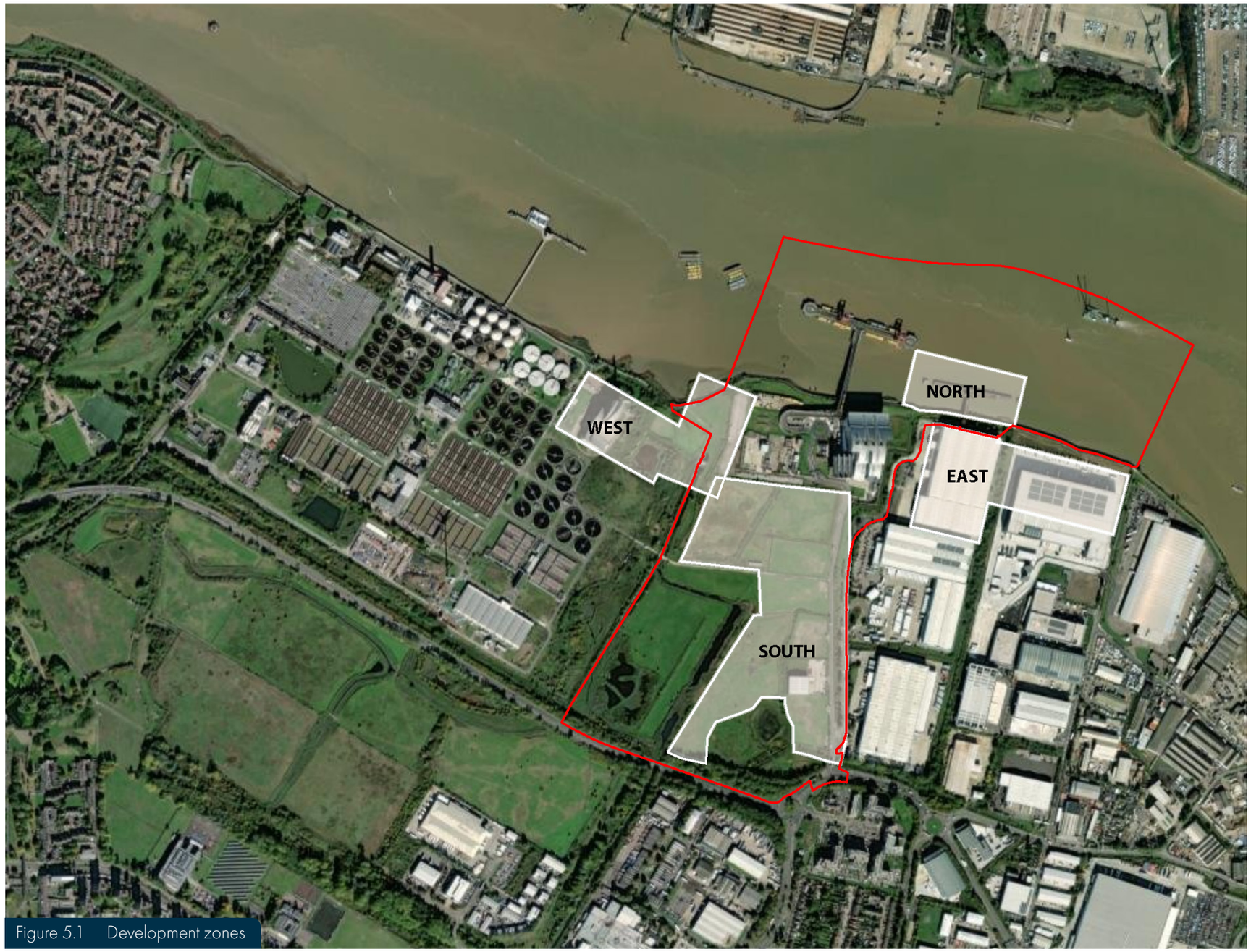


Figure 5.1 Development zones

Preferred Development Zone

South Zone 1 was selected for the following reasons:

- Most beneficial balance of all Zones in relation to impact to locally important biodiversity sites due to the least amount of land take on the Erith Marshes SINC. Although there were two zones with smaller impacts to Crossness LNR, these were marginal differences and have greater SINC impacts.
- Would have the smallest requirement for land take of Crossness LNR.
- To form a single homogenous area with sufficient space for the necessary footprint of the Carbon Capture Facility unincumbered by a break in operational layout, providing a contiguous layout uninterrupted by public access or private land holding.
- Close proximity to Riverside 1 and Riverside 2 for connection of the flue gas ducting and further utilities.
- The ability to consolidate the direct loss of Crossness LNR land, Erith Marshes SINC land and land designated as MOL, into a single coherent land area to be defined as a proposed extended CLNR.
- Avoiding adverse environmental impacts associated with works within the River Thames above and beyond those required for the Proposed Jetty.

From selection of the chosen development zone, further design development to develop the parameters for a scheme layout was undertaken considering project design in response to detailed operational brief; response to the local environment; and stakeholder and technical consultation including refinement of the Site boundary for the operational layout.

Carbon Capture Facility Layout

In particular, it was noted that the different elements of the CCF have an operational relationship which broadly dictates what the layout arrangement can be. All options explored were driven by:

- the need to locate the more significant elements of the CC Facility including the flues and absorber columns toward the north and towards the Riverside 1 and 2 facilities.
- significant elements of the CC Facility distanced from the nearest residential community.
- stepping the height of the CC Facility elements down from north to south to provide a welcoming entrance to the proposed extended CLNR and in line with Design Principles whilst also prioritising buffering of the western boundary which interfaces the CLNR.

During the exploration of the CC Facility operational layout, Cory also sought to balance the need to deliver all aspects of the CCF, to protect and enhance the grazing marsh and associated biodiversity of the CLNR, and address the possible effects and performance of retained Metropolitan Open Land.

Two clear options, Diffused Layout and Compact Layout, emerged and were measured against the Design Principles, as set out below.

These two operational layouts were developed and are described and illustrated in section 5.1. It is recognised that both options involve land take of the Munster Joinery parcel, and so Cory did consider whether a layout could involve avoidance of that parcel. This is discussed in Chapter 3 of the Environmental Statement.

Figure 5.2 South development zone 1

Layout Influences

Four key high-level spatial factors have influenced the masterplan at this stage, responding to context, as well as Project Principles and Design Principles.

1. Carbon Connections

Proximity to source and export is of utmost importance for efficiency in the Carbon capture process and reinforces the strategic location of core industrial process plant in the north.

2. Access and Edges

The CCF site boundary is defined by a ditch extending north-south to the west, and Norman Road to the east.

Norman Road provides the development, as well as Riverside 1 and Riverside 2, with the main point of access. To relieve pressure on any one point of entry, Norman Road can be used to directly access individual areas of the CC Facility and reduces the need for longer vehicle circulation routes.

3. Buffering

The layout should prioritise buffering the impact of the operational facility on adjacent open space, as defined in the Design Principles.

4. Generous Main Point of Arrival

The layout should provide a generous main point of arrival into the proposed and expanded Crossness Local Nature Reserve which will provide an enhanced access for the local community and visitors coming by public/active transport.

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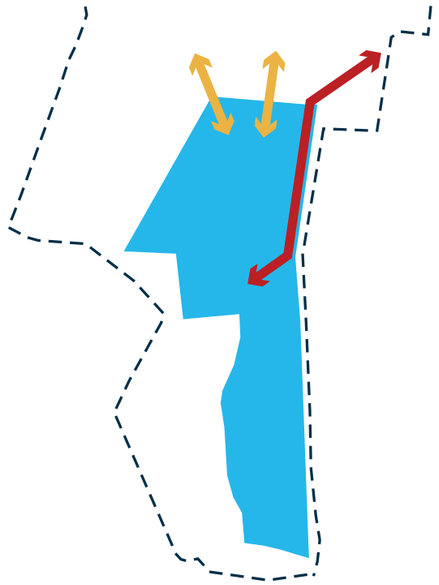

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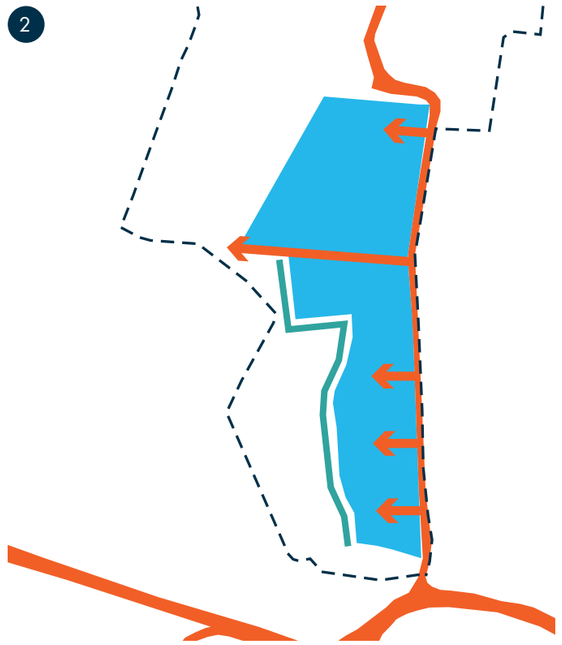

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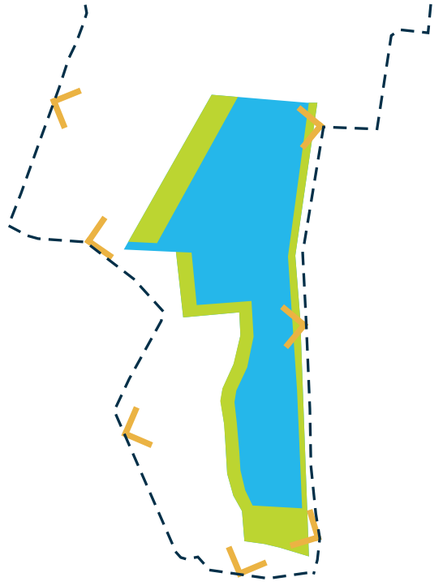

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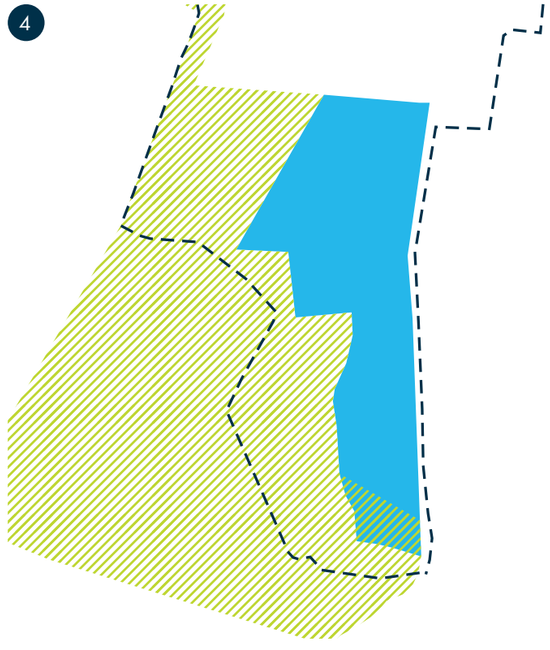
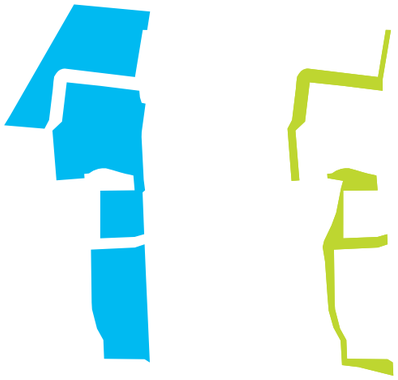


Diffused Layout



This option places a focus on retaining existing and adding to the East-West ditch network that bisect the proposed operational development parcels. The ditches are recognised as important water vole habitat, a UK BAP priority species that features with a healthy population in the area. Surveys found the ditches are used by the water vole, but that they are in less than favourable condition, something that could be enhanced by this option to their benefit.

The operational layout worked around the existing ditch network with offsets for maintenance access and to support buffering. A new ditch and green link were added to the south, connecting with the wider green corridors of to the east, and tree planting could be woven into the less densely developed areas of the CC Facility.

A consequence of this approach is that the development spreads further south and possibly west, leaving little room for appropriate green edges, buffering to give visual and physical separation from the neighbouring Crossness Local Nature Reserve and being unable to deliver a rational Metropolitan Open Land outcome while also restricting the establishment of a generous and welcoming entrance to the proposed reconfigured Crossness Local Nature Reserve.

This option was considered likely to have a significant and overbearing impact on the open character of the Local Nature Reserve and that of the Metropolitan Open Land.

Within this option, the bisected parcels of operational land result in a loss of layout efficiency and result in operational challenges for the technical process, that would result in the likely need for connecting bridges, ducting frameworks and relatively complex access and security strategies for the CCF.

Key

- Operational boundary
- Roads
- Buildings and equipment
- Green areas
- Water courses
- Overhead ductwork

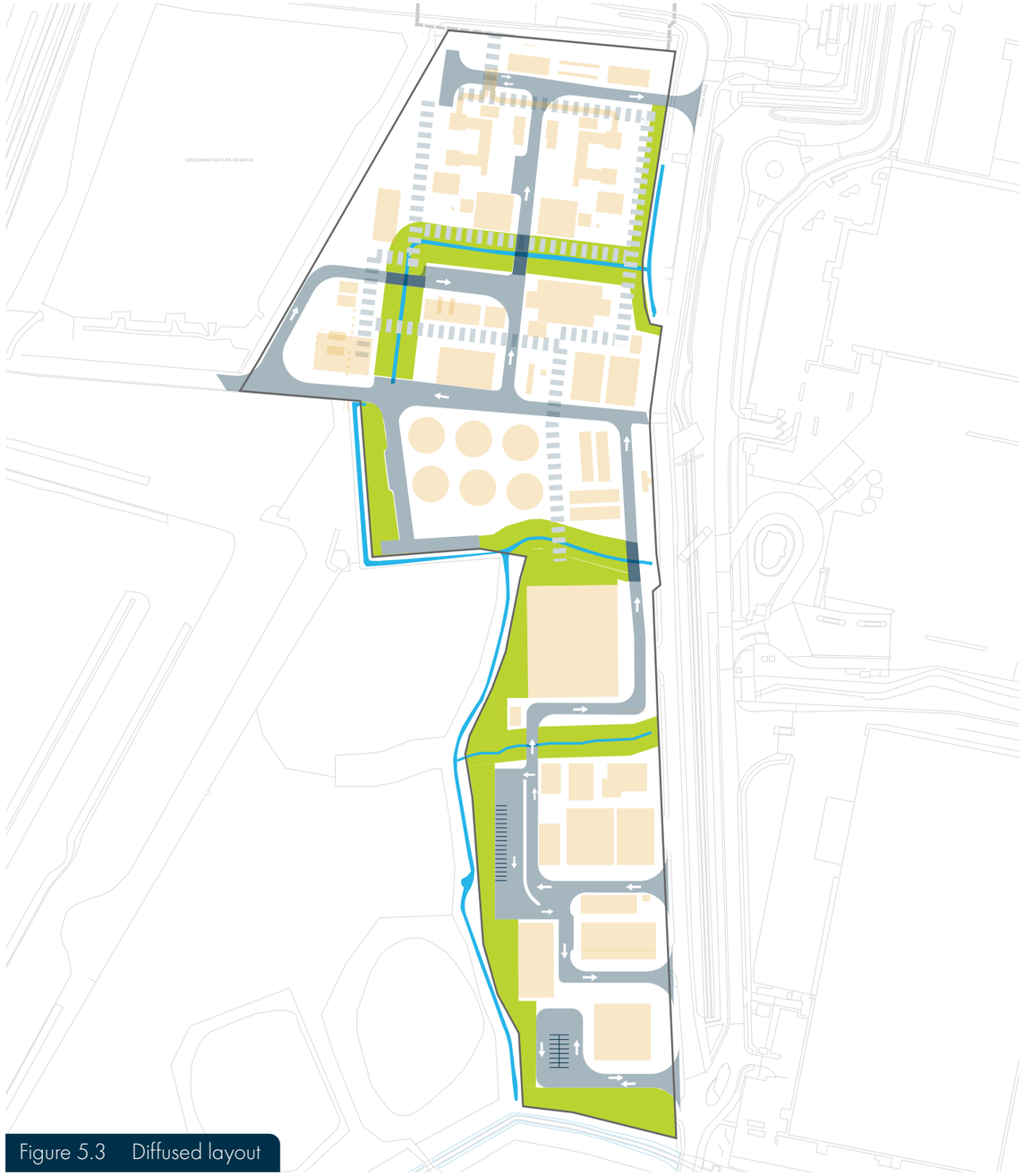


Figure 5.3 Diffused layout

Compact Layout

This option prioritises efficiency of layout, removing existing ditches to allow the technical team to design the most compact facility possible within the footprint. This option prioritises the freeing up of space in the western and southern areas of the Site, which can be used to buffer the development from the adjacent Local Nature Reserve and establish a more generous entrance to the proposed reconfigured Crossness Local Nature Reserve.

The decision to consider the removal of ditches and reprovision elsewhere on site was guided by the existing condition of those habitats, being of poor condition and distinctiveness and lacking open water (valued by water vole) due to the lack of maintenance carried out.

The compact layout releases a significant area of land in the south of the development and along the western edge of eastern and stable paddock.

The land in the west could be used for buffering, including native tree planting, attenuation ponds and to distance the security fence from the nature reserve boundary. In the south, the open area could support increased habitat creation and a generous reconfigured Crossness Local Nature Reserve with public access and car parking.

Following a period of testing for alignment with project principles, engagement and calculating BNG potential, as well as taking into consideration the qualitative value to the Local Nature Reserve and retained MOL, it was deemed that the more compact layout would be beneficial over the diffused option, from this point referred to as the Proposed Illustrative Layout or Masterplan.

Figure 5.4 Compact layout

5.2 Masterplan Strategies - Green Infrastructure

The Environmental Proposals and Access and Recreational Proposals that comprise part of the Proposed Scheme set out in section 4.0, deliver the project's Green Infrastructure Strategy and supports planning policy and strategy ambition.

The GI Strategy delivers mitigation that addresses harms arising from the Proposed Scheme but also provides an integrated strategy that delivers multifunctional benefits.

Network and connectivity

The proposals retain open land which continues to support the network of green spaces linked by existing and enhanced connections outlined in the Access Proposal.

Quantity of natural and semi natural space and access

While acknowledging that natural and semi natural space is the most extensive form of open space in the borough, it remains an important open space typology in the mix of space provision and the character of the area. The retained open land will be comprehensively managed to support a more consistent semi natural environment forming a setting for recreation and enjoyment of the natural environment. The proposed scheme does not reduce the quantity of accessible open space and extends access through provision of additional PRoW and permissive paths.

Metropolitan Open Land (MOL)

The Proposed Scheme is informed by an appreciation of and strategy to minimise the effects on Metropolitan Open Land in relation to its openness, purposes, and its performance in relation to LBB Policy SP8 'Green Infrastructure including designated Green Belt'.

The Proposed Scheme focuses on minimising the effect on visual openness through careful massing and screening and in relation to addressing harm to purposes, ensures there is no 'unrestricted sprawl of large built-up areas'.

The preferred Development Zone selected as part of the Optioneering Process described in section 5.0, limits sprawl and maintains the separation of built areas over and above other options considered.

In relation to judgements on other harms on the MOL, the impact on visual openness is relevant and addressed in the TVIA (Document Reference 6.1.10).

In its undeveloped state, the Site including the CCF is visually open, but the character is compromised by the presence of existing industrial and large-scale logistics development, and infrastructure that adjoins the Site. In its developed state, the CCF site area will be characterised by built development and infrastructure reducing in intensity of scale from north to south, with a focus of higher elements to the north associated with existing tall structures associated with Riverside 1 and 2.

The proposed CCF layout in the south is lower, less dense and less industrial in character and supports a looser and more 'visually open' development character that steps down to engage with the nearby local community of Belvedere.

This layout supports the establishment of a generous physical and visual approach to the reconfigured CLNR off Norman Road. The open areas of the Site comprising the proposed expanded and reconfigured CLNR, will be visually open and characterised by an increased coherence of 'natural' landscape and deliver the 'One Nature Reserve' concept. This concept is delivered through the Environmental Proposals and Access and Recreation Proposals and takes into consideration this Green Infrastructure Strategy, the Levels, Hydrology and Drainage Strategy and Edges and Interfaces Strategy.

Open Space

In recognition of the Site's 'Higher quality/ higher value' open space category the strategy for environment, access and recreation seeks to improve its value to the community and those special interest group and those responsible for its management through the provision of the proposed expanded CLNR operating under a single, consistent and fully funded management regime, to support the quality of its recreation, access and biodiversity to allow it to continue to meet the requirements of the communities it serves.

In addition to footpath improvements, including boardwalks and raised walkways for accessibility and inclusivity year-round, the illustrative scheme proposes a new car park for visitors and users of CLNR. The need for this would be developed and agreed with stakeholders as part of developing the full LaBARDS.

Security

The provision of a more formalised entrance to the CLNR is anticipated to increase its beneficial use by the community and through positive management support greater levels of natural surveillance.

Biodiversity

The biodiversity of the Site will be improved as a result of the planned delivery of the habitats illustrated in Figure 5.5, their management and improvements in water levels in the flood plan grazing marsh secured through the Levels, Hydrology and Drainage Strategy and further development of the OLaBARDS into the final LaBARDS.

The approach to biodiversity responds to relevant nature conservation policies including the Site's status as a Site of Importance for Nature Conservation (Metropolitan) London Plan Policy G6 and LBB Local Plan Policy SP9.

The proposed habitats and landscape typologies shown in Figure 5.5 should be achieved through a combination of planting and revised management regimes to secure successful plant/habitat establishment and long-term resilience.

The design intent is to establish a robust, well managed and cohesive 'natural environment' delivered through good management that reinforces and establishes a Local Nature Reserve of consistent and coherent quality that also forms an attractive setting for recreation and for the Riverside Campus.

Section 4.3 provides detail on the Environmental Proposals.

Refer to Outline Landscape, Biodiversity, Access, and Recreation Delivery Strategy (OLaBARDS) for proposed delivery mechanism, implementation, and management detail.

Figure 5.5 Green infrastructure strategy diagram

Levels, Hydrology and Drainage

The drainage strategy embodies the fundamental principles of Sustainable Drainage Systems (SuDS), prioritising best practices for drainage in new developments. SuDS solutions are integrated to emulate natural drainage processes wherever possible, and manage surface water runoff in a more sustainable manner aligning with the overarching goal of enhancing sustainability and resilience. The drainage strategy is designed to fulfil the surface water storage and discharge needs for the carbon capture facility, manage risks associated with climate change, and direct surface water drainage from the operational area into the Mitigation and Enhancement Area that forms part of the flood plain grazing marsh west of the operational site.

For the operational site, proposed levels have been designed to ensure that key infrastructure is not adversely impacted in the event of flood. Surface water is collected through surface infiltration, and sealed drainage pipework to attenuation structures with suitable pollution controls. Discharge is facilitated through pipework and controls into the local surface water drainage ditch network. Details are provided in the Outline Drainage Strategy (Document Reference 7.2).

This strategy supports the surcharging of the local watercourse and ground water levels to enhance the condition of the grazing marsh and wetland habitat that form a key characteristic of the local landscape. During the operational phase, the supplementary measures enacted will ensure discharged water meets stringent quality standards, preventing any degradation of the water environment and associated habitats, and whenever feasible, offering enhancements.

Key

- Site boundary
- Existing ditches
- Proposed ditches
- Proposed wetland areas
- Proposed attenuation basins
- Proposed below ground connections
- Proposed conveyance direction
- Water re-wetting the grazing marsh
- Infiltration through permeable hard landscape
- Proposed sluice gates

Figure 5.6 Levels, hydrology and drainage strategy diagram

Figure 5.7 Norman Road River

Access and Movement

The masterplan strategy for access and movement builds on the key role of Norman Road forming the approach and gateway to the Riverside Campus, the access spine to provide access to the CC Facility at multiple points of entry to limit the need for internal roads and provide access to the Crossness Local Nature Reserve approaching from Belvedere and from the proposed visitor car park.

Improvements to the local public footpath network and connections to deliver circular recreation routes are proposed including linking Thamesmead to the Crossness Local Nature Reserve. Further the project aims include improvements to wayfinding, identity, and supporting greater levels of surveillance through good design and increased recreation usage while recognising the need to minimise bird disturbance especially in the core areas of the CLNR.

Footpath improvements, including raised walkways for accessibility and inclusivity year-round, the illustrative scheme also proposes a new car park for visitors and users of CLNR, creating a welcoming and safer formal point of arrival, as part of the Cory Campus.

FP2 is the main PRoW access to Crossness Local Nature Reserve and the Accessible Open Land, located within the wider Site and would need to be permanently diverted as a result of the CCF construction activities and for the operational requirements of the Carbon Capture Facility. Such diversions are likely to be localised and may differ between the construction and operational phases. In both cases, the diversion route will need to be approved by LBB.

Key

- Site boundary
- Public Rights of Way (PRoW)
- PRoW Diversion
- New PRoW
- Other public access route and cycleway
- Security fenceline to CC Facility
- Existing fencelines
- Amended fencelines
- Proposed fencelines
- Direction/access toward nearby locations
- Proposed gates
- Proposed vehicular access
- Proposed pedestrian crossings
- Proposed car park

Figure 5.8 Access and movement strategy diagram

Section 4.4 provides detail on the Access and Recreation Proposals.

The illustrative general arrangement of internal circulation within the CCF is illustrated in Figure 5.9 and has been rationalised to limit the amount of land take.

The CCF layout allows for (but does not require) staff parking and CLNR visitor parking with associated EV charging points and cycle parking:

- CCF -16 parking spaces (including 2 disabled spaces)
- Heat transfer - 2 parking spaces.
- CLNR -10 parking spaces.
- Cycle parking.

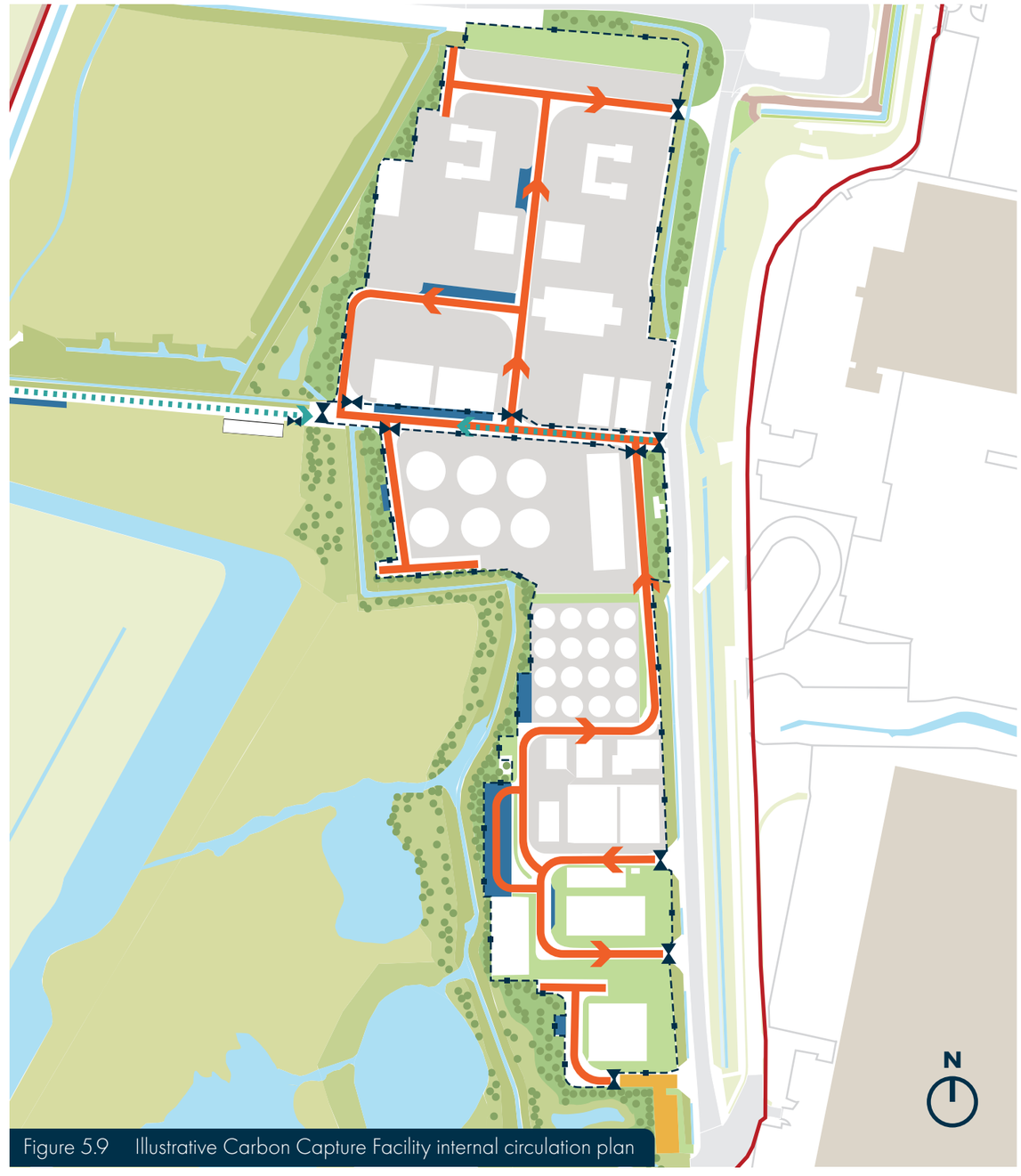


Figure 5.9 Illustrative Carbon Capture Facility internal circulation plan

Edges and Interfaces

This section provides illustrative cross sections and sectional elevations of the Proposed Scheme edges and interfaces with existing features comprising:

- Cross section of CCF in relation to CLNR
- Cross section of CCF in relation to Norman Road
- Cross section of CCF connecting pipework to Riverside 2 in relation to CLNR
- Cross section of CCF connecting pipework to Riverside 1 - adjoining FP4
- CLNR Elevation
- Norman Road Elevation

Cross section of CCF in relation to CLNR

The section illustrates low-level wet scrub within the CLNR with deciduous woodland screen planting on the east side of the reprofiled ditch forming the CCF boundary and screening perimeter fencing. Planting on the boundary and within the CCF would feather from substantial in the north to sparse in the south extending towards the new entrance to the expanded CLNR.

Cross section of CCF in relation to Norman Road

The section illustrates the interface with Norman Road. The existing ditch/river channel will be retained and managed as a positive habitat and the boundary fencing of the CCF, set back from the adopted highway to support planting and integration of levels.

1

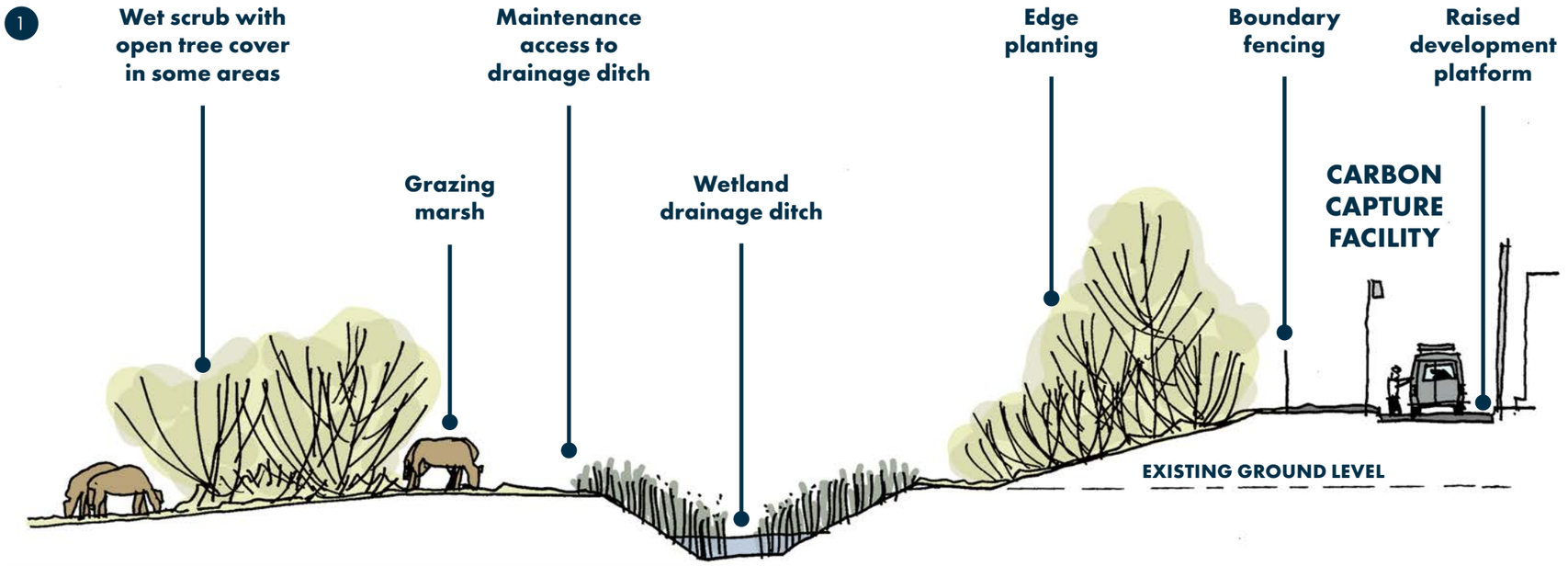


Figure 5.10 Illustrative sketch section - Cross section of CCF in relation to CLNR

2

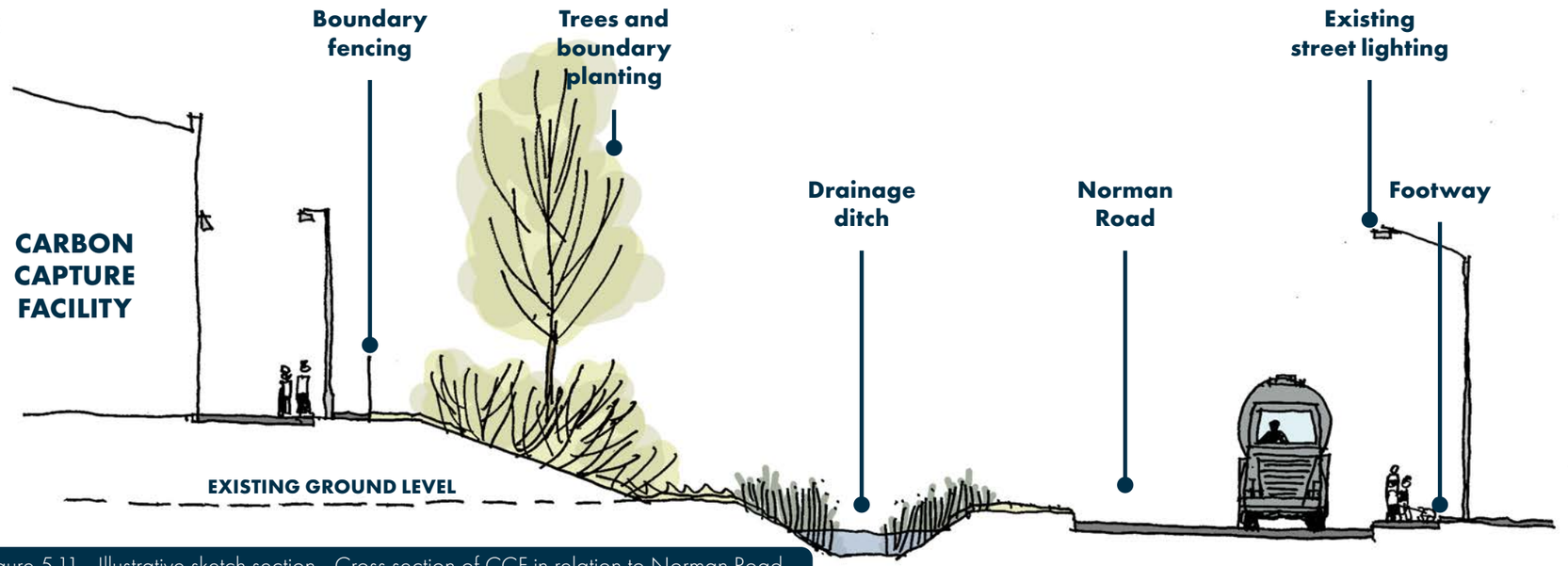


Figure 5.11 Illustrative sketch section - Cross section of CCF in relation to Norman Road

Cross section of CCF connecting pipework to Riverside 2 in relation to CLNR

The section illustrates the position of the connecting pipework elevated above ground on trestles, lying between the CCF and Riverside 2 extending along the existing boundary of the CLNR. The section illustrates the location of the original CLNR ditch and Riverside 2 boundary and location of the proposed revisions, allowing for adequate ditch maintenance space. The new ditch would lie within the CLNR and the proposed fence form the boundary between Riverside 2 and the CLNR. The habitat implications on the natural environment are described in the ES.

Cross section of CCF connecting pipework to Riverside 1 - adjoining FP4

The section illustrates the position of the connecting pipework elevated above ground on trestles, lying between the CCF and Riverside 1 extending along and within the existing boundary of Riverside 1 and parallel to the existing PRoW, FP4. The pipework would lie within the Riverside 1 operational area.

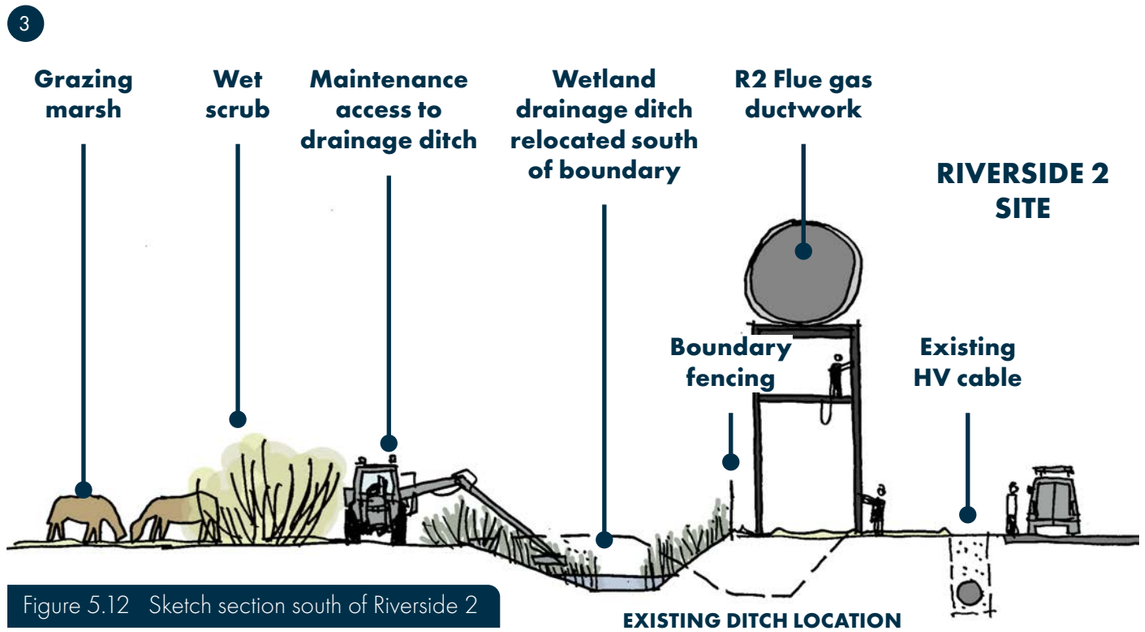


Figure 5.12 Sketch section south of Riverside 2

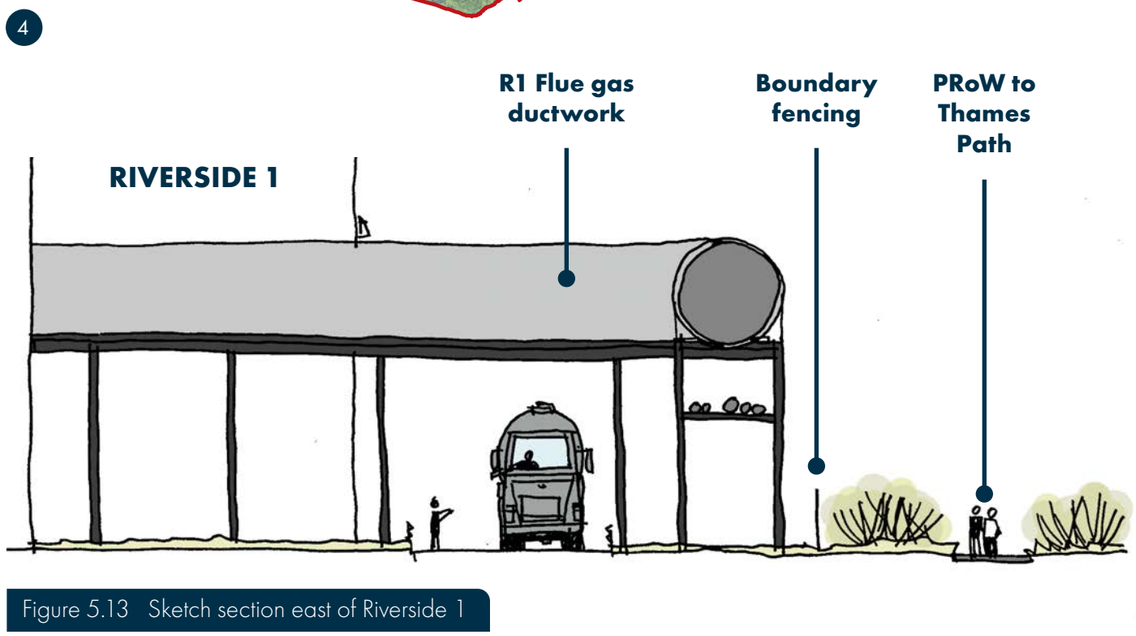


Figure 5.13 Sketch section east of Riverside 1

CLNR Elevation

The elevation illustrates a low-level screened interface with the CLNR with screening on the CCF boundary straddling the existing ditch, grading from substantial in the north to sparse in the south representing the scaling down in the scale of the architectural massing and softening of the materials from industrial metal and coloured finishes to proposed timber wrapping around supporting structures that face the CLNR. During the hours of darkness, the level of lighting on the CLNR interface is controlled to support the proper functioning of the habitat. Refer to the Lighting Strategy in section 5.3.

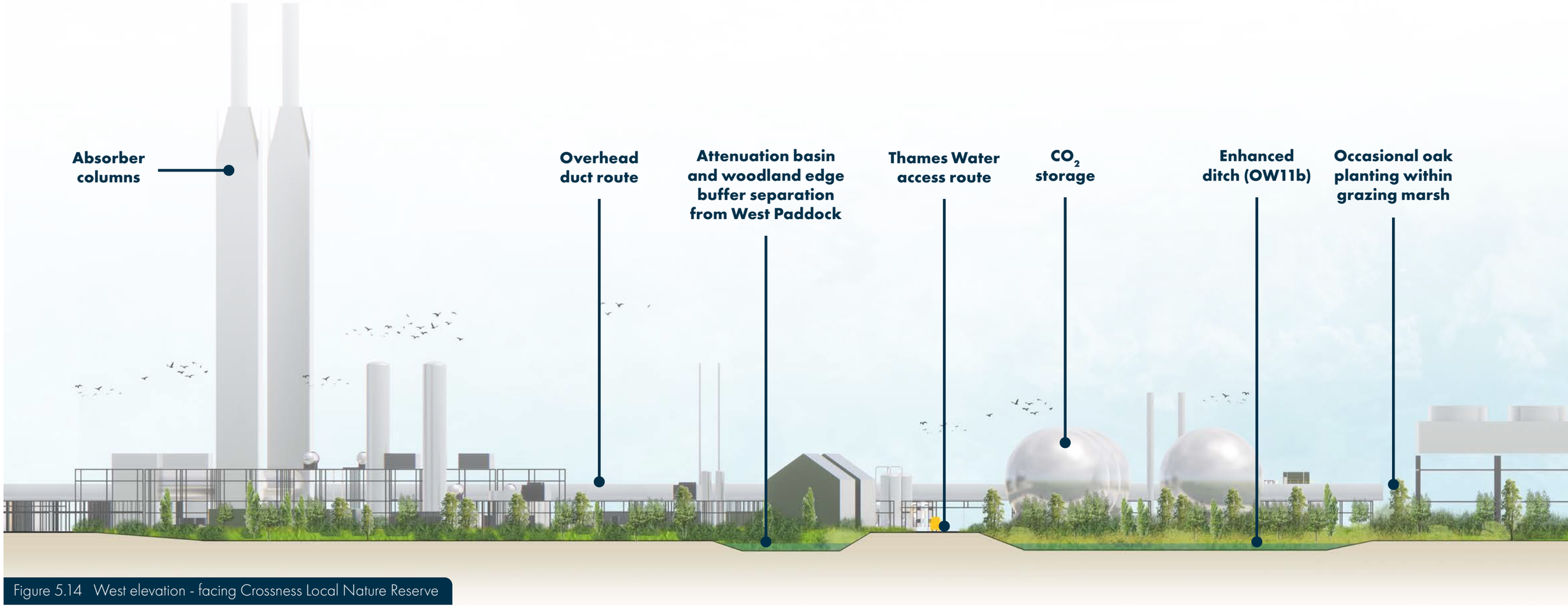
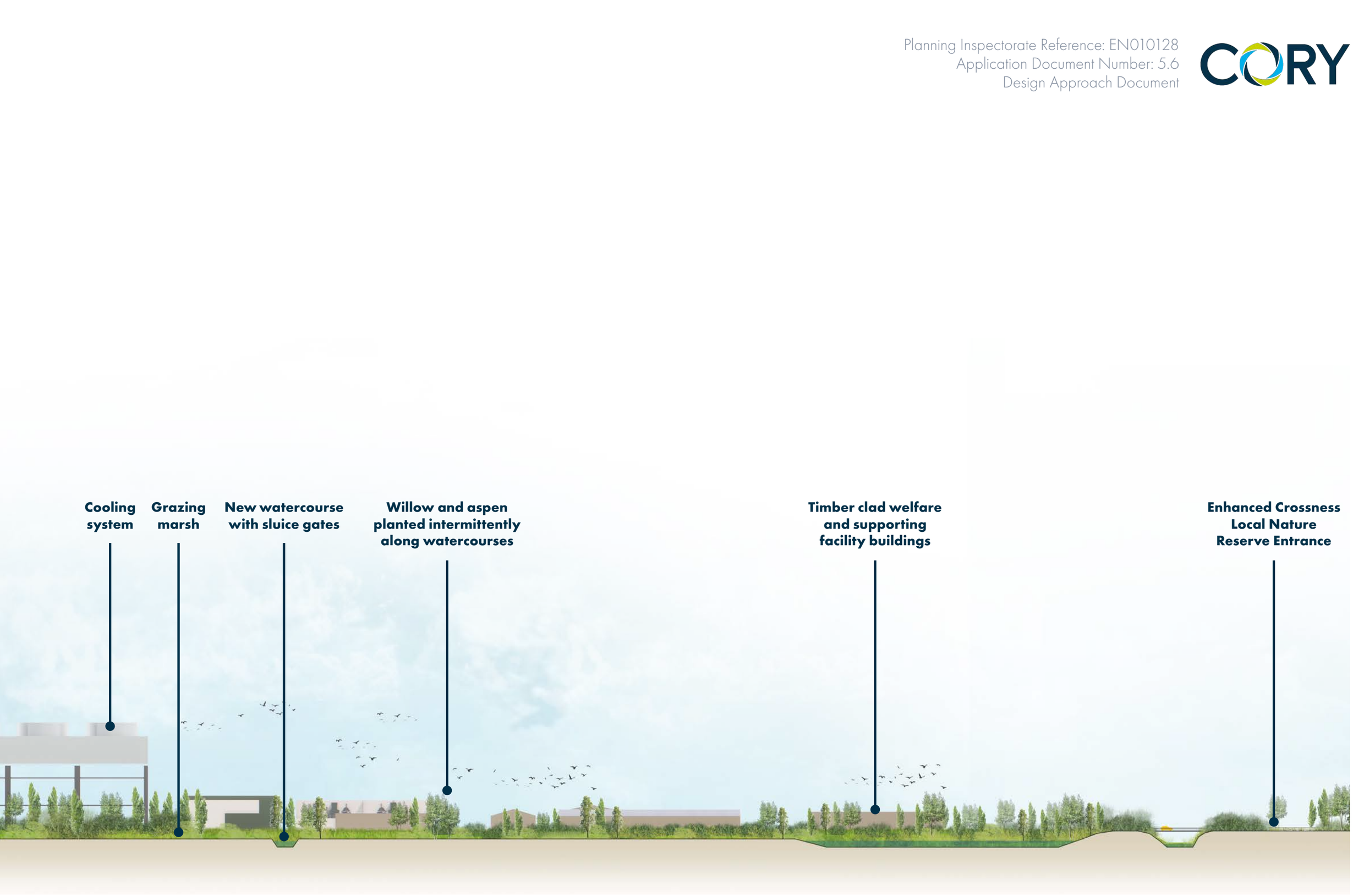


Figure 5.14 West elevation - facing Crossness Local Nature Reserve


Cooling system
Grazing marsh
New watercourse with sluice gates
Willow and aspen planted intermittently along watercourses
Timber clad welfare and supporting facility buildings
Enhanced Crossness Local Nature Reserve Entrance

Norman Road Elevation

The elevation illustrates the intentionally controlled industrial interface with Norman Road. The existing ditch/river channel will be retained and managed as a positive habitat and the boundary fencing of the CCF visible but softened by proposed planting associated with the ditch interface and the proposed transition of CCF platform levels and Norman Road. The material finishes to the Norman Road elevation will be industrial in character. During the hours of darkness, the buildings addressing Norman Road will be illuminated to provide an enhanced and activated road and footpath environment during the hours of darkness. Refer to the Lighting Strategy in section 5.3.

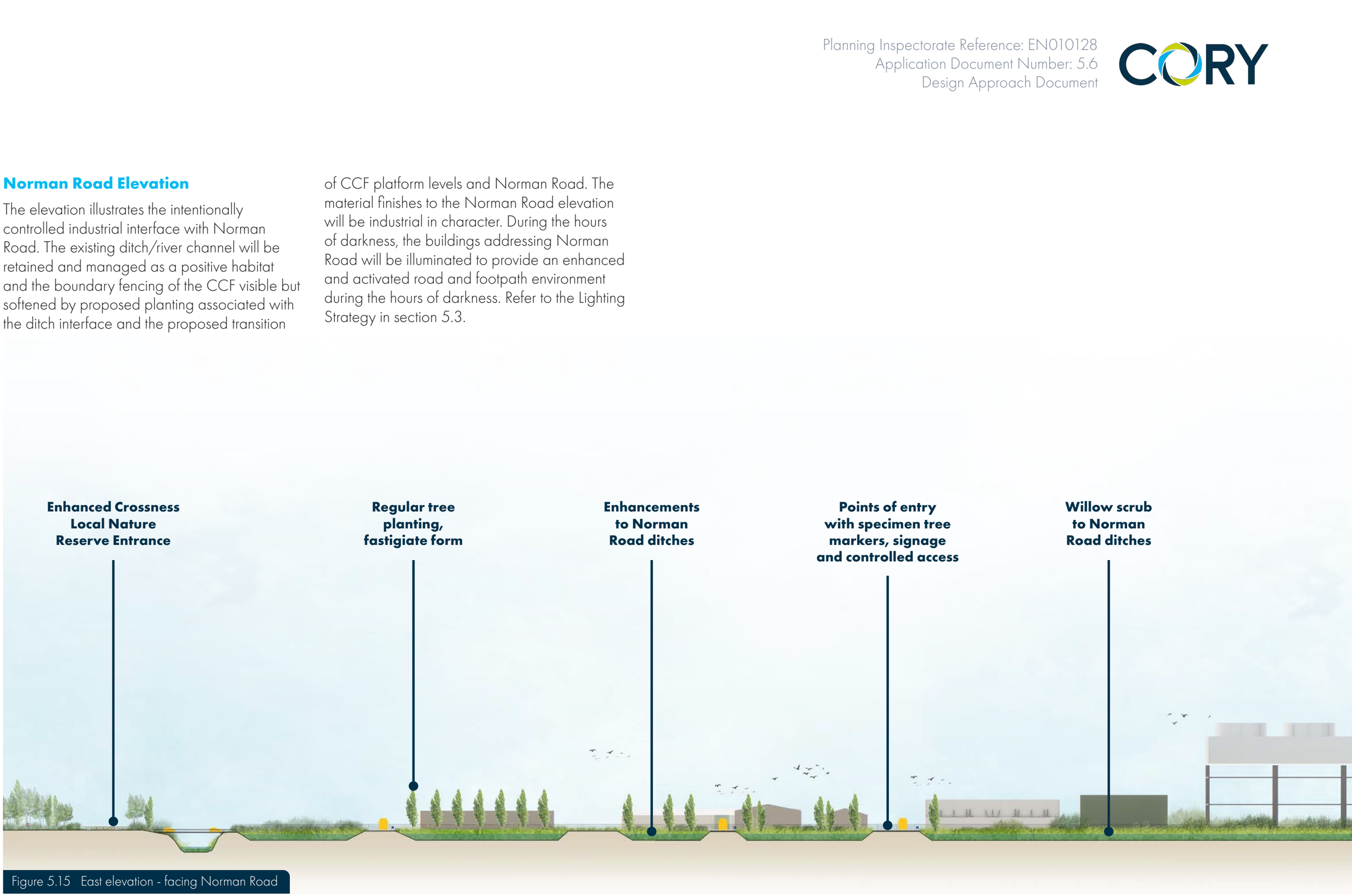
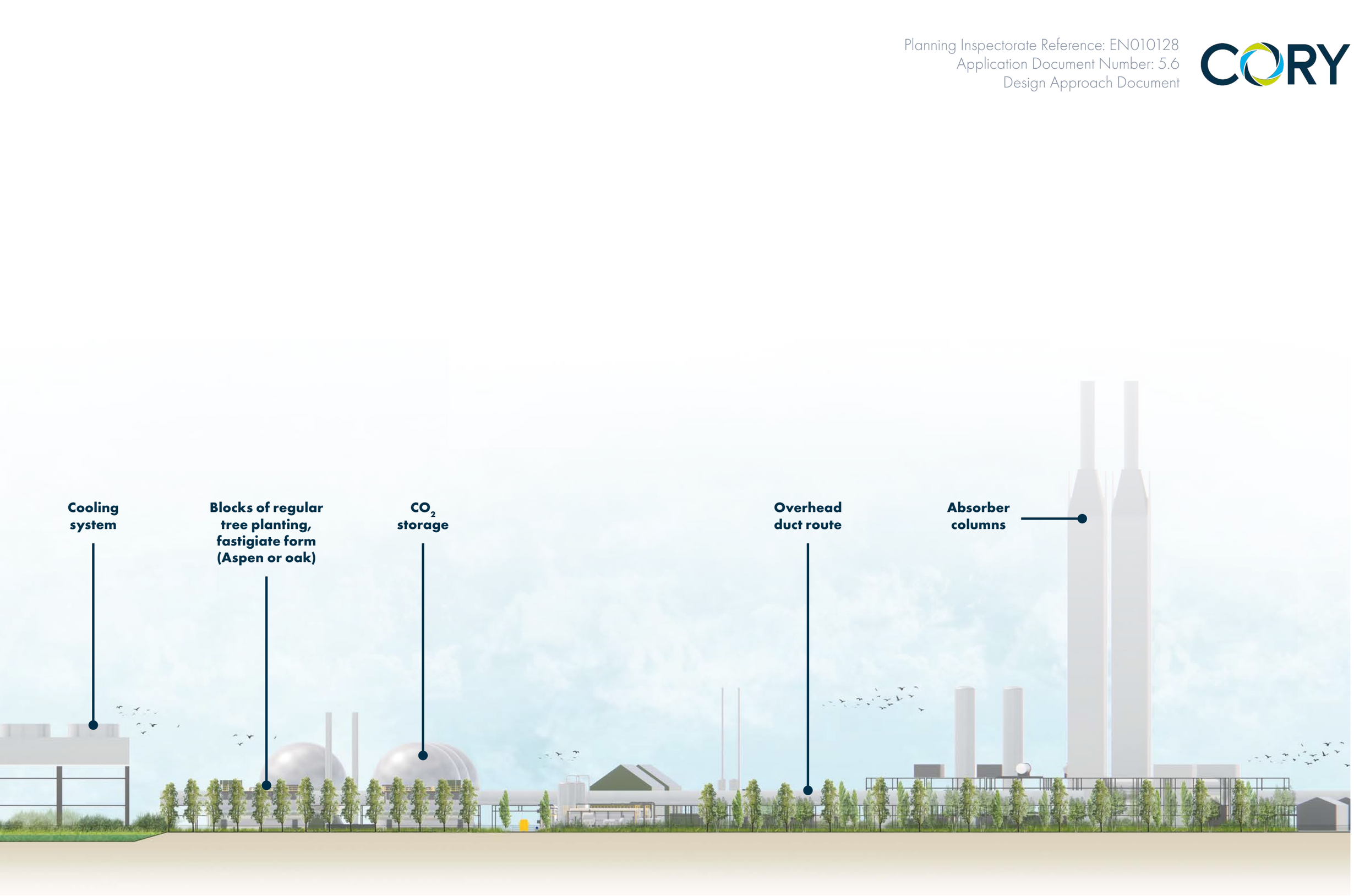


Figure 5.15 East elevation - facing Norman Road


Cooling system
Blocks of regular tree planting, fastigiate form (Aspen or oak)
CO_2 storage
Overhead duct route
Absorber columns

Materiality

Zone 1 - CCF Carbon Capture Process

The north end of the Carbon Capture Facility houses the largest and most industrial equipment. A controlled palette of robust materials and careful detailing can provide a contemporary feel and quality aesthetic.

Zone 1 - CCF Supporting Facilities

Further south, the facility is more fractured and low lying; materiality and form can start to respond to the nature reserve edge whilst maintaining a contemporary feel.

Figure 5.16 Example of how the CO_2 storage tanks could look

Figure 5.17 Example of stainless steel ductwork and yellow balustrades

Figure 5.18 Example of metal cladding and yellow accents for doors

Figure 5.19 Concrete swatch

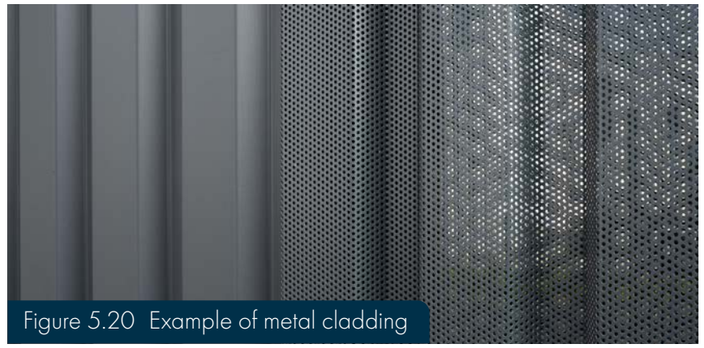


Figure 5.20 Example of metal cladding

Figure 5.21 Example of timber clad buildings

Figure 5.22 Example of stainless steel/metallic finish for equipment and yellow accents for balustrades and safety stairs

Zone 2 - Nature Reserve

Interventions within the expanded nature reserve should be low key, with minimal built form visible across the open land. Hides, screens, seats, and interpretation should be hunkered down into the landscape. Materials must stand up to conditions and high vandalism risk.

Figure 5.23 Example of wetland habitat

Figure 5.24 Corten steel swatch

Figure 5.25 Example of a gabion

Figure 5.26 Example of weathered timber

Figure 5.27 Example of a boardwalk/bridge

Figure 5.28 Site image - Natural bird hide using concrete and timber

Figure 5.29 Illustrative sketch of Crossness Local Nature Reserve entrance

Zone 3 - Thames Path and Jetties

Built form and placemaking interventions must stand up to extreme maritime conditions north of Riverside 1 including the Jetty, duct routes, habitat, and Thames Path enhancements.

Figure 5.30 An oyster catcher - example of local bird species

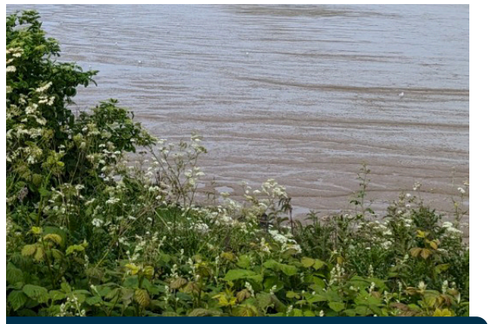


Figure 5.31 Site image - embankment habitat

Figure 5.32 Example of a bird hide/viewing area

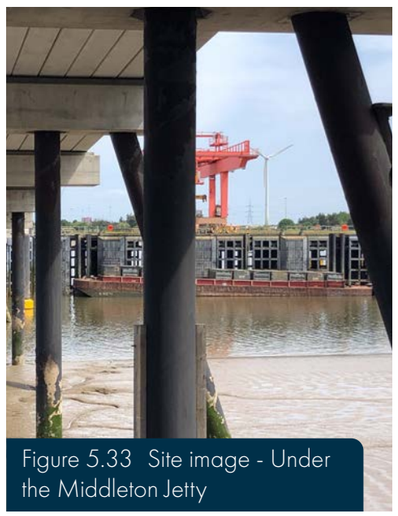


Figure 5.33 Site image - Under the Middleton Jetty

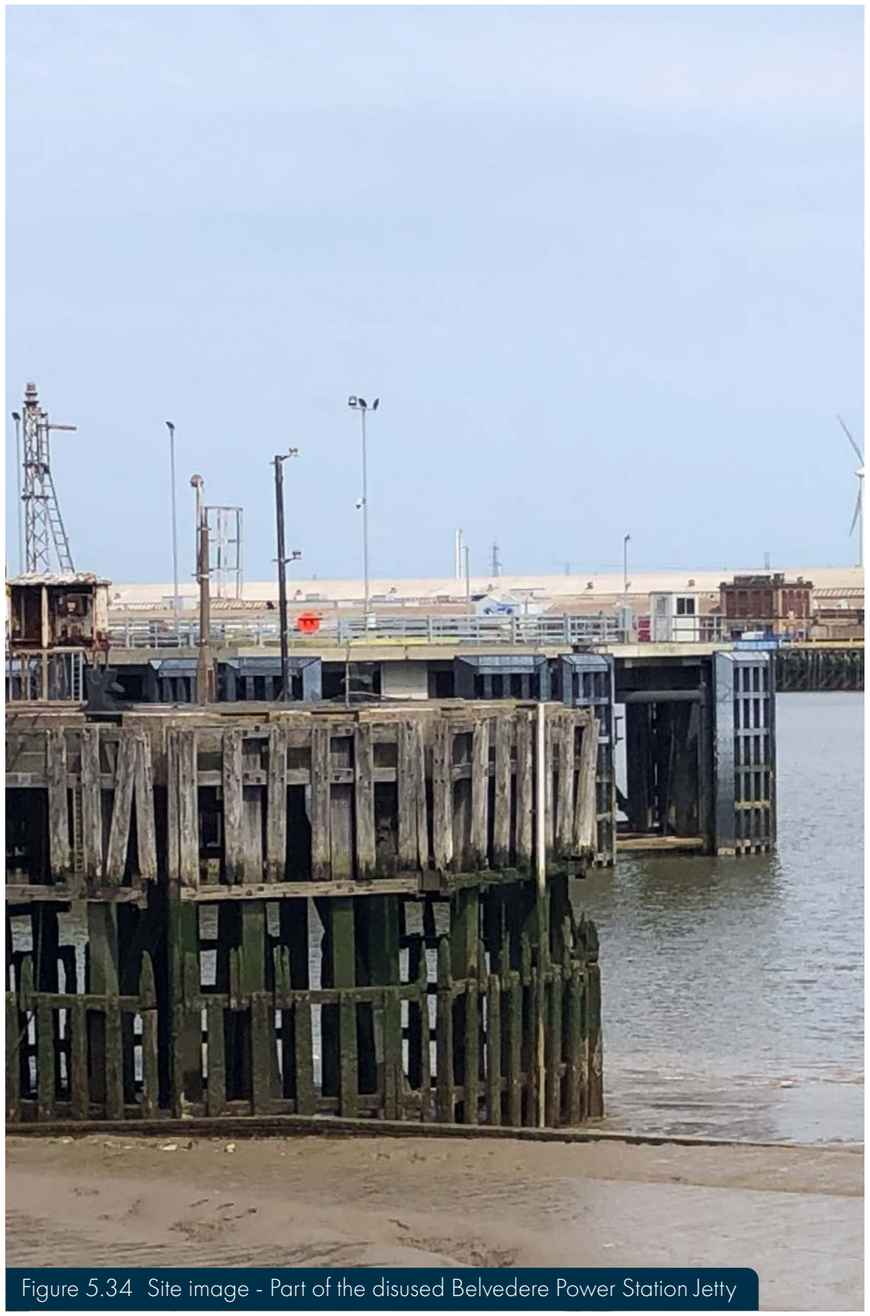


Figure 5.34 Site image - Part of the disused Belvedere Power Station Jetty

Zone 4 - Norman Road

Norman Road should present a coherent development frontage fitting of the industry-leading facilities within; this is the opportunity to realise the Cory Campus identity and make an attractive place to work and visit.

Figure 5.35 Example of timber cladding

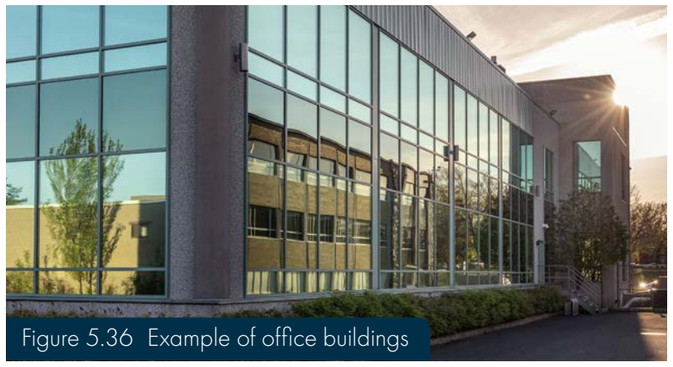


Figure 5.36 Example of office buildings

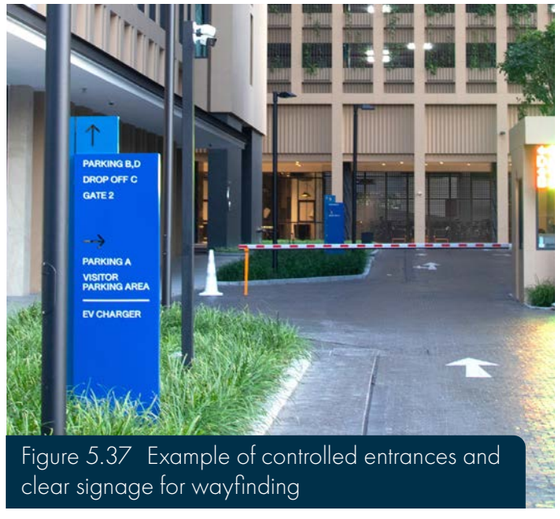


Figure 5.37 Example of controlled entrances and clear signage for wayfinding

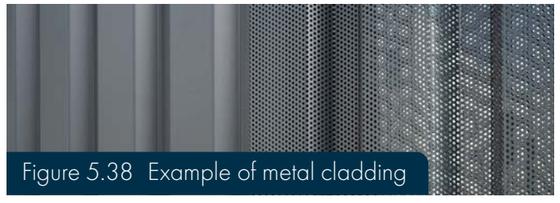


Figure 5.38 Example of metal cladding

Figure 5.39 Example of timber clad buildings

Figure 5.40 Illustrative sketch of Norman Road

5.3 Operational Strategies - Lighting

An Outline Lighting Strategy (Document Reference 7.3) has been developed for the assessment of likely effects. The strategy addresses the need for:

- Functional/operational lighting.
- Highway/access lighting.
- Appropriate light levels and periods for respective areas.
- Minimising effects on adjacent areas and upward light pollution.

The strategy responds to the following constraints:

- Avoid light spill into important habitats that border the CCF site and Jetty including grazing marsh, ditches, foreshore and reedbeds (home to UKBAP species such as water vole)
- Avoidance of glare/visibility of luminaires from the western MOL and beyond.
- Warmer lighting colour tones for reduced disturbance to species (max. 3000k)
- Limited light in areas less frequently used by people (timers & sensors for activation)

Opportunities to enhance architectural forms, visual appeal and identity of the development have been identified below responding to placemaking goals, and should be delivered as part of the final lighting strategy:

- Uplighting of key/iconic forms.
- Use of red-light spectrum to reduce disturbance to wildlife.
- Locating fittings to avoid visibility/glare.
- Use of lighting to illustrate emphasises process/connections.
- Improve the safety and activation of the environment along Norman Road.
- Use of high-quality durable materials with minimal maintenance.

Light Spill and Crossness Local Nature Reserve

Main vehicular routes within CCF site will require column mounted luminaires, these would be positioned well into the site and avoided along boundaries, the fittings would be directional and avoid light spill outside of the CC Facility site area.

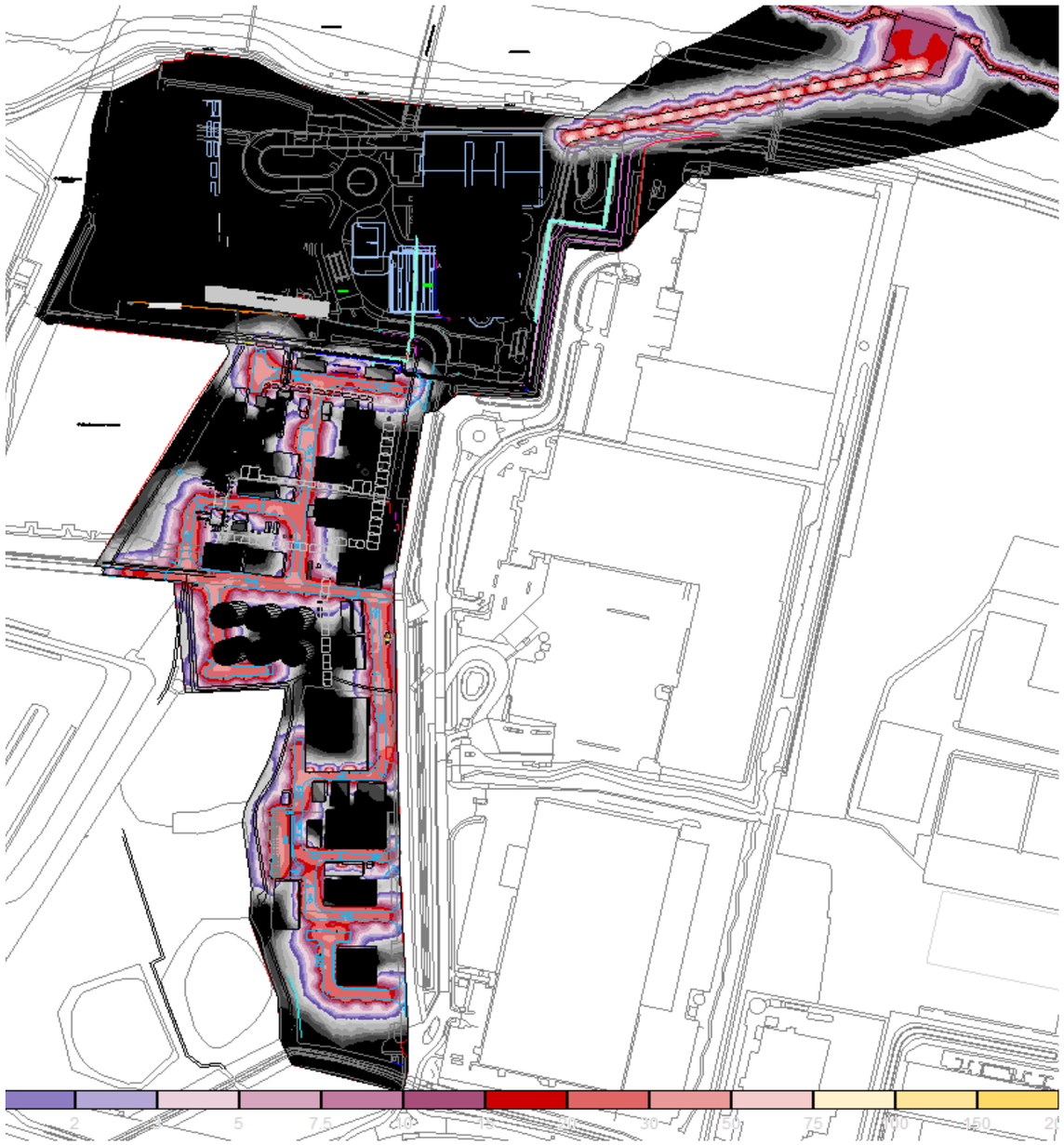


Figure 5.41 Lighting strategy diagram

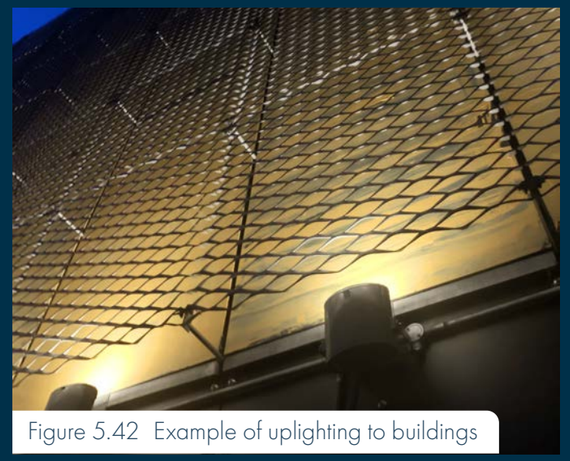


Figure 5.42 Example of uplighting to buildings

Figure 5.43 Example of lighting to storage tanks

Figure 5.44 Example of lighting key features and tall elements

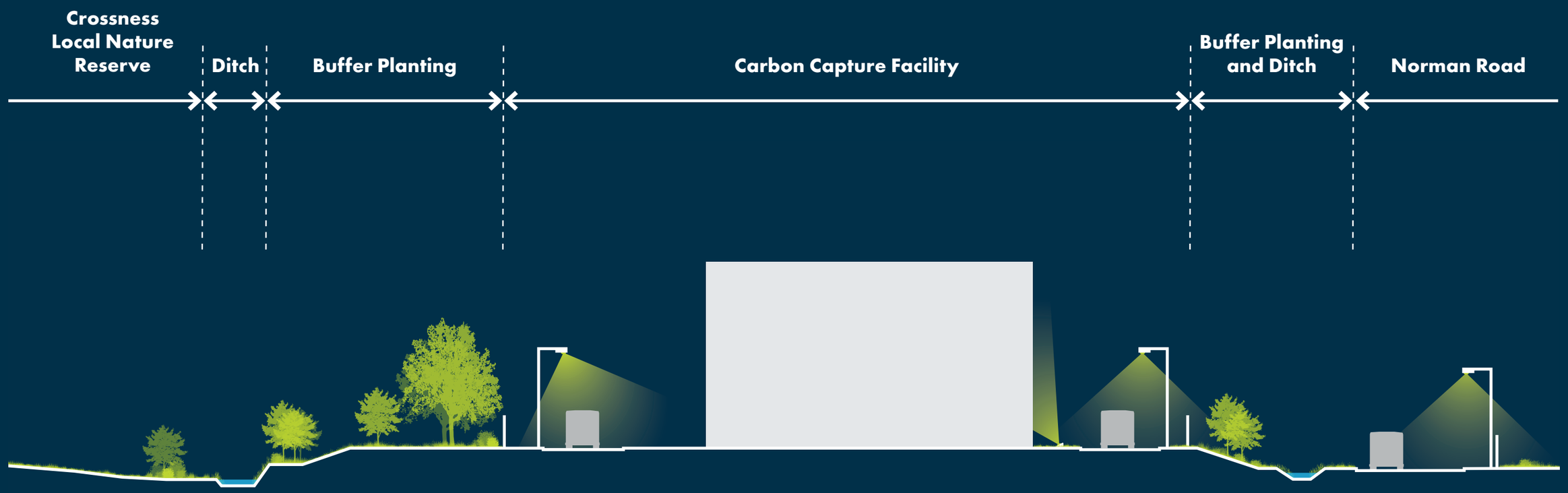


Figure 5.45 Illustrative lighting section

Massing

The approach to building/infrastructure massing proposes that the height of the buildings and infrastructure within the CC Facility steps down from high in the north to low in the south in response to context, reflecting the local character transition from the industrial river corridor to residential community in the south, and supports the provision of a generous access into the proposed extended Crossness Local Nature Reserve.

The strategic massing directs locating larger industrial forms to the eastern side of the CCF site, distanced from the CLNR boundary where possible. The form of the smaller buildings further south should reflect a more human scale relating to the intended use types and the spacing between buildings should widen, making room for trees/greening and providing views between buildings. The massing strategy is reinforced by design code DC_CCF 1.2 (refer to section 6.0).

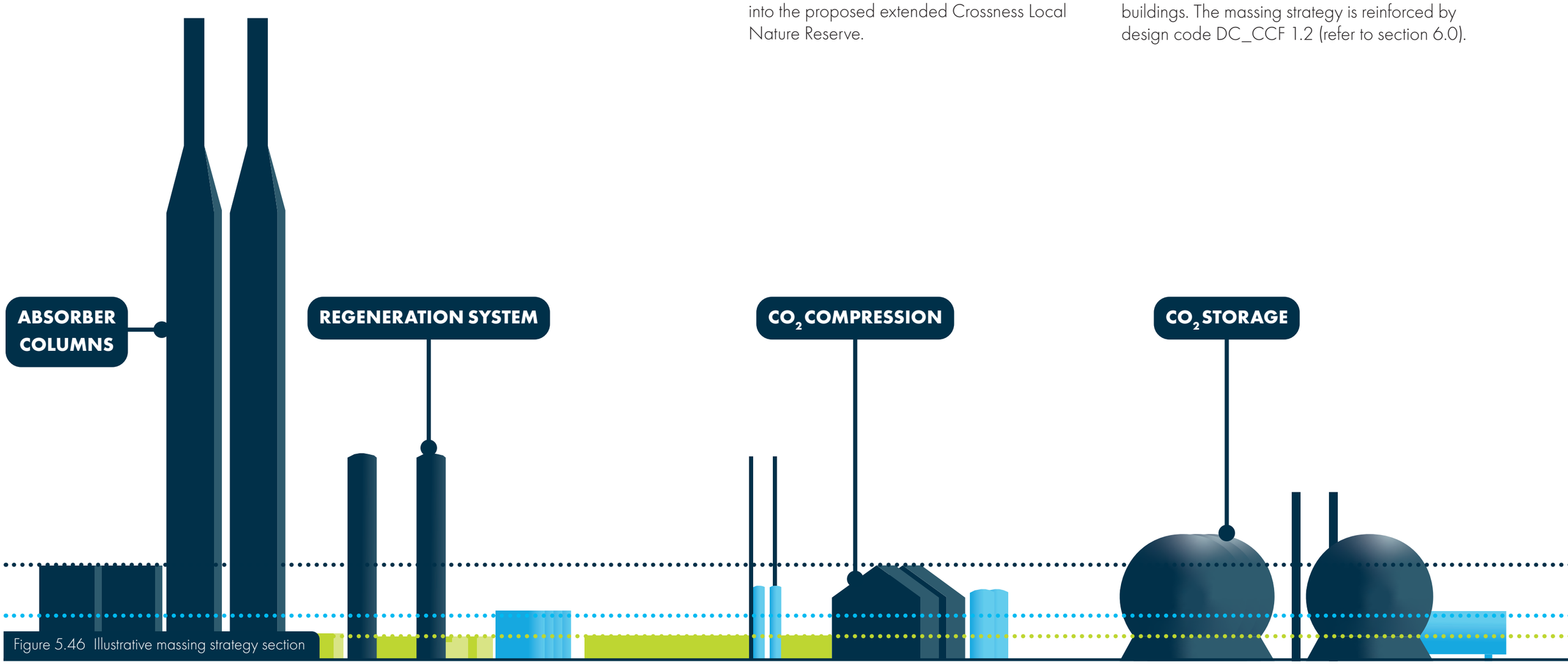


Figure 5.46 Illustrative massing strategy section

Integrating the absorber column and stack minimises the plant footprint and number of tall structures within the plant. The height of the absorber is optimised to achieve high capture rates and minimise environmental emissions. The stack height is designed to ensure good dispersion of the exhaust gases, avoiding downdraughts.

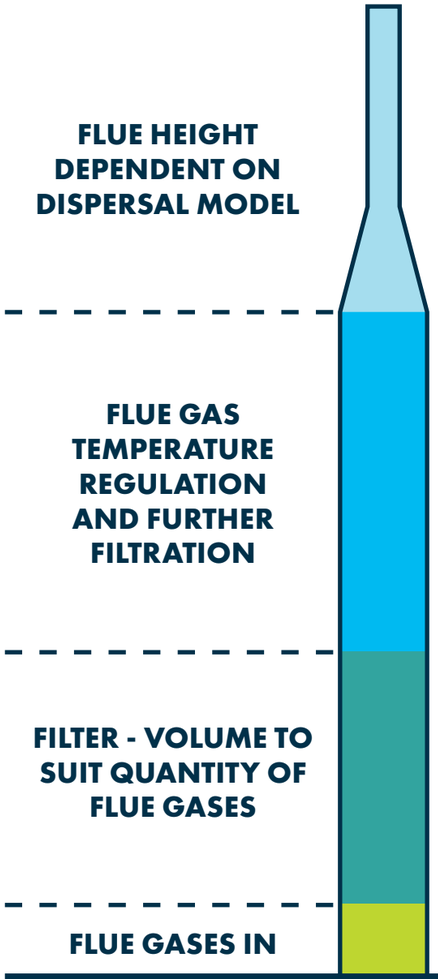


Figure 5.47 Absorber column process diagram

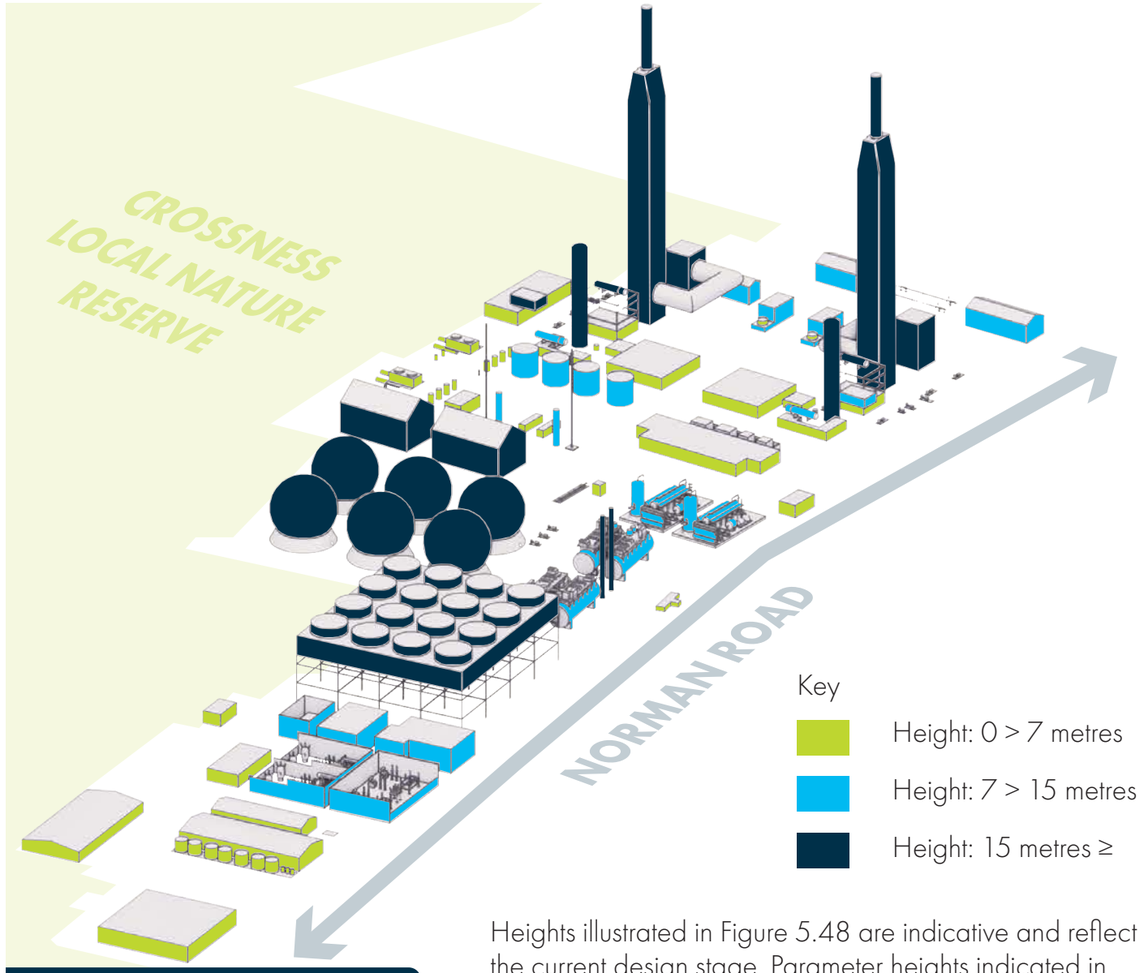
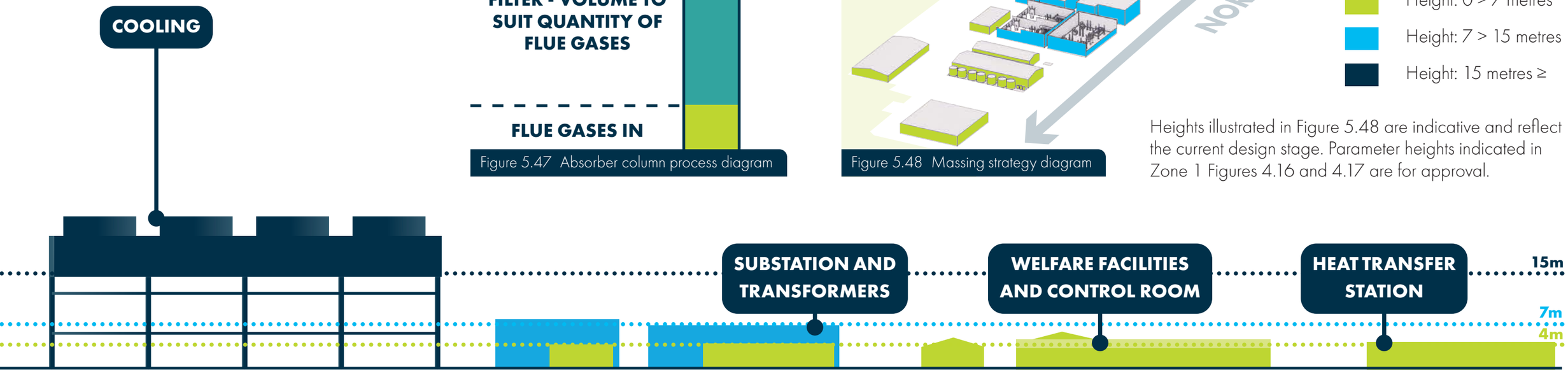


Figure 5.48 Massing strategy diagram

Heights illustrated in Figure 5.48 are indicative and reflect the current design stage. Parameter heights indicated in Zone 1 Figures 4.16 and 4.17 are for approval.



5.4 Sustainable Design

Our approach to sustainability is underpinned by the United Nations (UN) Sustainable Development Goals (SDGs) and 1987 UN Brundtland Commission sustainability definition as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' . The concept of sustainable development requires consideration of three things: economic growth, social inclusion, and environmental protection. The UN define 17 interconnected Sustainable Development Goals that cover these three dimensions that form an outcomes-based framework. The UN SDGs are aimed at everyone; policymakers, civil society, business, academia, and each and every individual.

NPS EN-1 sets out the government's wider objectives for energy infrastructure including contributing to sustainable development.

It notes that sustainable development is relevant not just in terms of addressing climate change, but because the way energy infrastructure is deployed affects the well-being of the environment, society, and the economy, for both current and future generations. For example, the availability of appropriate infrastructure supports the efficient working of the market so as to ensure competitive prices for consumers. The regulatory framework also encourages the energy industry to protect the more vulnerable.

Section 4.7 of EN-1 'Criteria for "Good Design" for Energy Infrastructure' Notes: 'The visual appearance of a building, structure, or piece of infrastructure, and how it relates to the landscape it sits within, is sometimes considered to be the most important factor in good design. But high quality and inclusive design goes far beyond aesthetic considerations.

The functionality of an object - be it a building or other type of infrastructure - including fitness for purpose and sustainability, is equally important.

Applying "good design" to energy projects should produce sustainable infrastructure sensitive to place, including impacts on heritage, efficient in the use of natural resources, including land-use, and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible. It is acknowledged, however that the nature of energy infrastructure development will often limit the extent to which it can contribute to the enhancement of the quality of the area.'

The Overarching National Policy Statement for Energy EN-1 ('NPS EN-1') establishes the criteria for good design for energy infrastructure.

Given the importance that the Planning Act 2008 places on good design and sustainability, NPS EN-1 paragraph 4.7.10 states that the Secretary of State 'needs to be satisfied that energy infrastructure developments are sustainable and, having regard to regulatory and other constraints, are as attractive, durable and adaptable (including taking account of natural hazards such as flooding) as they can be.' In so doing, the Secretary of State should be satisfied that 'the applicant has taken into account both functionality (including fitness for purpose and sustainability) and aesthetics (including its contribution to the quality of the area in which it would be located) as far as possible'.

Figure 5.49 United Nations 17 Sustainable Development Goals

The London Plan 2021 Policy SI2 'Minimising greenhouse gas emissions', requires major development to be net zero-carbon and highlights the need to consider a whole life-cycle approach with respect to emissions, including during the operation of the development. This is reinforced by the Bexley Local Plan 2023: Policy SP14 (Mitigating and Adapting to Climate Change) and Policy DP30 (Mitigating Climate Change); The Bexley Climate Change Statement and Action Plan 2022 to 2026; and The London Environment Strategy, which seeks to ensure that London will become a "zero carbon city by 2050".

Cory's corporate sustainability strategy (2022) is structured around three key themes - getting to net zero, improving environmental performance, and engaging with employees and the wider community. The themes were derived from a materiality assessment of Cory's key sustainability impacts. The assessment was carried out in accordance with the Global Reporting Initiative Standards, which means that a company's material topics (i.e. the topics that are covered by its sustainability strategy and that are publicly reported on) need to represent the company's most significant impacts on the economy, environment, and people. The assessment identified six material issues – these reflect Cory's most significant sustainability topics and form the basis of its sustainability strategy.

In this context, the Proposed Scheme has been designed with sustainability and good design as a key driver informing the design process and outcomes.

Development Aims

The inherent purpose of the Proposed Scheme is to capture CO_2 generated by Riverside 1 and Riverside 2 for permanent storage, avoiding those GHG emissions being released to the atmosphere and aiding decarbonisation of waste management and electricity generation.

The Project balances the delivery of an operationally efficient Carbon Capture Facility, with the expectations of NPS EN-1 in relation to design ambition, environmental improvement, placemaking outcomes and minimising potential development impacts.

Figure 5.50 Cory's material sustainability issues

Sustainability Themes

We have defined Six Sustainability Themes with the relevant United Nations Sustainable Development Goals and mapped how their delivery is delivered through the established Design Principles and Design Code.

Social Value

A catalyst for job creation and regeneration, generating economic and community benefits for the local area, wellbeing, access, neighbours, and community.

As set out in the Project Vision, the Cory Decarbonisation Project should be a good neighbour to the nearby communities by delivering on commitments set out in the Design Principles and Design Code.

Social value is to be gained by promoting positive social, economic, and environmental impact in the Proposed Scheme. The design and operation decisions considering social value include the way of operation, employment, engagement with the local communities and procurement of products and services.

The Proposed Scheme makes a commitment to strong community engagement throughout the design phases. As a key local business in Bexley and along the Thames corridor, Cory has established a Community Fund to support groups and projects that play a role in strengthening local communities, with a particular focus on activities that support Cory's wider goals of:

- Enhancing the local environment.
- Preventing waste and growing the reuse economy.
- Enhancing science, technology, engineering, arts and mathematics skills.
- Supporting employability skills and helping people to access education.
- Increasing engagement with the River Thames.

The project will be planned to enhance the local natural environment through mitigation and compensation activities and improve access to the natural assets in the area for the community and local interest groups, through a comprehensive strategy of habitat enhancement and access, setting the Cory EfW plants and carbon capture proposal in a coherent and attractive setting.

The Proposed Scheme will also provide improved access and facilities for students and school groups to gain educational experiences in the Crossness LNR area.

The Bexley Climate Strategy identifies Cory's heat network as one of the key actions: Work with Cory to encourage the use of the heat produced at the Belvedere Riverside Resource Recovery Ltd in a local district heating initiative or by a local business. Cory are developing a district heat network to provide affordable and low carbon heating to more than 21,000 homes in the London Borough of Bexley and the Royal Borough of Greenwich from Riverside 1 and Riverside 2. The Riverside Heat Network will revolutionise how a large part of the city is supplied with heating, displacing natural gas. Similar to the energy recovery technology within Riverside 1 and 2, the carbon capture process produces heat that is typically wasted. Instead, it is proposed to capture the excess heat created and redirect it to the Riverside Heat Network. The Proposed Scheme has the potential to provide over 100MW of additional heat which would benefit an even greater number of homes and businesses.

The Proposed Scheme will generate hundreds of jobs during construction phases of varying skillset requirement, including opportunity for local apprenticeships. Once operational the Carbon Capture Facility will generate around 27 direct, new FTE positions, with additional indirect and induced employment, many of which will be positions requiring high level knowledge and skills.

In 2022, Cory quantified the social value it generated from its activities, calculating that it delivered £84 million of value to society beyond profit and income, including supply chain spend and engagement, its apprenticeship programme, training opportunities for employees, diverting waste from landfill, engaging with employees and local communities on environmental issues, and supporting local community initiatives.

Land Use and Biodiversity

Protecting and restoring the land for the benefit of wildlife and people.

The Proposed Scheme prioritises mitigation of impacts on the natural environment including strategic planning and spatial matters including Metropolitan Open Land (MOL), Open Space etc.

The Proposed Scheme will provide habitat mitigation, compensation and enhancement within the Mitigation and Enhancement Area and the BNG Opportunity Area. The Proposed Scheme will deliver as a minimum 10% Biodiversity Net Gain. The Outline LaBARDS supports the delivery of the habitat mitigation, enhancements, and BNG commitments.

At a more detailed level enhanced existing ditch management and new ditches, channels, scrapes, and ponds will provide additional diversity of habitat as well as floodwater volume for storage within the grazing marsh.

Capturing rainwater from the operational area, attenuating, treating, and diverting into grazing marsh areas will support the establishment of a more consistently wet grazing marsh habitat suitable for supporting native planting and species with high diversity, and improving ecosystem resilience.

An Outline Lighting Strategy (Document Reference 7.3) has been prepared for the Proposed Scheme in accordance with relevant legislation and guidance in order to minimise effects on valued habitats and species from light intrusion, sky glow or glare.

Tree Planting is proposed within the Mitigation and Enhancement Area and CCF. Additional measures proposed across the Mitigation and Enhancement area include improvements to access, wayfinding, new nesting boxes and platforms and hides, aligned with the existing CLNR management objectives.

Increased access to green space through the construction of new footpaths and cycleways around the development which will contribute towards promoting active travel.

Connectivity

A strategy that works for both the local community and visitors, underpinned by sustainable travel choices to support health and wellbeing outcomes.

Parking and improved access to open land areas should be provided making new links to nearby footpath networks, and creating all-weather routes including raised causeways, bridges, and boardwalks useable throughout wetter periods. Widened and better sign posted active travel connections linking the development and adjacent green space to the Thames Path national cycle route, Thamesmead, and local travel connections.

Promotion of circular routes between Thamesmead to the Crossness LNR will improve local public footpath network while minimising disturbance to local wildlife. Visitor car parking and enhanced pedestrian entrance to the Crossness LNR are proposed to increase recreational usage in the Crossness LNR.

Sustainability Theme	Alignment with the UN SDGs	Delivered by Design Principles and/or Design Code
Social Value		**Design Principles** DP_PE 1.3; DP_PE 1.4; DP_PE 1.6; DP_PL 1.6; DP_PL 1.7; DP_VA 1.3 **Design Code** DC_CW 1.2; DC_LNR 1.1; DC_LNR 1.15; DC_LNR 1.16; DC_LNR 1.3; DC_NOR 1.1
Land Use and Biodiversity		**Design Principles** DP_CL 1.1; DP_CL 1.3; DP_CL 1.4; DP_PL 1.3; DP_PL 1.8; DP_VA 1.2 **Design Code** DC_CW 1.7; DC_CCF 1.1; DC_CCF 1.10; DC_CCF 1.33; DC_LNR 1.2; DC_LNR 1.11; DC_LNR 1.13; DC_LNR 1.5; DC_LNR 1.6; DC_NOR 1.5
Connectivity		**Design Principles** DP_PE 1.1 **Design Code** DC_CW 1.2; DC_LNR 1.15; DC_LNR 1.17; DC_TP 1.2; DC_LNR 1.3; DC_NOR 1.2

Climate Resilience

Building in capacity to adapt to a changing climate and future extremes, protecting the long-term wellbeing of the community and functionality of the Proposed Scheme.

Design specifications will allow for climate change impact on ambient temperatures. The design will be in accordance with the UK Building Regulations and BE EN codes. Where no BS EN code exists the Eurocodes and ISO standards will be adopted. Designing to account for climate resilience is secured through DCO Requirement.

Building design takes into consideration future flood risk and climate change. Finished floor levels are set at an appropriate level where practicable with the minimum equipment height of approximately 3m AOD, to minimise flood risk. Alternatively, any flood sensitive equipment could be raised above the breach flood level.

Flood prevention measures include proposed swales and open basins, underground attenuation tanks and the enhancement of the flood plain habitat. Finished levels are, where practicable, set at an appropriate level to provide for resilient infrastructure.

The drainage system will be designed such that the rate of surface water run-off leaving the Site and entering the adjacent watercourse network is limited to the 1 in 100-year greenfield rate of 35.3 l/s. Surface water storage will be provided by below ground tanked systems and open basins and swales with capacity to cater for a 1 in 100-year plus climate change (+40% increase in rainfall intensity) event.

Sea level rise that can affect the Proposed Jetty have been assessed using UK Climate Projections database from the Met Office, using the 70th and 95th percentile data for RCP 8.5. Extreme water levels have been based on the TE2100 Plan15. Appropriate clearance is provided to enable the flood defences to be raised during the operational lifetime of the Proposed Scheme.

Circular Economy

Design of resource efficiency over the whole life of the development through responsible consumption and facilitation ease of re-use and recycling.

The design of the Proposed Scheme will be undertaken with a view to maximising the lifespan of operational components in the face of particularly corrosive conditions expected, minimising the need for maintenance and refurbishment (thus reducing the frequency of release of associated GHG emission when the carbon capture plant is not in operation/ undergoing maintenance).

The Proposed Scheme will ensure the design is optimised to minimise material consumption and waste generation, as far as reasonably practicable. Construction waste will be recycled or reused where practicable to avoid disposal to landfill, including the reuse of excavated arisings on the Proposed Scheme, where suitable.

The Proposed Scheme will use existing onsite waste prevention, minimisation and management processes and procedures to drive good practice behaviour and contracts, to maximise action in the highest tiers of the Waste Hierarchy and adherence to the proximity principle. Circular Economy practices will be identified and considered to design out wastes, reduce wastes and to divert materials from landfill, into other productive uses. Onsite regeneration of solvent will maximise reuse of this material and reduce embodied emissions associated with procuring fresh solvents for use in the process.

Greenhouse Gas (GHG) Emissions

Responding to the climate emergency with a commitment to net zero.

Whilst Cory is pursuing activities across its business to reduce its carbon footprint, the only method available to materially address the CO_2 emissions from residual waste management is through post-combustion carbon capture.

By capturing both the fossil and biogenic carbon emitted by Cory's operations, they have the potential to play a vital role in helping the UK to achieve net zero.

The GHG emissions arising from the processing of maximum consented waste for Riverside 1 and Riverside 2 has formed the basis of the operational baseline for the Proposed Scheme.

To minimise energy consumption and reduce embodied GHG emissions, the design of the Proposed Scheme will include a selection of highly energy efficiency carbon capture technology.

In line with policy requirements to consider whole-life cycle GHG emissions for proposed development, the Proposed Scheme takes into account GHG emissions and the potential effects from emissions arising during construction, operation and decommissioning. This is aligned with the lifecycle stages identified in PAS 2080:20239, a standard developed for managing carbon in building and infrastructure, which looks at the whole value chain and aims to reduce carbon and cost through intelligent design, construction, and use.

Construction contractors will be expected to ensure optimal performance of plant and equipment through correct and efficient operation, maintenance, and servicing of vehicle fleet to minimise emissions. Contractors will be required to develop and implement an Outline Code of Construction Practice (OCoCP) to measure, monitor and report energy and water consumption and GHG emissions during construction.

The Proposed Scheme will consider options to utilise construction materials with lower embodied carbon. Transportation of materials will be optimised to minimise impacts from GHG emissions, including sourcing construction materials from local suppliers, making use of local waste management facilities where practicable and ensuring the construction programme takes into account requirements for onsite storage of materials and waste.

The backup generator infrastructure for the CCF will be located as far away from the Site Boundary and/or create separation from public right of ways as is practicable to address other potentially harmful emissions.

Sustainability Theme	Alignment with the UN SDGs	Delivered by Design Principles and/or Design Code
Climate Resilience		**Design Principles** DP_CL 1.1; DP_CL 1.2; DP_CL 1.3; DP_CL 1.4; DP_PE 1.3 **Design Code** DC_CW 1.6; DC_CCF 1.5; DC_CCF 1.10; DC_CCF 1.13
Circular Economy		**Design Principles** DP_CL 1.1 **Design Code** DC_CW 1.14; DC_CCF 1.8; DC_CCF 1.18
Greenhouse Gas (GHG) Emissions		**Design Principles** DP_VA 1.1 **Design Code** DC_CCF 1.6; DC_CCF 1.7; DC_LNR 1.8

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