Connah's Quay Low Carbon Power

Environmental Statement Volume IV Appendix 13-A: Water Environment Baseline Survey and Methodology Report

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1. Water Environment Baseline Survey and Methodology Report

1.1 Introduction

1.1.1 This appendix supports **Chapter 13: Water Environment and Flood Risk** (**EN010166/APP/6.2.13**) and provides a detailed description of the study area baseline including the identification of receptors and their individual importance (value).

1.1.2 This appendix also defines the methodology that is used to assess the potential impacts associated with the Proposed Development and the determination of the significance of effects. This baseline also supports the Water Framework Directive Assessment presented in **Appendix 13-B: Water Framework Directive Report** (**EN010166/APP/6.4**).

1.2 Existing Baseline

Existing site

1.2.1 The Site is located north-west of Connah's Quay in Flintshire, North East Wales. The Proposed Development Site is shown on **Figure 3-1: Order Limits** (**EN010166/APP/6.3**). The current four-unit CCGT and associated infrastructure (including GTP) was constructed between 1993 and 1996 in the south-east of the Main Development Area. The plant was constructed on the Pulverised Fuel Ash (PFA) settlement lagoons of the former coal-fire station site, which raised the site to its current height (maximum 7 m AOD). The Construction and Indicative Enhancement Area (C&IEA) formed part of the laydown area for the construction of the current power station.

1.2.2 The Main Development Area is relatively flat with an average elevation of 7.3 m Above Ordnance Datum (AOD) and covers approximately 56.46 ha. The Main Development Area is bordered to the north-east and north-west by the Dee Estuary, to the east and south-east by the existing National Grid 400 kV Deeside Substation, and south and south-west by North Wales Main Railway line.

1.2.3 The existing Connah's Quay Power Station is a four-unit combined CCGT plant providing dispatchable power export to the National Grid. The existing gas fired (CCGT) generating station also includes supporting infrastructure, including settlement ponds, cooling towers, and a water treatment plant, in addition to buildings for storage and workshops, internal access road and parking. Cooling water abstraction and discharge points for the existing Connah's Quay Power Station are located adjacent to the River Dee Estuary, within the Water Connection Corridor, adjacent to the Main Development Area.

1.2.4 The current power station relies on a recirculating hybrid tower system for process cooling. This system draws water from the nearby River Dee as makeup water. Additionally, the cooling system discharges purge water from the cooling system back into the Dee River following treatment on Site and in accordance with an Environmental Permit from Natural Resources Wales (NRW). To minimise any impact on the River Dee Estuary, the abstraction and discharge of cooling water occurs only during specific periods around high tide where there is the greatest supply, dilution and dispersion potential.

Current Abstraction and Discharge Restrictions

1.2.5 The current abstraction licence limits the abstraction of cooling water from the River Dee Estuary, and the current permit allows discharge of cooling water to the River Dee Estuary, as well as the discharge of surface water to Kelsterton Brook / Old Rockcliffe Brook. The currents limits are listed below:

- **abstraction limitation**: includes a maximum of three hours per tide around high water, one hour before and two hours after high water. Make-up and purge water are stored in ponds with capacities of 31,000 m3 and 20,000 m^3, respectively. The purge ponds included a cooling tower for additional cooling before discharge. Water abstraction limits include a maximum instantaneous abstraction of 3.04 m3/s, hourly abstraction of 11 megalitres per hour (ML/h) per high tide abstraction of 33 ML, and annual abstraction of 24,090 ML;
- **discharge limitation:** purge discharge is limited to no more than three hours, starting one hour after high water during the ebb tide;
- **temperature Limits:** the maximum temperature of the cooling water discharge to the River Dee is limited to 25°C. The temperature difference between cooling water discharge and the river must not exceed 13°C;
- **salinity:** levels in the discharge are limited to a maximum of 60 g/l;
- **pH Limits:** pH of the discharge must be maintained within the range of 6 to 9. The limit applied to both cooling water discharge and surface water drains;
- **Residual Chlorite Ion:** discharge must contain no more than 1 mg/l of residual chlorite,
- **Total Residual Oxidant** (**TRO**)**:** levels must not exceed 0.2 mg/l in the cooling water discharge (W1), which is considered the instantaneous maximum limit, and
- **oil and grease:** discharge must not contain more than 20 mg/l of oil and grease.

Study Area

1.2.6 The study area represents a Zone of Influence (ZOI) that has been defined to include water environment features likely to be at risk from possible direct and indirect impacts that might arise from the Proposed Development, as well as to consider existing flood risk. The potential ZOI is 1 km from the Order limits, excluding the Abnormal Indivisible Load routes and Port of Mostyn[1].

1.2.7 Since watercourses flow and impacts may propagate downstream, where relevant, the study area should also consider a wider ZOI based on professional judgement. However, in this case due to the proximity of the Main Development Area to the River Dee Estuary, and the size of this water feature, it is considered the ultimate downstream receptor for this assessment.

1.2.8 During the scoping assessment as described in Chapter 11: Water Environment and Flood Risk of **Appendix 1-A: Scoping Report** (**EN010166/APP/6.4**), a 2 km ZOI was initially considered. However, it has since been found that there are no hydrological connections to water features between 1 km and 2 km distance, therefore a reduced 1 km ZOI has been considered only. However, as noted above, downstream water features and their attributes have been considered within the assessment.

1.2.9 Additionally, tidal influences have been assessed and detailed in **Chater 16: Physical Processes** (**EN010166/APP/6.2.16**). The mean tidal ellipse near the entrance of the Dee Estuary is approximately 6.2 km, with a maximum tidal excursion of 10 km during the highest astronomical tide. Freshwater inflows into the Dee Estuary allows for partial mixing with saline water, leading to density-driven gravitation circulation. While flood tides contribute flows more evenly through the water column, ebb flows remain strongest at the surface resulting in a net seaward flow at the surface and a landward flow closer to the estuary bed. Given the combination of reduced tidal volume, partial mixing, and longitudinal salinity gradient, there is no realistic pathway for significant tidal influence to carry effects upstream. As such, while downstream receptors have been considered, there is no anticipated impact on upstream receptors due to tidal movements.

1.2.10 As flood risk impact can also impact upstream and downstream, **Appendix 13-C: Flood Consequences Assessment (FCA)** (**EN010166/APP/6.4**) considers a wider study area, where relevant. Professional judgement has been applied to identify the extent to which such features are considered. Additional indirect effects may also occur to other water environment receptors distant from the study area through increased demand on potable water supplies and foul water treatment.

[1] Note that potential water quality impacts to surface water and groundwater associated with the delivery of Abnormal Indivisible Loads (AIL) to the Main Development Area are scoped out. Refer to Chapter 13 Water Environment and Flood Risk (**EN010166/APP/6.2**) for further details.

Data sources

1.2.11 The data sources for the assessment are based on a desk-based study and a Site walkover survey, which are described in the following sections.

Desk based study

1.2.12 The desk-based study has been undertaken to identify the surface water and groundwater features within and adjacent to the Proposed Development, and to gather and critically evaluate relevant data and information on their condition and attributes. The baseline information for this chapter has been derived from:

- Ordnance Survey (OS) Mapping (Ref 3 and Ref 4);
- Met Office climate averages (Ref 2);
- Water Watch Wales WFD Mapping (Ref 1);
- The Department for Environment, Food and Rural Affairs (Defra) Multi-agency geographical information for the countryside website (MAGIC) map (Ref 5);
- National Rivers Flow Archive website (Ref 6);
- NRW River, rainfall and sea levels website (Ref 7);
- British Geological Survey (BGS) online Borehole and Geology Mapping (Ref 9 and Ref 10);
- Soil site investigation reports (Ref 6);
- NRW Development Advice Map (Ref 13);
- NRW Flood Map for Planning (Ref 12);
- NRW Flood and Coastal Erosion Risk Maps (Ref 15);
- Flintshire Local Flood Risk Management Strategy 2013 (Ref 16);
- Flintshire Strategic Flood Consequence Assessment 2018 (Ref 17);
- North West England and North Wales Shoreline Management Plan SMP2 (Ref 18);
- Dee Estuary: North West Estuaries Processes Reports (Ref 19);
- Tidal Dee Catchment Action Plan (Ref 20);
- River Dee Basin Management Plan (Ref 22);
- The Deeside Plan 2017 (Ref 21);
- NRW Licenced Water Abstractions website (Ref 24);
- Permitted Discharges to Controlled Waters with Conditions (Ref 25);
- NRW Environmental Pollution Incidents website (Ref 26); and
- NRW Water Quality Archive website (Ref 41).

Site walkover survey

1.2.13 A site walkover survey was undertaken by a geomorphologist and a water scientist on 26 March 2024. This site walkover was to observe the surface watercourses identified as potential receptors, and record connectivity, water quality observations, and hydromorphology.

1.2.14 Weather conditions were dry at the time of survey, but with rainfall preceding. The site visit occurred over one day, and survey locations were determined based on likely areas of impact and availability of access.

Topography and Land-use

1.2.15 The Proposed Development is predominantly located immediately south-east of the Dee Water Framework Directive (WFD) Transitional Water Body. The Main Development Area is therefore indicative of its flat, low-lying coastal topography with typical ground levels ranging between approximately 6-8 m AOD.

1.2.16 The Main Development Area, Electrical Connection Corridor and C&IEA are characterised by flat, low-lying coastal topography with typical ground levels of approximately 6 m to 8 m AOD. The Water Connection Corridor is similar to the aforementioned sites, with the northern portion extending out into the lower marshland and channel of the River Dee Estuary to the north (approximately 3 m to 4 m AOD).

1.2.17 The Main Development Area, Electrical Connection Corridor, C&IEA and Water Connection Corridor are bounded to the south-west by the North Wales Main Line railway and to the north-east by the River Dee and associated floodplain/marshland. The A548 passes over the River Dee between the Main Development Area /Water Connection Corridor and C&IEA.

1.2.18 The Repurposed CO_2 Connection Corridor extends from the Main Development Area rising upslope towards the Proposed CO_2 Connection Corridor (ground levels ranging from approximately 36 m AOD to 48 m AOD).

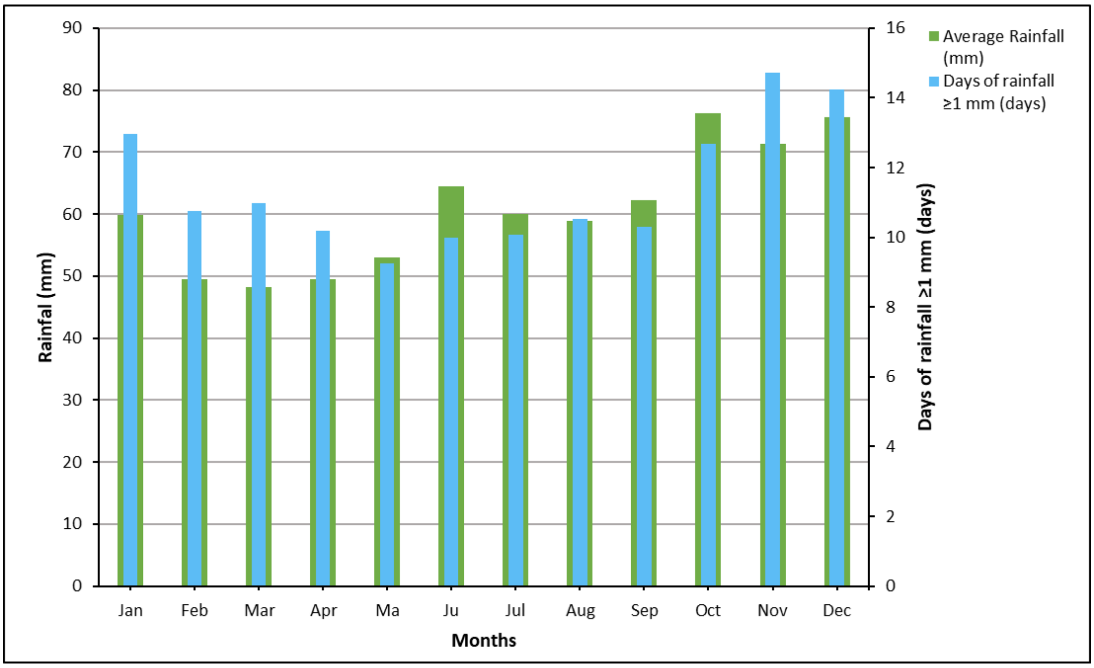
1.2.19 The land use in the south-east of the Main Development Area is predominantly industrial, containing the existing Connah's Quay Power Station, with arable/grasslands surrounding the Main Development Area to the west, and the River Dee Estuary to the north. The C&IEA is constrained by the River Dee Estuary to the north and east, with the remainder surrounded by built-up land, with the power station to the north-west and the residential areas of Kelsterton and Golftyn to the south-west.

Rainfall

1.2.20 The nearest weather station on the Met Office website (Ref 2) with historical data is located at Hawarden (Flintshire), approximately 6.9 km west south-east of Connah's Quay eastern extent of the Main Development Area. Based on the average climate data (for the period 1981 to 2010 (as the most recent data available)) for this weather station, it is estimated that the study area experiences an average of approximately 1465 mm of rainfall per year with it raining more than 1 mm on approximately 137 days per year. This demonstrates that the area can be categorised as dry in comparison to most of the United Kingdom. Rainfall at this location in winter and spring is generally peaking in December (around 136 mm), with the least rainfall in April (approximately 76 mm) on average.

1.2.21 **Plate 1** illustrates how the average rainfall varies throughout the year, with the wettest period being in early autumn to winter, and driest in later winter to spring. Average rainfall is generally less than 60 mm throughout the year, except in September to November when it is between 62 and 75 mm, March is the driest with an average rainfall of approximately 48 mm rainfall between 1991 and 2020.

Plate 1: Hawarden (Flintshire) Weather Station – Average rainfall per month (1991-2020) and average days per month with >1 mm of rainfall (1991-2020)



Surface Water Features

1.2.22 Surface watercourses within the study area have been identified from data from OS mapping and the NRW Water Watch Wales Map Gallery website (Ref 1) and observations from the site walkover. A list of the surface waterbodies identified within the Order limits is provided within **Table 1** and also shown on **Figure 13-1: Surface Water Features** (**EN010166/APP/6.3**).

Table 1: Surface Water Features within the Study Area

Waterbody	Waterbody Type	Description Summary	Scoped In/out
River Dee (WFD)	Transitional / Main River	The River Dee is a designated Main River and flows south-east to north-west along the boundary of the Main Development Area.	In
Kelsterton Brook	Watercourse (Ordinary)	The Kelsterton Brook is an ordinary watercourse that flows in a northly direction towards the Main Development Area before being culverted beneath the Site.	In
Old Rockcliffe Brook	Watercourse (Ordinary	The Old Rockcliffe Brook is a tributary of the Kelsterton Brook. The watercourse flows in a northerly direction to Chester Road, where it enters a culvert.	In
Lead Brook / Northop Brook including Oakenholt Reservoir	Watercourse (Ordinary)	The Lead Brook is an ordinary watercourse that flows south to north through the study area and is a tributary of the Dee Estuary. Upstream of the study area this is known as Northop Brook.	In
Pentre Brook and tributaries	Watercourse (Ordinary)	Pentre Brook is an ordinary watercourse and is a tributary of the Dee Estuary. Pentre Brook is also known as Pandy Brook by NRW. It flows south-west to north-east meeting the Dee at Pentre.	In
Wepre Brook	Watercourse (WFD)	Wepre Brook is a WFD water body that flows in a generally north-easterly direction. The water body enters the River Dee approximately 1.5 km south-east and upstream of the Order limits.	Out - The Proposed Development does not encroach on the Wepre Brook and Swinchiard Brook. These catchments have been identified as having no hydrological

Waterbody	Waterbody Type	Description Summary	Scoped In/out
Swinchiard Brook	Watercourse (WFD)	Swinchiard Brook is a WFD waterbody that flows through the western edge of the study area. The water body is approximately 1.7 km west of the Main Development Area and crosses beneath the A548.	connectivity and therefore have been scoped out of the assessment.
Allt-Goch and tributaries	Watercourse (Ordinary)	The Allt-Goch drains a small catchment to the south of the Main Development Area between Lead Brook and Pentre Brook.	In
Oakenholt Brook	Watercourse (Ordinary)	Oakenholt Brook is a small unnamed watercourse between Lead Brook and Old Rockcliffe Brook. It is culverted beneath the railway track to the south of the Main Development Area, beyond which its course is unclear.	In
Unmapped/Unnamed Streams (South of the Main Development Area)	Watercourse (Ordinary)	Various small watercourses that may all potentially be impacted by the Proposed Development by either being crossed by the Repurposed CO_2 Connection Corridor, crossing the Main Development Area, or being downstream of the Proposed Development.	In

1.2.23 Further descriptions of each of the watercourses are provided in the sections below. There is potential that unmapped watercourses, such as field drains, are located within the study area.

WFD Water Bodies

1.2.24 The NRW Water Watch Wales Map Gallery website (Ref 1) confirms that the Order limits is contained within the Dee Estuary WFD Operational Catchment, within the Dee Management Catchment.

1.2.25 In total, the Order limits includes two WFD water bodies, including one transitional WFD water body and one groundwater body, these are highlighted within **Table 2** (see also **Figure 13-1: Surface Water Features** (**EN010166/APP/6.3**)). There is a large area of the study area which does not fall within a WFD water body catchment, but as the ultimate receptor of all watercourses within the study area is the Dee (N. Wales) Transitional Water Body then they can be considered to relate to this WFD catchment.

Table 2: WFD Water Bodies in the Order limits and current status (Cycle 3 2021) (Ref 34)

Water body name	Waterbody ID	Waterbody type	Hydro-morphological Designation	Catchment / groundwater Area (km^2)	Current status / Potential	Chemical Failing Elements		Reasons for not achieving good status	Overall Objectives
Dee (N. Wales)	**GB531106708200**	Transitional	Heavily modified	305.8	Overall status	Moderate	Specific pollutants, phosphate	Point source pollution from continuous sewage discharge by the water industry	Good by 2027
					Chemical	Moderate			
					Ecological	Good			
Dee Carboniferous Coal Measures	**GB41102G204800**	Groundwater	Natural	1184	Overall	Poor	Chemicals – not specific	Diffuse source pollution from abandoned mine	Poor by 2015
					Ecological	Good			
					Chemical	Poor			

River Dee and Dee Estuary

1.2.26 The River Dee is a designated Main River which drains a catchment area of approximately 1,800 km^2, mainly in Wales but in the lower reaches the Dee often runs along the border of England. Its source is in the mountains and lakes of the Snowdonia National Park before it runs to the Dee Estuary. Reservoirs in the upper parts of the catchment store water and regulate the flow in the Dee. There is a continuous area of low-lying marshland and tidal mudflats between the Proposed Development and the main channel. The River Dee and its estuary has a high conservation value being designated as two Special Areas of Conservation (SAC) and notified as three separate Sites of Special Scientific Interest (SSSIs). The intertidal habitat of the Dee Estuary is designated as a Special Protection Area (SPA) and Ramsar site.

1.2.27 The Shoreline Management Plan (SMP) (Ref 18) describes the mouth of the Dee Estuary as being characterised by several channels and sandbanks. It states that much of the Welsh bank of the estuary has industrial and commercial activities at the shoreline, including factories and power stations, as well as the railway line and roads. The extensive inter-tidal flats, and the waterfowl that use them, are protected with numerous environmental conservation designations. The long-term plan under the SMP is to continue to manage risks to commercial and industrial assets from flooding and erosion, but to also allow more natural evolution where appropriate. In order to mitigate the impacts of the defences on the evolution of the estuary in combination with expected long term future sea level rise the plan allows for creation of areas of new habitat by moving defences inland where opportunities exist. Managed realignment was therefore assessed as an alternative policy at a number of locations within the Dee.

1.2.28 The existing Connah's Quay Power Station sits on an area of reclaimed land which was previously an expanse of clay-silt-sand-based alluvium deposits. Expansive sandbars were prominent at the Main Development Site between 1885-1900, with a single-thread meandering channel, before entering the Irish Sea.

1.2.29 Today, the estuary has had industrial properties built along the south-western edge, including flood defences, which alongside climate change has the potential for further loss of salt-marsh due to processes associated with coastal squeeze. The main channel of the River Dee which flows in from the east-side of the estuary, is also heavily modified, exhibiting a canalised and regular planform upstream of Connah's Quay which it has been since as far back as at least the 1860's.

1.2.30 Superficial deposits of the transitional water body mainly consist of alluvium deposits, which stretch across much of the current urban area on the right-bank where the A548 passes over, highlighting that the transitional body was once a lot wider than is currently observed today. Further inland, glaciofluvial sands and gravel are present, along with Devensian till, where loam to clayey loam is the predominant parent material.

1.2.31 The estuary is macro-tidal where a mean spring tidal range at Hilbre Island at the far west of the estuary is recorded at 7.6 m and is restricted to 3.4 m by Connah's Quay due to the entering river flow. Flood tidal currents are stronger than ebbing tides which promotes the accretion of sediments within the estuary (Ref 19). The estuary is considered to be a major sink for both mud and sand, with the key source of sediment the onshore movement of sediment from the Irish Sea.

1.2.32 Further information on the Dee Estuary and coastal processes is provided in **Chapter 16: Physical Processes** (**EN010166/APP/6.2.16**).

Water quality

1.2.33 Water quality is monitored by NRW for the estuarine River Dee, as shown on Water Watch Wales (Ref 1). There have been no bathing water sites identified within the study area.

1.2.34 **Table 3** provides an overview of water quality sample locations for the River Dee.

Table 3: Overview of water quality sample locations for the River Dee

Monitoring Station	NGR	Duration	Number of samples
Powergen Buoyage Point	SJ2840071200	2014-2024	50
Johnson Hole	SJ2923370304	2014-2024	13
White Sands	SJ2612473753	2014-2015	5
The Grindes	SJ2906470442	2014-2015	4

1.2.35 The monitoring locations at Powergen Buoyage Point and Johnson Hole were originally established to assess the impacts of industrial discharge from local manufacturing and power generation facilities. As such, these locations are not fully representative of baseline water quality conditions in the estuary, as they reflect the influence of these industrial inputs. However, they have been included in the baseline monitoring to indicate the broader impacts of industrial discharges on the estuarine environment.

1.2.36 In contrast, the monitoring locations at White Sands and The Grindes are more likely to provide a closer representation of the baseline water quality of the estuary, as they are located in areas less influenced by industrial activities.

1.2.37 **Table 4** presents a summary of monitoring data for the River Dee.

Table 4: Results of water quality sampling undertaken by NRW for the River Dee (2014-2024)

Parameter Name	Units	EQS	Powergen Buoyage Point			Johnsons Hole			White Sands			The Grindes		
			Min	Max	Mean[1]	Min	Max	Mean[1]	Min	Max	Mean[1]	Min	Max	Mean[1]
Temperature of water	°C	-	4.07	21.10	10.84	4.36	17.67	11.69	11.50	17.60	14.72	12.60	17.20	14.88
Salinity (In Situ)	µg/l	-	1.73	30.92	19.42	7.70	30.92	19.34	11.45	25.71	19.19	0.66	24.49	17.09
Dissolved Oxygen %	%	-	78.7	113.1	91.4	83.7	123	93.0	87.0	114.2	95.6	88.9	116.1	88.9
Dissolved Organic Carbon as C	mg/l	-	1.32	5.71	2.74	2.12	8.87	4.51	-	-	-	-	-	-
Lead (dissolved)	µg/l	1.3	0.052	0.439	0.128	<0.4	<0.4	<0.4	-	-	-	-	-	-
Mercury (dissolved)	µg/l	0.07	<0.01	0.013	0.0108	<0.01	0.027	0.0128	-	-	-	-	-	-
Cadmium (dissolved)	µg/l	0.2	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	-	-	-	-	-	-
Zinc (dissolved)[3]	µg/l	6.8	3.17	20.5	6.80	2.9	6.9	5.34	-	-	-	-	-	-
Nickel (dissolved)[3]	µg/l	0.3 / 2	0.591	1.32	0.861	<0.2	<0.2	<0.20	-	-	-	-	-	-
Arsenic (dissolved)	µg/l	25	<2	2.93	2.13	<2	<2	<2	-	-	-	-	-	-
Copper (dissolved)	µg/l	3.76[2]	0.731	1.75	1.117	<3	<3	<3	-	-	-	-	-	-
Chromium Hexavalent (dissolved) Cr VI	µg/l	0.6	<0.3	<0.3	<0.3	-	-	-	-	-	-	-	-	-

Notes

1- Average concentrations have conservatively calculated that values below level of detection are at the level of detection.

2 – EQS is for DOC less than 1 mg/l, EQS will be variable and higher for this waterbody given the elevated DOC.

3 – Zinc and Nickel average annual concentration will be variable and higher than EQS for this waterbody accounting for ambient background concentrations (shaded in red).

1.2.38 This data indicates that many of the parameters are below the detectable limit against the WFD Environmental Quality Standards (EQS) (Ref 40) for transitional waters, although there is some evidence of dissolved metal concentrations across the monitoring sites, including exceedances of the EQS at Powerge Buoyage Point for Zinc and Nickel. Zinc average annual concentrations at Powergen Buoyage Point are at around the EQS, however would be higher than the EQS taking into account the ambient background concentration. Nickel concentrations at Powergen Buoyage Point exceed the average annual EQS, however do not exceed the maximum allowable EQS. It is important to note that these concentrations have not been measured in the wider estuary in the publicly available datasets.

Flow

1.2.39 There are no gauging stations within the Proposed Development study area to provide baseline data on flow. However, three stations are located south-east of the Main Development Area, approximately 16 km to 17 km away. These include the Dee at Chester Suspension Bridge (Station NG: SJ410659), the Dee at Iron Bridge (Station NGR: SJ4180060020) and further upstream, the Dee at Farndon (Station NGR: SJ4121154347).

1.2.40 The nearest gauging station on the National River Flow Archive (NRFA) (Ref 6) to the Main Development Area is Dee at Chester Suspension Bridge (gauging station reference 067033) which lies in the town of Chester. The average annual mean flow at this station is 34.078 m^3/s. The flow that is exceeded 5% of the time (Q5) is 119 m^3/s and the flow that is exceeded 95% of the time (Q95) is 5.13 m^3/s for gauged mean daily flow for 1994 – 2013. National River Flow Archives (NRFA) indicates that this station became inoperative in 2013 due to issues with the ultrasonic gauge, and it has not been reinstated since.

1.2.41 The next nearest upstream gauging station on the National River Flow Archive is Dee at Ironbridge (gauging station reference 067027) which lies downstream of the village of Aldford. The average annual mean flow at this station is 37.785 m^3/s. The flow that is exceeded 5% of the time (Q_5) is 123 m^3/s and the flow that is exceeded 95% of the time (Q_{95}) is 9.686 m^3/s for gauged mean daily flow for 1994 – 2022. NFRA states that flows are slightly higher here than at Chester Suspension Bridge due to abstractions on the reach.

Summary of Ecological Value

1.2.42 The River Dee and its estuary are of significant ecological importance, hosting diverse habitats, species, and several conservation designations. The estuary, influenced by tidal dynamics, serves as a critical transitional zone between marine and freshwater ecosystems. Full details regarding these ecological features are provided in **Chapter: 11 Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**) and **Chapter 12: Marine Ecology** (**EN010166/APP/6.2.12**).

Conservation Designations

1.2.43 The Dee Estuary is designated as a Ramsar site, a SPA, SAC under the Conservation of Habitats and Species Regulations 2017 (Ref 37), a Shellfish Water Protection Area (2022) (Ref 38) and as a SSSI under the Wildlife and Countryside Act 1981 (Ref 39). These designations underline the ecological value and protection of this area. Additional designations beyond the estuary include the River Dee and Bala Lake SAC, recognised for their importance to migratory species such as Atlantic salmon (*Salmo salar*).

Habitats and Species

1.2.44 The Dee Estuary and River Dee support a range of habitats that contribute to its ecological diversity:

- **Intertidal Sand** and **Muddy Sand,** these habitats display sediment variation influenced by tidal cycle and support a variety of species;

1.2.45 **Coastal Saltmarshes and Saline Reedbeds,** found along the upper intertidal zone, these areas provide vital ecosystem services, including flood defence and biodiversity support; and

- **Intertidal Mud,** limited but critical habitat between saltmarshes and sandy areas, supporting benthic communities.

1.2.46 The estuary supports several species of conservation concern, including:

- **Annex I Habitats:** Intertidal sand, muddy sand, and saltmarshes; and
- **Annex II Species:** River lamprey (Lampetra Fluviatilis) and sea lamprey (Petromyzon marinus).

1.2.47 In terms of fisheries, the Dee Estuary and River Dee are vital breeding, sheltering and nursey areas for many coastal migratory fish species, some of which are listed as Species of Principal Importance (SOPI). Notably, plaice larve use estuarine nursey areas before moving to coastal zones.

Invasive Species

1.2.48 The estuary also hosts Invasive Non-Native Species (INNS), such as the Chinese mitten crab (*Eriocheir sinensis*), which is spreading throughout the mid and lower reaches of the River Dee. This species, although primarily freshwater, migrates downstream for reproduction in brackish, estuarine, and marine environments.

Benthic Invertebrates

1.2.49 The estuary benthic invertebrate community is diverse, as identified in surveys conducted by the Environment Agency in 2015. Key species comprised of 31% molluscs, 25% nematodes, 23% ammelids (polychaetes and oligochaetes), 19% crustaceans, and 1% nermertea, with an overall good species diversity and abundance. These invertebrates provide an abundant food source for fish and waterbirds.

Kelsterton Brook

1.2.50 Kelsterton Brook is an ordinary watercourse and is a tributary of the Dee Estuary.

1.2.51 The watercourse arises south of the study area at Mole Road and flows in a northerly direction towards the Main Development Area. The brook is culverted immediately upstream of Kelsterton Lane and the A548, prior to appearing to flow in an easterly direction to the south of the railway line. It is joined by flows from a number of named and unnamed tributaries, before being culverted beneath the Main Development Area and eventually discharging to the Dee Estuary.

1.2.52 There are named watercourses to the east of Kelsterton Brook, some of which may be tributaries (Golftyn Drain, Coleg Drain and Top-y-fron Dingle) or which may coalesce and be culverted beneath the eastern extent of the Proposed Development site, north of Golftyn (see **Figure 13-1: Surface Water Features** (**EN010166/APP/6.3**)). It is not clear as to the exact course of these watercourses based on available information.

Water quality

1.2.53 NRW have confirmed that they have no water quality data available for Kelsteron Brook.

Flow

1.2.54 There are no NRW flow gauging stations for Kelsterton Brook, and NRW have stated that they have no spot flow data on the Kelsterton Brook.

Hydromorphology

1.2.55 The Kelsterton Brook was surveyed on the site walkover (26 March 2024). At approximately 1 km upstream of the Order limits (NGR SJ 27545 70182) the watercourse was characterised by a sinuous single thread, gravel bed channel which displayed a pool-riffle typology (**Plate 2**). It flowed through an area of woodland surrounded by agricultural fields, and woody material provided by the adjacent woodland helped promote morphological diversity within the channel. Pools, bars and riffles, and areas of natural bank erosion were all noted through this reach. Small pools or scrapes were noted through the left floodplain within the woodland, fed by small drainage channels. Some of these channels had evidence of iron ochre deposits and appeared to be of groundwater origin. An area of channel widening, and excessive bank retreat was noted where livestock poaching was evident, which likely contributes fine sediment to the watercourse. A short historic culverted section was also observed in this reach.

Plate 2: Kelsterton Brook flowing through woodland habitat 1 km upstream of Order limits (taken with iPhone at NGR SJ 27556 70179 on 26 March 2024)

1.2.56 Immediately upstream of the Order limits (NGR SJ 27586 70982) the watercourse emerges from a culvert under the A548 (**Plate 3**). Mapping indicates that Kelsterton Brook and Old Rockcliffe Brook join around this location, although the confluence could not be observed on site. The watercourse comprised an open channel for approximately 25 m at this location, set between the A458 road culvert at the upstream extent and the railway and power station culvert and the downstream extent. A small bridge crossing was also present through this short reach. The channel was straight with a uniform cross section and had little morphological diversity. The banks and riparian zone were vegetated with scrub, grasses and trees. Bed material could not be observed due to access restrictions.

Plate 3: Kelsterton Brook and wider landscape immediately upstream of Order limits (taken with iPhone at NGR SJ 27586 70982 on 26 March 2024)

1.2.57 Downstream of the existing power station (NGR SJ 27883 71263), Kelsterton Brook and Old Rockcliffe Brook emerges from an approximately 1 m diameter culvert with a tidal flood gate. Concrete wingwalls extend for approximately 4 m downstream of the culvert (**Plate 4**). The watercourse represents a tidal creek through salt marsh from this location to its confluence with the Dee Estuary (**Plate 5**). It is surrounded by tidal marsh which is likely to be periodically inundated during particularly high tides. The channel appeared to have been historically straightened and likely has a more fixed planform due to historic landscape modifications. Bed sediment comprised mud, clay and silt, representative of sediments typically found within a tidal channel.

Plate 4: Outfall from culvert on Kelsterton Brook (taken with iPhone at NGR SJ 27882 71262 on 26 March 2024)

Plate 5: Tidal creek character of Kelsterton Brook and surrounding tidal marsh (taken with iPhone at NGR SJ 27899 71251 on 26 March 2024)

Summary of Ecological Value

1.2.58 Kelsterton Brook flows directly into the Dee Estuary, which is a SAC, SPA, Ramsar, and SSSI, reflecting its ecological importance as part of the estuary broader conservational network. Top-y-fon Dingle and Kelsterton Brook Local Wildlife Site (LWS), located approximately 0.35 km south-east of the Order limits, is designated for its broad-leaved woodland and scrub habitats, elevated as being of County importance. Although these habitats are not directly associated with Kelsterton Brook, the site maintains hydrological connectivity via the Brook, which is culverted under the existing Connah's Quay Power Station.

1.2.59 Similarly, Cheshire Farm Woodland (LWS), situated 0.85 km south-east of the Order limits, holds County-level ecological value. In both cases, these LWSs are not water dependent designated sites. Information in relation to ecological value is provided in **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

Old Rockcliffe Brook

1.2.60 Old Rockcliffe Brook is an ordinary watercourse and arises approximately 1.6 km south of the Main Development Area. The watercourse is unnamed on OS mapping, however anecdotal information from those working at the existing power station indicates that it is named Old Rockcliffe Brook, therefore this name has been used within the assessment. The watercourse flows in a northerly direction to Chester Road, where it enters a culvert. North of the road there is a confluence with Kelsterton Brook and a small tributary, following which the three are culverted beneath the existing power station site as described above for Kelsterton Brook.

Water quality

1.2.61 NRW have stated they have no water quality data available for Old Rockcliffe Brook.

Flow

1.2.62 There are no NRW flow gauging stations and NRW have stated they have no spot flow data on the Old Rockcliffe Brook.

Hydromorphology

1.2.63 Old Rockcliffe Brook was surveyed on the site walkover (26 March 2024). The watercourse was observed at NGR SJ 27277 70529 where it comprised a straight modified channel that flowed along a field boundary (**Plate 6**). The channel was uniform and displayed little morphological diversity, having been historically modified for agricultural drainage and likely impacted by livestock poaching and siltation. The bed largely comprised finer material, although some small gravels were noted in parts. The watercourse was culverted under a field access.

Plate 6: Old Rockcliffe Brook flowing adjacent to field boundary approximately 500 m upstream of the Order limits (taken with iPhone at NGR SJ 27263 70520 on 26 March 2024)

Summary of Ecological Value

1.2.64 Old Rockcliffe Brook flows into Kelsterton Brook, maintaining indirect hydrological connectivity to the Dee Estuary SAC, SPA, Ramsar site, and SSSI. While the brook is smaller in scale compared to the Kelsterton Brook, it serves as part of the interconnected watercourse network within the same area. Cheshire Farm Wood (LWS) located 0.85 km south-east of the Order limits is hydrologically linked via Old Rockcliffe Brook albeit it is not water dependent.

1.2.65 Information in relation to ecological value is provided within **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

Pentre Brook

1.2.66 Pentre Brook is an ordinary watercourse and is a tributary of the Dee Estuary. Pentre Brook is also known as Pandy Brook by NRW.

1.2.67 The watercourse arises in Flint Mountain and flows in a generally north-easterly direction. The brook flows approximately 480 m west of the Proposed CO_2 Connection Corridor, through Pentre Ffwrndan, prior to discharging to the River Dee Estuary.

1.2.68 Tributaries of Pentre Brook (Allt-Goch Brook and an unnamed tributary) are crossed by the Repurposed CO_2 Connection Corridor and the Proposed CO_2 Connection Corridor.

Water quality

1.2.69 NRW have stated that they have no background water quality data available for Pentre Brook, other than records of Water Treatment work discharges to the watercourse.

Flow

1.2.70 There are no NRW flow gauging stations and NRW have stated that they have no spot flow data on the Pentre Brook.

Hydromorphology

1.2.71 Pentre Brook was surveyed on the site walkover (26 March 2024). The watercourse was observed at NGR SJ 25403 72025, where it occupied a gravel and cobble bed channel flowing through a small woodland through the upper length. Further downstream, however, it was confined to a brick banked modified channel taking flow to a mill pond. The channel appeared to have been diverted through an area of higher ground, reducing the gradient and energy of the watercourse. A weir of approximately 4 m height was present at the downstream extent of the mill pond, impounding flow to create the pond (**Plate 7**). The watercourse is culverted under the A548 approximately 0.13 km downstream of the mill pond. Downstream of the A548 crossing the watercourse flows through a straightened channel confined on both banks by buildings and a car park, although there is a minor buffer of some trees and scrub on the right bank. Aerial imagery and mapping indicate that the watercourse is culverted under the railway further downstream, before becoming a tidal creek and discharging to the River Dee.

Plate 7: Weir on Pentre Brook (taken with iPhone at NGR SJ 25469 72043 on 26 March 2024)

Summary of Ecological Value

1.2.72 The Pentre Brook, also known as Pandy Brook, is an ordinary watercourse that serves as a tributary to the Dee Estuary SAC, SPA, Ramsar, SSSI and through the Mynydd Y Fflint / Flint Mountain SSSI. No records of protected or notable species have been identified for this watercourse. Information in relation to ecological value is be provided within **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

Lead Brook

1.2.73 The Lead Brook is an ordinary watercourse that flows south to north through the study area and is a tributary of the Dee Estuary.

1.2.74 The brook arises as Northop Brook to the south of Northop and flows in a northerly direction to become Lead Brook. Upstream of Oakenholt, the watercourse is impounded to form a small reservoir, called Oakenholt Reservoir which supplies water for commercial purposes (see **Table 10**) as well as angling. Downstream of the reservoir, the watercourse is culverted beneath Oakenholt Mills and the railway line before discharging to a wide-open channel that extends along the full length of the western boundary of the Main Development Area, before eventually discharging to the River Dee through a tidal reach. The Repurposed CO_2 Connection Corridor intersects the Lead Brook in the culverted section (NGR SJ 26271 71670) adjacent to the Main Development Area boundary upstream of the A548 culvert.

Water quality

1.2.75 NRW have a water quality monitoring site on the Lead Brook at "STREAM FROM OAKENHOLT, BY BIRD WATCH" (NGR SJ 2663072000). Sampling there was undertaken on 48 occasions between 2018 and 2024. A summary of the data is provided in **Table 5.**

Table 5: Results of water quality sampling undertaken by NRW for Lead Brook "STREAM FROM OAKENHOLT, BY BIRD WATCH" (2018 – 2024)

Parameter Name	Units	EQS	Min	Max	Mean[1]
Temperature of Water	°C	-	4.29	21.3	10.8
Dissolved oxygen	%	-	77.9	115.2	92.3
Salinity (In Situ)	µg/l	-	4.72	31.59	22.20
Dissolved Organic Carbon as C	mg/l	-	1.2	9.67	3.38
Lead (dissolved)	µg/l	1.3	0.0486	1.2	0.2589
Mercury (dissolved)	µg/l	0.07	<0.010	0.010	0.010
Cadmium, Dissolved	µg/l	0.2	<0.03	0.0315	0.03
Zinc, Dissolved[3]	µg/l	6.8	2.7	15.6	6.7
Nickel, Dissolved	µg/l	8.6	<0.2	2.7	0.83
Arsenic, Dissolved	µg/l	25	<2	2.68	2.02
Copper, Dissolved	µg/l	3.76[2]	0.621	2.58	1.32
Chromium Hexavalent (dissolved) (Cr VI)	µg/l	0.6	<0.3	<0.3	<0.3

Notes

1- Average concentrations have conservatively calculated that values below level of detection are at the level of detection.

2 – EQS is for DOC less than 1 mg/l, EQS will be variable and higher for this waterbody given the elevated DOC.

3 – EQS for Zinc is 6.8 µg/l, EQS will be variable and higher for this waterbody given its location to industrial and urban areas (shaded in red).

1.2.76 The data in **Table 5** indicates that Lead Brook is a well-oxygenated water body with detectable concentrations of dissolved metals. There are no exceedances of average annual WFD EQS, however Zinc is very close to the average annual EQS, with some maximum values above the annual average EQS. This is unsurprising given the location of the Lead Brook downstream of industrial and urban areas.

Flow

1.2.77 Lead Brook drains a catchment of 3.05 km^2. There are no NRW flow gauging stations or spot flow data on the Lead Brook.

Hydromorphology

1.2.78 Lead Brook was surveyed on the site walkover (26 March 2024). The watercourse was observed at NGR SJ 26316 71180, where it is impounded by an earth dam creating a reservoir upstream that was being used for recreational coarse fishing. A spillway with vertical brick banks took flow down the approximately 15 m high slope to the natural channel level (**Plate 8**). It is likely that coarse sediment transport within the watercourse is severely hindered by the dam, preventing coarse sediment from being transported from reaches upstream of it. The watercourse flowed through a woodland for approximately 250 m downstream of the dam, where mapping then indicates it is culverted under a paper mill, the A548 road and the railway.

Plate 8: View to Lead Brook at bottom of spillway from reservoir (taken with iPhone at NGR SJ 26308 71181 on 26 March 2024)

1.2.79 Lead Brook was also observed downstream of Chester Road (NGR SJ 26326 71752), where it emerges from a culvert with tidal flood gate into an approximately 5 m wide artificial basin. This basin had a silty bed with barely perceptible flow. A straight channel, likely artificially straightened, flowed from the basin (**Plate 9**) towards the Dee Estuary. This channel had some gravel noted on the bed, especially where the gradient was steeper, although bed substrate was predominantly comprised of silt and clay, characteristic of a tidal creek. The creek is quite incised in places and low tide levels may be around 1 m below bank top. The riparian zone comprised short grasses and halophytes typical of a coastal lowland location. The creek was observed close to high tide.

Plate 9: Straight section of Lead Brook to the west of the Order limits (taken with iPhone at NGR SJ 26333 71759 on 26 March 2024)

Summary of Ecological Value

1.2.80 Lead Brook flows directly into the Dee Estuary SAC, SPA, Ramsar, and SSSI. The Lead Brook also has hydrological connectivity to Lead Brook Wood LWS, which is designated for its broad-leaved woodland, scrub, and pasture habitats of County importance. The LWS is not water dependent.

1.2.81 The brook supports a diverse community of aquatic macroinvertebrates and is home to fish species. Additionally, aquatic macrophytes are also present, though the range of plant species is limited. This habitat contributes to a productive ecosystem, supporting protected species such as European eel (*Anguilla anguilla*), Atlantic salmon (*Salmo salar*), and brown/sea trout (*Salmo trutta*). The surrounding woodland and watercourse also provide potential habitat for otters. These species are of conservation concern and further highlight the ecological importance of Lead Brook and its connections to the Dee Estuary SAC and SSSI.

1.2.82 Information in relation to ecological value is provided within **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

Oakenholt Brook

1.2.83 An unnamed watercourse arises approximately 1.6 km south-east of the Main Development Area, between Lead Brook and Old Rockcliffe Brook. The watercourse flows in a northerly direction beneath Oakenholt Lane and is then culverted beneath Chester Road and the railway line. The direction of the watercourse after the railway line is not known. The watercourse has been named Oakenholt Brook for the purposes of this assessment.

Water quality

1.2.84 There are no NRW water quality data available for Oakenholt Brook.

Flow

1.2.85 There are no NRW flow gauging stations or spot flow data on the Oakenholt Brook.

Hydromorphology

1.2.86 Oakenholt Brook was surveyed on the site walkover (26 March 2024). The watercourse was observed at the crossing of Oakenholt Lane (NGR SJ 26406 70775), approximately 0.85 km upstream of the Order limits (**Plate 10**). The watercourse at this location comprised a gravel bed channel set within agricultural fields. The watercourse was incised and likely has limited floodplain connection through this length. A narrow strip of trees and scrub occupy the riparian zone, with agricultural fields and Oakenholt Lane surrounding.

Plate 10: Incised reach of Oakenholt Brook upstream of Oakenholt Lane (taken with iPhone at NGR SJ 26409 70771 on 26 March 2024)

1.2.87 The watercourse was also observed immediately upstream and downstream of the A458 road culvert (NGR SJ 26880 71288). It occupied a straight, modified incised channel both upstream and downstream of the road crossing. The riparian zone comprised a narrow strip of trees and scrub surrounded by agricultural fields and hardstanding farmland. Aerial imagery and mapping (Ref 4) indicate that the watercourse is culverted again when it reaches the railway line approximately 80 m downstream of the A458 road crossing. It is not clear from mapping or aerial imagery where this culvert discharges to.

Plate 11: Straightened reach of Oakenholt Brook (taken with iPhone at NGR SJ 26871 71258 on 26 March 2024)

Summary of Ecological Value

1.2.88 Oakenholt Brook flows northward into the River Dee Estuary, site designated as a SAC, SPA, SSSI, and Ramsar site. However, no designated Local Wildlife Sites (LWS) or specified habitat designations are directly associated with the brook itself. It is not known to contain protected species.

1.2.89 Information in relation to ecological value is provided within (see also **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

Allt-Goch Brook

1.2.90 Two unnamed tributaries of Pentre Brook are crossed by the Existing and Proposed CO_2 Connection Corridors. The larger has been named Allt-Goch Brook for the purpose of this assessment, which arises approximately 1.7 km south of the Main Development Area boundary and drains a small catchment between Lead Brook and Pentre Brook. The watercourse flows in a northerly direction through a park and is then culverted beneath many residential roads, Chester Road and the railway line to flow to Pentre Brook within the tidal zone of the River Dee Estuary.

1.2.91 The tributary arises near to Lead Brook Drive to the east of Allt-Goch Brook, and flows in a north-westerly direction and is culverted beneath residential roads and is assumed to join Allt-Goch Brook within the park.

Water quality

1.2.92 There are no NRW water quality data available for Allt-Goch Brook.

Flow

1.2.93 There are no NRW flow gauging stations or spot flow data on the Allt-Goch Brook.

Hydromorphology

1.2.94 The tributary of Allt-Goch Brook was surveyed on the site walkover (26 March 2024). The watercourse was observed at the crossing of a track which runs between Lead Brook Drive and Coed Onn Road (NGR SJ 25798 71345). Upstream of the track the watercourse occupied a very small, poorly defined, informal channel that is likely dry for much of the year. The minor drainage channel was approximately 0.2 m wide and grassed. Downstream of the track the watercourse occupies a more formal, incised channel (**Plate 12**). Bed material appeared to comprise gravels. Some trees occupied the riparian zone, but short grassed pasture fields were dominant.

Plate 12: Allt Goch Brook approximately 650 m upstream of Order limits (taken with iPhone at NGR SJ 25845 71471 on 26 March 2024)

1.2.95 Allt-Goch Brook was also observed at the crossing of a track which runs between Lead Brook Drive and Coed Onn Road (SJ 25391 71092). Here the watercourse flowed through a small woodland (**Plate 13**). The watercourse appeared to have been straightened, likely to facilitate the track crossing. Little morphological diversity was observed, and the bed appeared silty.

Plate 13: Allt-Goch Brook flowing through wooded area at track crossing (taken with iPhone at NGR SJ 25390 71090 on 26 March 2024)

1.2.96 Allt-Goch Brook was further observed within an incised channel at the edge of a housing development (NGR SJ 25717 71735) (**Plate 14**). The banks and riparian zone were grassed through the upstream length and appeared to be maintained with regular mowing. Bed sediment appeared silty and turbidity was higher, likely as a result of fine sediment from active construction of the nearby housing development entering the watercourse via road drainage. The watercourse was culverted under a road within the housing development. Further downstream, gravel and coarser material was noted on the bed, and some minor riffle features provided some flow diversity. The watercourse is culverted under the A548, after which it flows adjacent to a boundary wall of a property, and onwards through grazed farmland.

Plate 14: Allt-Goch Brook flowing adjacent to houses, to the west of the Order limits (taken with iPhone at NGR SJ 25717 71737 on 26 March 2024)

Summary of Ecological Value

1.2.97 Allt-Goch Brook is a tributary of Pentre Brook, which subsequently flows into the River Dee, maintaining indirect hydrological connectivity to the River Dee SAC, SPA, SSSI and Ramsar site. While Allt-Goch brook is smaller in scale compared to the main river, it serves as part of the interconnected watercourse network within the same catchment. This connection makes it relevant for several important species, include the European eel (*Anguilla anguilla*), Atlantic salmon (*Salmo salar*), and brown/sea trout (*Salmo trutta*). However, no designated Local Wildlife Sites (LWS) or other water dependent designated sites are directly associated with the Allt-Goch Brook.

1.2.98 Information in relation to ecological value is provided within Chapter **11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**).

Groundwater

1.2.99 The following sections provide a summary of the existing geology and ground conditions within the Proposed Development Site and 1 km study area. Further information on the geological baseline conditions is presented in **Appendix 14-A: Geo-environmental Desk Based Assessment** and **Appendix 14-F: Tier 2, Stage 1 Generic Risk Assessment: Soil and Groundwater (EN010166/APP/6.4)**. Also refer to **Figure 13-2: Superficial Geology** (**EN010166/APP/6.3**) and **Figure 13-3: Bedrock Geology** (**EN010166/APP/6.3**).

Geology Summary

1.2.100 A summary of the geology within the study area can be found below; further information can be found in **Appendix 14-A: Geo-environmental Desk Based Assessment** (**EN010166/APP/6.4**).

Made Ground

1.2.101 Made Ground is present below: Main Development Area, Water Connection Corridor (partly), Electrical Connection Corridor, C&IEA, Existing Surface Water Outfall, and Alternative Access to Main Development Area and Access to C&IEA (partly).

1.2.102 The Made Ground is comprised of clay, PFA, clayey sand and gravel and the occasional brick and concrete layers.

1.2.103 Made Ground has been recorded in the Main Development Area to be between 1.6 m to 3 m (Ref 6).

Superficial deposits

1.2.104 Superficial deposits are shown on **Figure 13-2: Superficial Geology** (**EN010166/APP/6.3**).

1.2.105 There is a large area of Tidal Flat Deposits associated with the Dee Estuary, and also to the east of, and underlying, the A458 and the North Wales Main Line railway. The Tidal Flat Deposits comprise of unconsolidated silts, sands and clays and underlie the following Site areas: Main Development Area, Water Connection Corridor, Electrical Connection Corridor, C&IEA, Existing Surface Water Outlet, Access to Main Development Area, Alternative Access to DA and Access to C&IEA.

1.2.106 Glacial Till, comprising of diamicton, is mapped below the Proposed CO_2 Connection Corridor, the Repurposed CO_2 Connection Corridor and Access to Main Development Area.

1.2.107 Along the eastern boundary of the Proposed CO_2 Connection Corridor, Glaciofluvial Deposits comprising of sand and gravel are mapped.

1.2.108 In the study area there are isolated pockets of Head deposits (clay, silt, sand and gravel) and Glaciofluvial Deposits (sands and gravels).

1.2.109 Superficial deposits have been recorded beneath the Main Development Area to be up to approximately 20 m (Ref 6).

Bedrock Geology

1.2.110 Bedrock Geology is shown on **Figure 13-3: Bedrock Geology** (**EN010166/APP/6.3**). The bedrock geology in the study area consists of heavily faulted and complex strata.

1.2.111 The Pennine Lower Coal Measures Formation (PLCMF) consists of mudstones, siltstones and pale grey sandstones. It is the predominant geology in the study area. PLCMF underlies, to different extents, each area of the Site. PLCMF sandstone, outcrops along the Proposed CO_2 Connection Corridor, Electrical Connection Corridor and Alternative Access to Main Development Area and Access to C&IEA.

1.2.112 Etruria Formation (ETM) consists of conglomerates, lenticular sandstone and mottled mudstone and is located within the centre of the Main Development Area.

1.2.113 Gwespyr Sandstone Formation (GS) consists of fine grained micaceous and feldspathic sandstones and cross-stratified conglomerates with siltstone and mudstone beds. GS is located below the: Main Development Area, C&IEA and the Access to Main Development Area.

1.2.114 The Bowland Shale Formation is present within the study area but does not underlie the Proposed Development Site.

Aquifer Designations

1.2.115 The superficial deposits are dominated by low permeability silts and clays (Tidal Flat, Glacial Till, and Head deposits), and are classified as Secondary Undifferentiated Aquifers defined as 'layers previously designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.

1.2.116 Glaciofluvial deposits are designated as Secondary A Aquifers defined as 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers'.

1.2.117 The majority of the Proposed Development Site excluding the northern half of the Water Connection Corridor is underlain by bedrock aquifers designated as Secondary A Aquifers.

1.2.118

1.2.119 **Table** 6 summarises the superficial and bedrock aquifers present within each area of the Proposed Development Site.

Table 6: Aquifer Designations

Area	Superficial Aquifer (geological strata)	Bedrock Aquifer (geological strata)
Main Development Area	Secondary Undifferentiated (Tidal Flat Deposits)	Secondary A (PLCMF, GS, ETM)
Proposed CO_2 Connection Corridor	Secondary Undifferentiated (Glacial Till) Secondary A (Glaciofluvial Deposits)	Secondary A (PLCMF inc. sandstone formation outcrop)
Repurposed CO_2 Connection Corridor	Secondary Undifferentiated (Tidal Flat Deposits and Glacial Till)	Secondary A (PLCMF inc. sandstone formation outcrop, GS)
Water Connection Corridor (Southern half)	Secondary Undifferentiated (Tidal Flat Deposits)	Secondary A (PLCMF)
Electrical Connection Corridor	Secondary Undifferentiated (Tidal Flat Deposits)	Secondary A (PLCMF inc. sandstone formation outcrop)
C&IEA	Secondary Undifferentiated (Tidal Flat Deposits)	Secondary A (PLCMF, GS)
Existing Surface Water Outlet	Secondary Undifferentiated (Tidal Flat Deposits)	Secondary A (PLCMF)
Access to Main Development Area	Secondary Undifferentiated (Glacial Till)	Secondary A (PLCMF, GS)
Alternative Access to Main Development Area and Access to C&IEA	Secondary Undifferentiated (Tidal Flat Deposits)	Secondary A (PLCMF inc. sandstone formation outcrop)

Area	Superficial Aquifer (geological strata)	Bedrock Aquifer (geological strata)
Study area only, does not underlie Site	Secondary Undifferentiated (Head Deposits)	Secondary Undifferentiated (Bowland Shale Formation)

Notes:
Made Ground is not designated as an aquifer.
Secondary A: 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers'.
Secondary undifferentiated: 'layers previously designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.

Groundwater Levels and Flow

1.2.120 Groundwater levels within the Main Development Area have been monitored on three occasions following the most recent GI undertaken in 2025 (see **Appendix 14-A: Geo-Environmental Desk Based Assessment** (**EN010166/APP/6.4**). Groundwater levels within the superficial deposits have been recorded between 1.08 m bgl and 4.2 m bgl (0.76 m AOD and 5.68 m AOD respectively). Groundwater flow within the Made Ground and superficial deposits is likely to be controlled by the presence of low permeability clays, silts and ash. Groundwater flow may occur, and be perched, in areas of higher permeability for example where sand/gravel/cobbles/bricks may be present. Overall, groundwater flow is to the north-east towards the River Dee at a shallow gradient of 0.01 m which would likely vary locally across the Main Development Area due to the variable nature of the superficial deposits.

1.2.121 The bedrock aquifer is confined and exhibits artesian conditions to the south-east of the Main Development Area within the construction laydown area (**Appendix 14-A: Geo-Environmental Desk Based Assessment** (**EN010166/APP/6.4**). The potentiometric surface ('groundwater level') of the confined aquifer has been recorded between 0.46 m bgl and 3.16 m bgl (3.93 m AOD and 6 m AOD respectively). Groundwater flow within the aquifer is to the east and is likely to be influenced by the presence of fractures within the bedrock.

1.2.122 There is no groundwater level monitoring data available beyond the Main Development Area within the Proposed Development Site or the study area. An indicative understanding of groundwater levels has been obtained from publicly available information held by the British Geological Survey (BGS), see **Table 7**. It should be noted, these water levels are not representative of current baseline conditions. As expected, groundwater levels have been recorded to be shallow within the Made Ground and superficial deposits.

1.2.123 There is one bedrock aquifer groundwater level reading within the Order limits. This groundwater level does not indicate that the groundwater within the bedrock is in continuity with the overlying superficial deposits and Made Ground. Groundwater flow within the bedrock aquifers is likely to be predominantly by fracture flow however, intergranular flow may occur in the higher permeability mapped PLCMF sandstone beds. Groundwater flow direction cannot be confirmed however it is likely to be towards the Dee Estuary and the Liverpool Bay (Irish Sea).

1.2.124 As part of the 2025 GI, data loggers were installed in four boreholes within the Main Development Area to record groundwater levels. Two loggers were installed in the superficial deposits and two in the bedrock. The groundwater levels record a tidal fluctuation response of approximately 10 cm in the superficial deposits and a negligible tidal response in the bedrock.

Table 7: Historical Groundwater Levels

Borehole ID	Year	Geology	Groundwater level mbgl	Groundwater level mAOD	Comments
SJ27SE23	1967	Made Ground	0.3	5.6	Water strike
SJ27SE300	1990	Superficial deposits	4	2.6	Water strike, rose to 3.50 mbgl in 20 mins
SJ27SE301	1990	Superficial deposits	3	3.5	Water strike, did not rise
SJ27SE301	1990	Bedrock (sandstone)	12.30	-5.8	Strong groundwater inflow
SJ27SE16	1967	Superficial deposits	3.5	Unknown	Water strike

Source: Publicly available borehole logs from the BGS

1.2.125 During the 2025 GI, permeability testing was undertaken to obtain hydraulic conductivity data, a summary of the results can be found in **Table 8**.

Table 8: Hydraulic Conductivity

	Hydraulic Conductivity m/s		
Aquifer	Minimum	Geometric mean	Maximum
Superficial deposits	8.54×10^{-07}	1.74×10^{-06}	3.56×10^{-06}
Bedrock	2.96×10^{-07}	6×10^{-07}	1.20×10^{-06}

Groundwater Source Protection Zones

1.2.126 The study area does not lie within a Source Protection Zone (SPZ).

Groundwater Quality

1.2.127 The study area is located within the Dee Carboniferous Coal Measures WFD groundwater body (ID: GB41102G204800), this groundwater body was classified as being of 'poor' overall quality.

1.2.128 Three rounds of groundwater quality monitoring were undertaken following the GI. With regards to groundwater salinity, the results showed freshwater to be present within shallow boreholes parallel to the south-west boundary of the Main Development Area. This is as expected as the groundwater is recharged through infiltration of rainwater as well as groundwater flow from up hydraulic gradient within the aquifer. The deeper boreholes and those closer to the River Dee recorded brackish waters typically with Total Dissolved Solids (TDS) in the range of 1,250 mg/L to 5,600 mg/L. Brackish waters were encountered in both the deeper superficial deposits and the bedrock aquifers. One location recorded saline waters with TDS over 17,000 mg/L, this was in the mudstone bedrock from the borehole closest to the River Dee.

1.2.129 There is no further groundwater quality monitoring data available within the Order limits or the study area.

1.2.130 Further information on groundwater quality can be found in **Appendix 14-A: Geo-environmental Desk Based Assessment** (**EN010166/APP/6.4**).

Groundwater Vulnerability

1.2.131 Groundwater vulnerability across the study area is typically high, although this varies and ranges from low to high. Further details on groundwater vulnerability can be found in **Table 6** within **Appendix 14-A: Geo-environmental Desk Based Assessment** (**EN010166/APP/6.4**).

Groundwater dependent terrestrial ecosystems

1.2.132 The Water Connection Corridor is partially located within a groundwater-dependent terrestrial ecosystem (GWDTE) (Ref 35). The GWDTE is known as the Dee Estuary / Aber Afon Dyfrdwy.

Water Resources

1.2.133 This section contains information on water resources, including active permitted discharges, licensed water abstractions, and past environmental pollution incidents. The information contained was provided by NRW publicly available data sources. A data request was sent to NRW, however no additional water resources were provided at the time of writing.

Drinking Water Safeguard Zones

1.2.134 The study area falls within the Dee Carboniferous Coal Measures groundwater body, which is a classified groundwater Drinking Water Protection Area (DrWPA). DrWPA is an area designated to safeguard the sources of drinking water. These areas are critical for maintaining water quality and ensuring safe drinking water for communities.

Nitrate Vulnerable Zones

1.2.135 A Nitrate Vulnerable Zone (NVZ) is an area designated to protect water from nitrate pollution. Regulations within the NVZs aim to reduce nitrate runoff into water features, safeguarding environmental and human health. The Proposed Development Site does not overlap with a NVZ.

Active Permitted Discharges

1.2.136 In addition to the current operation of the existing power station there are 15 active permitted discharges known within 1 km of the Proposed Development Site. Locations are shown within **Figure 13-6: Water Resources** (**EN010166/APP/6.3**) and detailed further within **Table 9**.

1.2.137 The majority of the consented discharges are for sewage effluent from pumping stations and combined sewer overflows, whilst the remainder originate from trade effluent from industrial areas and sewage from a domestic landfill site.

Licensed Water Abstractions

1.2.138 In addition to the current operation of the existing power station, data provided by NRW indicates that there are four licensed water abstractions within 1 km of the Proposed Development Site. Locations are shown within **Figure 13-6: Water Resources** (**EN010166/APP/6.3**) and are listed in **Table 9**.

1.2.139 All four abstractions are related to surface water and no licensed groundwater abstractions have been identified within 1 km of the Proposed Development Site.

1.2.140 Three of the abstractions relate to industrial, commercial, and public services, including two abstractions for Essity UK Limited (paper production) abstracting from Lead Brook and Pentre Brook, an impoundment of the coastal Pentre Brook by Delyn Borough Council, and an abstraction from the tidal River Dee for the production of energy, which is licensed to the existing Connah's Quay Power Station.

Table 9: Active Permitted Discharges within 1 km of the Proposed Development Site

ID	Permit No	Issue date	Site Name	Description	Receiving Environment	Receiving Water	Easting	Northing
D1	BB3097HK	09/01/2019	Oakenholt HWRC	WA: Waste Site - Domestic Landfill Tip	Freshwater Estuary	River Dee Estuary	326319	371751
D2	CM0058401	31/03/2010	Flint WwTW	SA: Sewage Disposal Works – including a sewage pumping station at the head of a works	River, stream or ditch	Pandy Brook (Pentre Brook), Tidal Trib Of Dee	325788	372517
D3	CM0058402	27/05/2020	Settled Storm Sewage At Flint WwTW	SA: Sewage Disposal Works – including a sewage pumping station at the head of a works	Saline Estuary	River Dee Estuary	325780	372440
D4	CM0038701	17/12/2019	Oakenholt Main Sps	SC: Sewerage Network - Pumping Station - water company	River, stream or ditch	Pentre Ffwrndan Drain	325678	372147
D5	CM0086801	29/08/2019	Cestrian St CSO	SB: Sewerage Network CSO - water company	River, stream or ditch	Unnamed Watercourse Flowing To The River Dee	329732	369585
D6	CM0183501	10/07/1990	Papermill Lane Ps	SC: Sewerage Network - Pumping Station - water company	River, stream or ditch	Culverted Section of Lead Brook	326280	371720
D7	CM0164301	07/10/2019	Connahs Quay Deva Avenue - CSO	SB: Sewerage Network CSO - water company	Saline Estuary	River Dee	328738	369434

ID	Permit No	Issue date	Site Name	Description	Receiving Environment	Receiving Water	Easting	Northing
D8	CM0164401	26/02/2020	Connahs Quay Linden Avenue - CSO	SB: Sewerage Network CSO - water company	Saline Estuary	River Dee	328800	369499
D9	CM0164901	26/02/2020	Connahs Quay Dock Road Ps	SC: Sewerage Network - Pumping Station - water company	Saline Estuary	River Dee	329506	369885
D10	CM0165601	26/02/2020	Connahs Quay Golftyn Ps Cso/Storm	SC: Sewerage Network - Pumping Station - water company	River, stream or ditch	Golftyn Brook	328524	370377
D11	CG0322301	27/01/1992	Kelsterton Pump Stn.	SC: Sewerage Network - Pumping Station - water company	River, stream or ditch	The Kelsterton Brook	327900	370700
D12	CG0344101	29/09/1993	Dock Road Ps No 3 Dock Road Connah	SC: Sewerage Network - Pumping Station - water company	Saline Estuary	Dee Estuary	329470	369830
D13	CG0338201	01/03/1993	Dock Road Ps No 2 Dock Road Connah	SC: Sewerage Network - Pumping Station - water company	Saline Estuary	Dee Estuary	329880	369860
D14	CG0378901	12/02/2019	The Hedgerows Y Waen Flint Mountain	TF: Domestic Property (Multiple)	River, stream or ditch	Pentre Ffwrndan Via Sws	324350	370850
D15	BB3696ZC	15/02/2022	Oakenholt Mill	RB: Industrial estate	River, stream or ditch	Lead Brook	326303	371203

ID	Permit No	Issue date	Site Name	Description	Receiving Environment	Receiving Water	Easting	Northing
D16	EPR/NP3037AF	09/02/2007	Uniper UK Limited	Cooling water discharge – Thermal effluent	Saline Estuary	Dee Estuary	328500	371500

Note – The permitted discharge for the existing Connah's Quay Power Station is not available on the NRW data catalogue for permitted discharges. Therefore, this information has been sourced from the current permit details.

Table 10: Licensed abstractions within the Study Area

ID	Permit No	Operator	Source	Location	Purpose	Easting	Northing
SW1	24/67/10/0079	Essity UK Limited	Surface Water	Reservoir (Lead Brook)	Industrial, Commercial, Public Services	326334	371176
SW2	24/67/10/0080	Essity UK Limited	Surface Water	Stream (Petre Brook)	Industrial, Commercial, Public Services	325525	372065
SW3	24/67/10/0099	Delyn Borough Council	Surface Water	Impounding weir (Pandy/Petre Brook)	Impounding	325750	372440
SW4	24/67/10/0124	Uniper UK Limited	Surface Water	Dee Estuary	Production of Energy	328430	371160

Private water supplies

1.2.141 Private Water Supplies (PWS) are any water supply which is supplied to a property and does not originate from a mains supply or licensed water supplier. Anyone who wants to remove or abstract water from either an underground source or a surface source and wants to take more than 20 cubic metres a day would require an abstraction license from the relevant authority.

1.2.142 Details of PWS have been provided by Flintshire County Council, this indicates four PWS within the study area, details of these are provided in **Table 11**.

Table 11: FCC Private Water supplies

PWs Ref	Name	No. properties on supply	Source Type	Usage	Easting	Northing
P560/PWS/105	Nant Farm	2	Well	Domestic	323236	371112
P560/PWS/020	Coed Y Cra Mill	2	Spring	Domestic	323206	370289
P560/PWS/104	Leadbrook Cottage	1	Borehole	Domestic	326005	370412
D560/PWS/003	Tyn Y Coed	10	Mains	Domestic	325470	369322

1.2.143 In addition, Flintshire County Council have provided a list of 23 properties in the study area which are served by PWS though it is not clear the sources of these.

Past Environmental Pollution Incidents

1.2.144 Pollution incidents are classified by NRW as category 1 (major), 2 (significant), 3 (minor) or 4 (insignificant).

1.2.145 One past environmental pollution incident of Category 3 (Minor) was identified within 1 km of the Proposed Development Site within the last 20 years by NRW (Ref 26). Details are given within **Table 12** and the location is shown in **Figure 13-1: Surface Water Features** (**EN010166/APP/6.3**).

Table 12: Pollution Incidents in the Study Area between 2005 and 2017

ID	Incident No	Incident Date	Incident Location	Receptor	Category	Easting	Northing
P2	397313	09/05/2006	Connah's Quay	Dee Estuary	3 (Minor)	329811	369814

Flood Risk

1.2.146 The Main Development Area, Electrical Connection Corridor, C&IEA, Water Connection Corridor and the Repurposed CO_2 Connection Corridor are all entirely or partially situated on the south bank of the River Dee. These areas of the Site are potentially at risk from fluvial, tidal and, to a lesser extent, surface water flooding. This section outlines the baseline risk of flooding within the Order limits.

Tidal flood risk

1.2.147 Tidal flood sources include the sea and estuaries. The NRW Flood Map for Planning (FMfP, Ref 12) shows that parts of the Order limits are located within areas of tidal Flood Zone 3 (see **Figure 13-8: Flood Map for Planning: Rivers and Seas** (**EN010166/APP/6.3**)). NRW Flood Zone definitions are as follows for tidal flood risk:

- **Flood Zone 1**: **Areas** with less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.
- **Flood Zone 2: Areas** with less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
- **Flood Zone 3: Areas** with greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.

1.2.148 NRW provided a hydraulic model for the River Dee, originally produced in 2011 and updated in 2020 and 2022. This model did not include the Proposed Development location within the 1D-2D model extent. Therefore, to better define flood risk associated with the Proposed Development, hydraulic modelling has been undertaken, the details of which are given in **Appendix 13-C: FCA** (**EN010166/APP/6.4**). The scope of the modelling was agreed with NRW.

1.2.149 **Figure 13C-1** within **Appendix 13-C: FCA** (**EN010166/APP/6.4**) displays the maximum modelled flood extent during the 1 in 200 year (0.5% AEP) plus 2074 climate change event. Flooding is generally confined to the river channel, with minimal out of bank flooding. No inundation is present for the Main Development Area. A small area of the northern section of the Repurposed CO_2 Connection Corridor is shown to be inundated with depths reaching up to 1.1 m. Small areas of inundation are also present in the C&IEA with depths reaching up to 0.6 m. The Water Connection Corridor encroaches upon the River Dee and is located within the flood extent.

1.2.150 Floodwaters encroach onto small parts of the Main Development Area during the 1 in 1000 year (0.1% AEP) plus 2074 climate change event.

1.2.151 The construction laydown areas are shown on **Figure 13C-1** within **Appendix 13-C: FCA** (**EN010166/APP/6.4**). The eastern construction laydown area is partially located within the 1 in 200 year (0.5% AEP) plus 2074 climate change flood extent, however the welfare facilities and staff car park proposed in this area would be located outside of the 1 in 200 year (0.5% AEP) plus 2074 climate change flood extent. This is secured through the **Framework CEMP** (**EN010166/APP/6.5**).

1.2.152 Overall, the baseline tidal flood risk varies from low to high across the Order limits.

Fluvial flood risk

1.2.153 Fluvial flooding occurs when a river exceeds its capacity following sustained or intensive rainfall. **Figure 13-8: Flood Map for Planning: Rivers and Seas** (**EN010166/APP/6.3**) indicates the majority of the Proposed Development is in fluvial Flood Zone 1. However, part of the Water Connection Corridor and Repurposed CO_2 Connection Corridor are located within fluvial Flood Zone 3. NRW's fluvial flood zones are defined as follows:

- **Flood Zone 1**: Areas with less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.
- **Flood Zone 2:** Areas with less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
- **Flood Zone 3:** Areas with a greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.

1.2.154 **Figure 13C-2** within **Appendix 13-C: FCA** (**EN010166/APP/6.4**) displays the maximum modelled flood extent during the 1 in 100 year (1% AEP) plus 45% climate change event which shows that the only area of the Proposed Development located within the flood extent is the Water Connection Corridor.

1.2.155 Overall, the baseline fluvial flood risk varies from low to high across the Order limits.

Surface water flood risk

1.2.156 Overland flow routes form when the infiltration capacity of the ground surface is exceeded during rainfall events and surface water runoff is generated. This is exacerbated when low permeability soils and/or geology are experienced or where there are large areas of impermeable surfacing.

1.2.157 According to the NRW FMfP (Ref 12), the majority of the Proposed Development is shown to be in Flood Zone 1 for surface water flooding as shown in **Figure 13-8: Flood Map for Planning (Rivers and Sea)** (**EN010166/APP/6.3**). NRW define surface water flood zones as follows:

- **Flood Zone 1**: Areas with less than 1 in 1000 (0.1%) chance of flooding from surface water in a given year, including the effects of climate change.
- **Flood Zone 2**: Areas with 1 in 1000 (0.1%) to 1 in 100 (1%) chance of flooding from surface water in a given year, including the effects of climate change.
- **Flood Zone 3**: Areas with more than 1 in 100 (1%) chance of flooding from surface water in a given year, including the effects of climate change.

1.2.158 The existing internal roadways at the existing Connah's Quay Power Station are shown to be located within Flood Zones 2 and 3 from surface water flooding. There are other small, isolated areas of Flood Zones 2 and 3 within the Main Development Area.

1.2.159 Overall, the baseline surface water flood risk varies from low to high across the Order limits.

Groundwater flood risk

1.2.160 Groundwater flooding occurs when subsurface water levels rise above the ground surface. The geology dictates where this type of flooding takes place; it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

1.2.161 The **FCA** (**Appendix 13-C** (**EN010166/APP/6.4**)) indicates that soils at the Main Development Area, the C&IEA, the Electrical Connection Corridor and the onshore section of the Water Connection Corridor are indicated to be 'Loamy and clayey soils of coastal flats with naturally high groundwater'.

1.2.162 Soils at the Repurposed and Proposed CO_2 Connection Corridors are indicated to be 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils,' with the exception of the north-west to north-east portion of the Repurposed CO_2 Connection Corridor which is mapped as 'Loamy and clayey soils of coastal flats with naturally high groundwater'. 'Freely draining slightly acid loamy soils' are also mapped immediately south-east of the Repurposed CO_2 Connection Corridor.

1.2.163 The BGS Borehole Records Viewer (Ref 10) indicate groundwater levels at the Proposed Development location, with five available records within the Order limits or within close proximity to the Proposed Development Site with groundwater depth between 1 and 4 m below ground level (mbgl). See **Table 8** within **Appendix 13-C: FCA** (**EN010166/APP/6.4**) for full details of depths and locations.

1.2.164 A Preliminary Ground Investigation Report (April 2025) recorded groundwater levels on 5 visits between January and March 2025. **Table 9** within **Appendix 13-C: FCA** (**EN010166/APP/6.4**) provides full details, summarizing shallow groundwater levels ranging from 0.13-3 m bgl in the Main Development Area, 0.5 m bgl near the Repurposed CO_2 Connection Corridor and 1.03 m bgl near to the Electrical Connection Corridor.

1.2.165 The **FCA** (**Appendix 13-C** (**EN010166/APP/6.4**)) concludes that there is a medium risk of groundwater flooding within the Order limits.

Sewers

1.2.166 Sewer flooding may result from infrastructure failure (e.g. blockages or pump failure), or from combined sewer systems surcharge due to the volume or intensity of rainfall exceeding the capacity of the sewer, or debris or obstruction.

1.2.167 According to the Flintshire Strategic FCA (Ref 17), there have been no sewer flooding incidents at the Proposed Development location from 1990 – 2016. Based on this information the baseline sewer flood risk is considered to be low.

Artificial Sources

1.2.168 Artificial flood risk sources include raised channels such as canals, or storage features such as ponds and reservoirs.

1.2.169 The NRW FMfP (Ref 12) has been reviewed and shows a small part of the western side of the Main Development Area, the Water Connection Corridor and the northern part of the Repurposed CO_2 Connection Corridor to be at risk of flooding from reservoirs.

1.2.170 The consequences from a reservoir failure could be severe, however, NRW advise that this is based on a worst-case prediction; reservoirs are maintained to a very high standard and are extremely unlikely to fail. Based on this information, the baseline flood risk from artificial sources is considered to be low.

1.3 Future baseline

1.3.1 The future baseline scenarios are set out in **Chapter 2: Assessment Methodology and Consultation** (**EN010166/APP/6.2.2**).

Construction and Operation

1.3.2 The future baseline has been determined qualitatively by considering the possibility of changes in the attributes that are considered when deciding the importance of water bodies in the study area.

1.3.3 As outlined in **Chapter 5: Construction Programme and Management** (**EN010166/APP/6.2.5**), construction of the Proposed Development could, subject to securing the necessary development consent, start as early as Quarter Q4 2026. However, considering that the DCO would allow construction to commence up to five years from the date of consent, construction activities may commence as late as Q4 2031 (depending on market needs and financing).

Surface Water

1.3.4 It is likely that through new legislative requirements and more stringent planning policy and regulation, the water environment's health would broadly continue to improve, notwithstanding some very topical issues at the moment (e.g. sewerage discharges and microplastics etc.). There are, however, significant challenges such as adapting to climate change that are difficult to forecast with certainty.

1.3.5 The Dee Estuary, as detailed within the Tidal Dee Catchment Action Plan 2022 (Ref 20), which supersedes an earlier version published in 2018, is said to be pursuing a number of initiatives that are in the development phase, or have begun, in order to meet the vision that *'…the Dee estuary is clean and full of wildlife, enjoyed by people and sustainably managed'.* As such, there is likely to be an improvement over current conditions due to interventions that are being implemented or have already been implemented. This includes the Dee Blue Recovery which aims to work with farmers across the Dee Catchment (England only) to identify sources of pollution and implement interventions, training local community groups on water quality, invertebrate analysis and chemical monitoring using data analysis; Dee Dairy Project which would work with farmers to reduce agricultural pollutions; Dee Invasive Non-native Species Project, a catchment-wide scheme to control and monitor INNS within the Dee Catchment; and Natural Capital and Ecosystems Services Project, relating to the assessment of blue carbon and potential to increase carbon stores.

1.3.6 Overall, the current receptor importance criteria presented in **Chapter 13: Water Environment and Flood Risk** (**EN010166/APP/6.2.13**) are based on the presence or not of various attributes (e.g. water body size, WFD designation, ecological designations etc.) rather than current or future water quality, and these attributes are unlikely to change in future. Therefore, no significant changes to current baseline conditions are predicted for the future baseline in absence of the Proposed Development.

Groundwater

1.3.7 No significant changes to the current baseline condition are predicted for the future baseline for the same reasons as outlined above for surface water. The rise in groundwater level in coastal areas due to rising sea levels may extend saline intrusion.

1.3.8 Changes in groundwater abstractions could affect the groundwater flow regime and climate change could influence the future baseline conditions, due to changes on the rainfall regime, recharge, groundwater levels and flow. However, these changes are long-term and are not predictable at this stage.

Flood Risk

1.3.9 Climate change is predicted to alter both future tidal, fluvial and surface water flood risk and this has been taken into account within **Appendix 13-C: FCA** (**EN010166/APP/6.4**). Climate change resilience is accounted for, accommodating current government climate change projections, including peak river flow allowances, sea level allowances and peak rainfall intensity allowances.

Water Resources

1.3.10 Population growth and increased development may result in increased pressure upon surface water features, people, property, and infrastructure for water supply. Therefore, water abstraction and discharges volumes may increase overtime. However, considering the operational life of the Proposed Development, the increased pressure is unlikely to result in a considerable change to the baseline.

Decommissioning

1.3.11 It is considered that continued environmental improvements, tighter regulation at both national, regional and local scales, and environmental enhancements would lead to a gradual improvement over current baseline conditions in terms of water quality.

1.3.12 Climate change has the potential to significantly impact on drainage and flood risk, for example through increased storm intensity and changes in future rainfall patterns. However, the design of the Proposed Development would incorporate the climate change projections required by NRW so that potentially increased surface water flows are accounted for and managed across the lifetime of the Proposed Development. Therefore, it is assumed that there would be no significant adverse changes to current baseline conditions and so the impact assessment within the chapter is undertaken against existing baseline conditions.

1.4 Methodology

1.4.1 The scope of assessment includes impacts to surface water quality, water resources, fluvial hydromorphology, hydrogeology, flood risk and drainage.

1.4.2 The impact assessment has been undertaken in accordance with the following broad stages:

- reviewing the planning and legislation context;
- establishing the baseline context;
- identification and appraisal of potential impacts and determining the classification and predicting the significance of the effects (including an assessment of the confidence in prediction);
- identification of potential mitigation and enhancement measures; mitigation should be designed to limit or remove any significant adverse environmental effects of a development; and
- identification of likely remaining residual effects.

1.4.3 This section provides a description of the tools and techniques used to undertake the water environment impact assessment. It also outlines the significance criteria used with reference to any relevant legislation and/or guidance.

Approach Overview

1.4.4 There is no standard guidance in place for the assessment of the likely significant effects on the water environment from developments of this type. Based on professional judgement and experience of other similar schemes, a qualitative assessment of the likely significant effects on surface water quality and water resources has been undertaken.

1.4.5 The classification and significance of effects has been determined using the principles of the guidance and the criteria set out in the Design Manual for Roads and Bridges LA 113 Road Drainage and the Water Environment (Ref 23) adapted to take account of hydromorphology. Although these assessment criteria were developed for road infrastructure projects, the overall approach is independent of the type of development and this method is suitable for use on any infrastructure project. It provides a robust and well tested method for predicting the significance of effects and has been applied to assess the effects of many types of development, including other power generation projects such as this.

Source-Pathway-Receptor Approach

1.4.6 The assessment of impacts would be undertaken using a source-pathway-receptor model:

- source – an impact source (e.g. such as the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a water feature);
- pathway – the method or route by which the source could affect the receptor; and
- receptor – the feature that may be affected by the outcomes of the Proposed Development.

1.4.7 In accordance with the stages of the methodology, there are three stages to the assessment of effects on the Water Environment, which are as follows:

- a level of importance (negligible to very high) is assigned to the water resource receptor based on a combination of attributes (such as the size of the watercourses, WFD designation, water supply and other uses, biodiversity and recreation etc.) and on receptors to flood risk based on the vulnerability of the receptor to flooding (see Table 13);
- the magnitude of potential and residual impact (classed as negligible, low, medium, or large adverse / beneficial) is determined based on criteria in Table 14 and the assessor's professional judgement and the likelihood of the effect occurring. Potential impacts are those that occur having taken account of embedded measures, but before consideration of any required additional mitigation. Residual impacts are the remaining impacts having also taken account of the additional mitigation. The likelihood of an effect occurring is based on a scale of certain, likely or unlikely; and
- a comparison of the importance of the receptor and magnitude of the impact (for both potential and residual impacts) results in an assessment of the overall significance of the effect on the receptor using the matrix presented in Table 15. The significance of each identified effect (both potential and residual) is classed as major, moderate, minor, or negligible and either beneficial or adverse significance. Where there is a range of effects (e.g., moderate / minor, see Table 15) professional judgement has been used to determine the residual effect.

1.4.8 A precautionary approach to the assessment has been undertaken so that where uncertainty currently lies with any assessment work, a reasonable worst-case assessment has been made to the identification of a particular effect's significance.

Receptor Importance

1.4.9 All the receptor categories identified below have been assessed within the study area. The potential receptors associated with the Proposed Development have been identified to include:

- surface water features (including WFD designated, Main Rivers and Ordinary Watercourse (including drains), estuaries and coastal water bodies);
- groundwater water bodies receptors;
- water resources, including reservoirs, water abstractions, and water supply; and
- flood risk receptors (including people, property and infrastructure).

1.4.10 The importance of a receptor is largely determined by its quality, rarity, and scale. Value is used preferentially for the water environment as low value receptors can sometimes be the most sensitive to change and this could lead to an inappropriately large effect. The importance and / or where appropriate, the importance of the receptors have been defined using the criteria outlined in **Table 13**.

Table 13: Importance (and Sensitivity) Criteria[1]

Importance	General criteria	Surface Water	Groundwater	Hydromorphology[2]	Flood Risk
Very High	The receptor has little or no ability to absorb change without fundamentally altering its present character, is of very high environmental value, or of international importance.	Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 ≥ 1.0 m^3/s; site protected / designated under international or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar site). Critical social or economic uses (e.g., public water supply and navigation).	Principal aquifer providing a regionally important resource and/or supporting a site protected under international and UK legislation. Ecology and Nature Conservation. Groundwater locally supports GWDTE. Source Protection Zone (SPZ) 1.	Unmodified, near to or pristine conditions, with well-developed and diverse geomorphic forms and processes characteristic of river and lake type.	Essential Infrastructure or highly vulnerable development.
High	The receptor has low ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.	Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 < 1.0 m^3/s; Major Cyprinid Fishery; Species protected under international or UK habitat legislation. Critical social or economic uses (e.g., water supply and navigation). Important social or economic uses such as water supply,	Principal aquifer providing locally important resource or supporting river ecosystem. Groundwater supports a GWDTE. SPZ2.	Conforms closely to natural, unaltered state and would often exhibit well-developed and diverse geomorphic forms and processes characteristic of river and lake type. Deviates from natural conditions due to direct and/or indirect channel, floodplain, bank modifications and/or catchment development pressures.	More vulnerable development.

Importance	General criteria	Surface Water	Groundwater	Hydromorphology[2]	Flood Risk
		navigation or mineral extraction.			
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value or is of regional importance.	Watercourse detailed in the Digital River Network but not having a WFD classification as shown in a RBMP. May be designated as a local wildlife site (LWS) and support a small / limited population of protected species. Limited social or economic uses.	Secondary aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.	Shows signs of previous alteration and/or minor flow / water level regulation but still retains some natural features or may be recovering towards conditions indicative of the higher category.	Less vulnerable development.
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.	Surface water sewer, agricultural drainage ditch; non-aquifer WFD Class 'Poor' or undesignated. Low aquatic fauna and flora biodiversity and no protected species. Minimal economic or social uses.	Unproductive strata.	Substantially modified by past land use, previous engineering works or flow / water level regulation. Watercourses likely to possess an artificial cross-sector (e.g., trapezoidal) and would probably be deficient in bedforms and bankside vegetation. Watercourses may also be realigned or channelised with hard bank protection, or culverted and enclosed. May be significantly impounded or abstracted for water resources use. Could be impacted by navigation, with associated high	Water compatible development.

Importance	General criteria	Surface Water	Groundwater	Hydromorphology[2]	Flood Risk
				degree of flow regulation and bank protection, and probable strategic need for maintenance dredging. Artificial and minor drains and ditches would fall into this category.	
Negligible	The receptor is resistant to change and is of little environmental value.	Not applicable.	Not applicable.	Not applicable.	Not applicable.

Note 1: Professional judgement is applied when assigning an importance category to all water features. The WFD status of a watercourse is not an overriding factor, and, in many instances, it may be appropriate to upgrade a watercourse which is currently at poor or moderate status to a category of higher importance to reflect its overall value in terms of other attributes and WFD targets for the watercourse. Likewise, a watercourse may be below Good Ecological Status, this does not mean that a poorer quality discharge can be emitted. All controlled waters are protected from pollution under the Environmental Permitting (England and Wales) Regulations 2016 and the Water Resources Act 1991, and future WFD targets also need to be considered.

Note 2: Based on the waterbody 'Reach Conservation Status' presently being adopted for a major infrastructure project (and developed originally by Atkins) and developed from Environment Agency conservation status guidance as LA113 does not provide any criteria for morphology.

Magnitude of Change

1.4.11 The magnitude of effects has been determined using a scale (classed as negligible, low, medium, or large adverse / beneficial) as seen in **Table 14**.

Table 14: Determining Magnitude of Change

Level of Magnitude	Definition of Magnitude and Examples
Large Adverse	Results in a loss of attribute and/ or quality and integrity of the attribute. For example, loss of a fishery; decrease in surface water ecological or chemical WFD status or groundwater qualitative or quantitative WFD status. Loss of regionally important public water supply. Change in flood risk to receptor from low or medium to high.
Medium Adverse	Results in impact on integrity of attribute, or loss of part of attribute. For example, partial loss of a fishery; measurable decrease in surface water ecological or chemical quality, or flow; reversible change in the yield or quality of an aquifer; such that existing users are affected, but not changing any WFD status. Change in flood risk to receptor from low to medium.
Low Adverse	Results in some measurable change in attribute's quality or vulnerability. For example, measurable decrease in surface water ecological or chemical quality, or flow; decrease in yield or quality of aquifer; not affecting existing users or changing any WFD status. Change in flood risk to receptor from no risk to low risk.
Negligible	Results in impact on attribute, but of insufficient magnitude to affect the use or integrity. For example, negligible change discharges to watercourse or changes to an aquifer which lead to no change in the attribute's integrity.
Low Beneficial	Results in some beneficial impact on attribute or a reduced risk of negative impact occurring. For example, measurable increase in surface water ecological or chemical quality; increase in yield or quality of aquifer not affecting existing users or changing any WFD status. Change in flood risk to receptor from low risk to no risk.
Medium Beneficial	Results in moderate improvement of attribute quality. For example, measurable increase in surface water quality or in the yield or quality of aquifer benefiting existing users but not changing any WFD status. Change in flood risk to receptor from medium to low.
Large Beneficial	Results in a major improvement of attribute quality. For example, measurable increase in surface water quality or in the yield or quality of aquifer benefiting existing users leading to an improvement in WFD status. Removal of an existing polluting discharge or removing the likelihood of polluting discharges

	occurring to a watercourse. Change in flood risk to receptor from high to medium or low.
No Change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Significance Criteria

1.4.12 The significance of environmental effect is typically a function of the value/importance of a receptor and the magnitude of an impact as set out in **Table 15**. Effects that are moderate or major are typically considered significant in planning terms.

Table 15: Classification on Significance of Effect

Magnitude of change	Importance of receptor				
	Very High	High	Medium	Low	Negligible
Large	Major	Major	Moderate or Major	Minor or Moderate	Negligible
Medium	Major	Moderate or Major	Moderate	Minor	Negligible
Low	Moderate or Major	Minor or Moderate	Minor	Negligible to Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Water Framework Directive Assessment

1.4.13 A WFD assessment has been prepared for the Proposed Development. This is presented within **Appendix 13-B: Water Framework Directive Report** (**EN010166/APP/6.4**), with further methodological detail contained therein. The overarching aim of the WFD is to protect and enhance watercourses.

Hydrogeological Assessment

1.4.14 Hydrogeological assessment has been prepared for the areas where dewatering and excavation may occur and is presented within **Appendix 13-E: Hydrogeological Assessment** (**EN010166/APP/6.4**). Further methodological detail is contained therein.

Flood Consequences Assessment (FCA)

1.4.15 A site-specific FCA has been prepared for the Proposed Development. This is presented within **Appendix 13-C: FCA** (**EN010166/APP/6.4**). Further methodological detail is contained therein.

Rochdale Envelope

1.4.16 The setting of design parameters using the 'Rochdale Envelope' approach is described in **Chapter 4: The Proposed Development**

(**EN010166/APP/6.2.4**), including Table 4-1 which sets out the parameters currently under consideration for the main components of the Proposed Development. These parameters have been used to inform the reasonable worst-case scenario that has been assessed in the chapter, in order to provide a robust assessment of the impacts and likely significance of environmental effects of the Proposed Development at its current stage of design.

References

Ref 1. National Resources Wales (n.d.) Water Watch Wales Map Gallery [Online]. Available at: https://waterwatchwales-nrw.hub.arcgis.com/ [02/07/25].

Ref 2. Met Office (n.d) UK Climate Averages [Online]. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcmys019j [Accessed 2nd July 2025].

Ref 3. Bing (n.d.). Maps [Online]. Available at: https://www.bing.com/maps [02/07/25].

Ref 4. Online Ordnance Survey (OS) maps [Online]: Available at: https://www.gov.uk/government/organisations/ordnance-survey [Accessed 02/07/25].

Ref 5. Multi-Agency Geographic Information for the Countryside (MAGIC) [Online]. Available at: https://magic.defra.gov.uk/home.htm [Accessed 02/07/25].

Ref 6. UK Centre for Ecology & Hydrology (n.d.). National River Flow Archive [Online]. Available at: https://nrfa.ceh.ac.uk/. [Accessed 02/07/25].

Ref 7. Natural Resources Wales (n.d.). River Levels, rainfall and sea data [online]. Available at: https://rivers-and-seas.naturalresources.wales/. [Accessed 02/07/25].

Ref 8. Soil Mechanics Limited (1991) Site Investigation for North West Sites Alternative 'A'. [Accessed 02/07/25].

Ref 9. British Geological Survey (n.d.) Geology of Britain Viewer [Online]. Available at: https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/ [Accessed 02/07/25].

Ref 10. British Geological Survey (1999) Sheet 108 Flint Solid and Drift [Online]. Available at: https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=1003692 [Accessed 02/07/25].

Ref 11. Unknown (2005) Connah's Quay Site Report for PPC Application-MP3337SH. [Accessed 02/07/25].

Ref 12. Natural Resources Wales (n.d). Flood Map for Planning [online]. Available at: https://flood-map-for-planning.naturalresources.wales/ [Accessed 02/07/25].

Ref 13. Natural Resources Wales (2020). Development Advice Map [online]. Available at: https://gisgeoext.cyfoethnaturiolcymru.gov.uk/Geocortex/Viewers/Html5Viewer_4145/index.html?viewer=FloodRisk [Accessed 02/07/25].

Ref 14. Natural Resources Wales (n.d.). Flooding from Reservoirs [Online]. Available at: https://naturalresources.wales/flooding/managing-flood-risk/flood-risk-map-guidance/risk-of-flooding-from-reservoirs/?lang=en [Accessed 02/07/25].

Ref 15. Natural Resources Wales (2020). Flood and Coastal Erosion Risk Maps [Online]. Available at: https://flood-risk-maps.naturalresources.wales/?locale=en [Accessed 02/07/25].

Ref 16. Flintshire Local Flood Risk Management Strategy 2013 [Online]. Available at: https://committeemeetings.flintshire.gov.uk/documents/s16847/Appendix%204%20-%20Flood%20Risk%20HL.pdf [Accessed 02/07/25].

Ref 17. Flintshire Strategic Flood Consequence Assessment 2018 [Online]. Available at; https://www.siryfflint.gov.uk/en/PDFFiles/Planning/Evidence-Base-Documents/Natural-Built-Environment/LDP-EBD-EN1-Strategic-Flood-Consequences-Assessment-Final-Report-2018.pdf [Accessed 02/07/25].

Ref 18. North West & North Wales Coastal Group (2011). North West England and North Wales Shoreline Management Plan SMP2 [02/07/25].

Ref 19. Sefton Council (2013). Dee Estuary: North West Estuaries Processes Reports. Prepared by CH2MHill for Sefton Council. [Accessed 02/07/25].

Ref 20. Catchment Based Approach (2022) Tidal Dee Catchment Action Plan [Online]. Available at: https://catchmentbasedapproach.org/wp-content/uploads/2022/03/Tidal-Dee-Catchment-Action-Plan-March-2022.pdf [Accessed 02/07/25].

Ref 21. The Deeside Plan 2017 [Online]. Available at: https://www.flintshire.gov.uk/en/PDFFiles/Business-AdviceGuidance/Deeside-Plan-A4-v13.2.pdf [Accessed 02/07/25].

Ref 22. Dee River Basin Management Plan 2021-2027 [Online]. Available at: https://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans/river-basin-management-plans-2021-2027?lang=en [Accessed 02/07/25].

Ref 23. DMRB LA 113 Road Drainage and the Water Environment [Online]. Available at: https://www.standardsforhighways.co.uk/tses/attachments/d6388f5f-2694-4986-ac46-b17b62c21727?inline=true [Accessed 02/07/25].

Ref 24. Welsh Government (2024). Data Map Wales: Licenced Water Abstractions [Online]. Available at: https://datamap.gov.wales/layers/geonode:nrw_water_resource_permits. Publication date 18 April 2024. [Accessed 02/07/25].

Ref 25. Welsh Government (2024). Data Map Wales: Permitted Discharges to Controlled Waters with Conditions [Online]. Available at: https://datamap.gov.wales/layers/geonode:nrw_water_quality_permits. Publication date 18 April 2024. [Accessed 02/07/25].

Ref 26. Welsh Government (2024). Data Map Wales: Environmental Pollution Incidents [Online]. Available at: https://datamap.gov.wales/documents/2642. Publication date 19 February 2024. [Accessed 02/07/25].

Ref 27. Environment Agency, 2016. Water Framework Directive risk assessment: How to assess the risk of your activity. [Accessed 02/07/25].

Ref 28. Environment Agency (2016b). Protecting and improving the water environment. Water Framework Directive compliance of physical works in rivers. [Accessed 02/07/25].

Ref 29. National Infrastructure Planning (NIP), 2017. The Planning Inspectorate (2017). Advice Note eighteen: The Water Framework Directive. Available from: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/. [Accessed 02/07/25].

Ref 30. Clearing the Waters for All (2016) [Online]. Available at: Water Framework Directive assessment: estuarine and coastal waters - GOV.UK (www.gov.uk) [Accessed 02/07/25].

Ref 31. DESNZ, 2023; Overarching National Policy Statement for Energy (EN-1) [online]. Available at: https://assets.publishing.service.gov.uk/media/65a7864e96a5ec0013731a93/overarching-nps-for-energy-en1.pdf [Accessed 02/07/25].

Ref 32. DESNZ, 2023; National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) [online]. Available at: https://assets.publishing.service.gov.uk/media/655dc2d4046ed4000d8b9dd9/nps-natural-gas-supply-infrastructurepipelines-en4.pdf [Accessed 02/07/25].

Ref 33. TAN 15: Development, flooding and coastal erosion 2021 [Online] Available at; https://www.gov.wales/technical-advice-note-tan-15-development-flooding-and-coastal-erosion [Accessed 02/07/25].

Ref 34. Water Framework Directive (WFD) Regulations Cycle 3 Classification [Online] Available at; https://www.data.gov.uk/dataset/af2d8523-e70b-4597-a800-19efaccd1e7c/water-framework-directive-wfd-regulations-cycle-3-classification [Accessed 02/07/25].

Ref 35. Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems [Online] Available at; https://wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Risk%20assessment%20of%20terrestrial%20ecosystems%20groundwater_Draft_210104.pdf [Accessed 02/07/25].

Ref 36. Welsh Government, 2024; Planning Policy Wales: Edition 12 [online] Available at; https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf [Accessed 02/07/25].

Ref 37. The Conservation of Habitats and Species Regulations 2017 [Online] Available at; https://www.legislation.gov.uk/uksi/2017/1012/contents/made [Accessed 02/07/25].

Ref 38. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 [Online] Available at; https://www.legislation.gov.uk/uksi/2017/407 [Accessed 02/07/25].

Ref 39. Wildlife and Countryside Act 1981 [Online] Available at; https://www.legislation.gov.uk/ukpga/1981/69/contents [Accessed 02/07/25].

Ref 40. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 [Online] Available at; https://www.legislation.gov.uk/uksi/2015/1623/pdfs/uksiod_20151623_en_auto.pdf [Accessed 02/07/25].

Ref 41. Welsh Government (2024). Data Map Wales: NRW Water Quality Archive [Online] Available at; https://datamap.gov.wales/layers/geonode:nrw_water_quality_archive_stations [Accessed 02/07/25].

Ref 42. HMSO (2002) The Control of Substances Hazardous to Human Health (COSHH) Regulations 2002 [Online]. Available at; https://www.legislation.gov.uk/uksi/2002/2677/pdfs/uksi_20022677_en.pdf [Accessed 02/07/25].

Ref 43. Environmental Permitting (England and Wales) Regulations 2016 (as amended 2017 & 2018) [Online] Available at; The Environmental Permitting (England and Wales) Regulations 2016 (legislation.gov.uk) [Accessed 02/07/25].

Ref 44. Water Abstraction and Impounding (Exemptions) Regulations 2017 [Online], Available at: https://www.legislation.gov.uk/uksi/2017/1044/contents [02/07/25].