

ENVIRONMENTAL STATEMENT (VOLUME II)

Chapter 17 – Water Resources and Flood Risk

Padeswood Carbon Dioxide Spur Pipeline Proposed Development

Town and Country Planning Act 1990

Document Reference Number PW.3.2.17

Applicant: Liverpool Bay CCS Limited

English Version

REVISION: A

DATE: March 2025

DOCUMENT OWNER: WSP UK Limited.

CONFIDENTIAL

QUALITY CONTROL

Document Reference		PW.3.2.17			
Document Owner		WSP UK Ltd			
Revision	Date	Comments	Author	Checker	Approver
01	March 2025	Revision for Pre-Application Consultation	ST/BL/RP	MJ/MD/VM	HP

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17. WATER RESOURCES AND FLOOD RISK

17.1. INTRODUCTION

- 17.1.1. This Chapter reports the assessment of the likely significant effects of the Padeswood Spur Pipeline Proposed Development on water resources and flood risk and describes:
- Relevant, legislation, policy and guidance;
 - Consultation undertaken;
 - Assessment methodology;
 - Baseline conditions;
 - Potential effects of the Construction, Operational and Decommissioning Stages of the Padeswood Spur Pipeline Proposed Development;
 - Potential design, mitigation and enhancement measures; and,
 - Residual effects.
- 17.1.2. This chapter (and its associated figures and appendices) is intended to be read as part of the wider environmental Statement (ES), with particular reference to **Chapter 3 – Description of the Padeswood Spur Pipeline Proposed Development** (Document Reference: PW.3.2.3), **Chapter 9 – Biodiversity** (Document Reference: PW.3.2.9) and **Chapter 18 – Combined and Cumulative Effects** (Document Reference: PW.3.2.18).
- 17.1.3. This chapter has been prepared by competent experts with relevant and appropriate experience as described in **Chapter 5 EIA Methodology** of the ES (Document Reference: PW.3.2.5).

17.2. LEGISLATIVE AND POLICY FRAMEWORK

- 17.2.1. A summary of the international, national, and local legislation, planning policy and guidance relevant to the water resources and flood risk assessment for the Padeswood Spur Pipeline Proposed Development is set out below.

LEGISLATIVE FRAMEWORK

National

- Land Drainage Act (1991) (HM Government, 1991);
- The Water Resources Act 1991 (HM Government, 1991);
- Environment Act 1995 (HM Government, 1995);
- The Water Act 2003 (HM Government, 2003);

- Flood and Water Management Act 2010 (HM Government, 2010);
- The Water Act 2014 (HM Government, 2014);
- Environment Act 2021 (HM Government, 2021);
- Flood Risk Regulations 2009 (HM Government, 2009);
- Groundwater (England and Wales) Regulations 2009 (HM Government, 2009);
- Environmental Permitting (England and Wales) Regulations 2016 (HM Government, 2016);
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (HM Government, 2017);
- The Groundwater (Water Framework Directive) (England) Direction 2016 (HM Government, 2016); and,
- The Groundwater (Water Framework Directive) (Wales) Direction 2016 (Welsh Government, 2016).

POLICY

National

- Planning Policy Wales (2021) (Welsh Government, 2021);
- The Infrastructure Planning (EIA) Regulations 2017 (HM Government, 2017);
- The Planning Inspectorate Advice Note Eighteen: the Water Framework Directive (2017) (HM Government, 2024);
- Statutory national standards for sustainable drainage systems (2018) (Welsh Government, 2018)
- Technical Advice Note (TAN) 15: Development and Flood Risk (Welsh Government, 2004);
- National Resources Wales' Operational Guidance Note 072: Complying with the Water Framework Directive Regulations 2017: how to assess and appraised projects and activities (Natural Resources Wales, 2017); and,
- Relevant CEN standards as listed in Annex V of the Water Framework Directive (WFD) Legislation; and Design Manual for Roads and Bridges (LA113) (Standards for Highways; Highways England, 2019).

Local

- Flintshire Local Flood Risk Management Strategy (SFRA) (2013) (Flintshire County Council, 2013).

17.3. SCOPING OPINION AND CONSULTATION

RESPONSE TO THE SCOPING OPINION

17.3.1. An EIA Scoping Opinion (see **Appendix 1.2, Document Reference: PW.3.3.1.2**) was received by the Applicant from the Local Planning Authority (LPA) on 8 May 2024, including formal responses from Statutory Consultees. The responses from the LPA in relation to water resources and flood risk and how these requirements should be addressed by the Applicant are set out in **Appendix 1-3 Scoping Opinion Responses (Document Reference: PW.3.3.1.3)**.

CONSULTATION UNDERTAKEN TO DATE

17.3.2. **Table 17.1** provides a summary of the consultation undertaken to inform the water resources and flood risk assessment to date.

Table 17.1: Summary of Consultation Undertaken

Organisation	Meeting dates and form of consultation	Summary of outcome of discussions
Flintshire County Council (FCC)	General flood risk enquiries were sent on 11/06/2024, 30/07/2024, and 23/08/2024	Generic enquiry was sent to FCC contacts with a FCA consultation technical note and sectioned maps of the Padeswood Spur Pipeline Proposed Development. To this date, no consultation response has been received from FCC and further engagement is proposed with FCC.
Dwr Cymru Welsh Water (DCWW)	General flood risk enquiry sent on 11/06/2024	Generic enquiry sent to DCWW with FCA consultation technical note and sectioned maps of the Padeswood Spur Pipeline Proposed Development. A general response was received on 12/06/2024 regarding asset and easement information via DCWW's pre-planning advice application service for consideration as part of the design. Given that neither DCWW asset diversions, nor new surface water or foul drainage connections, are proposed, further engagement on flood risk matters with DCWW was not required.

Organisation	Meeting dates and form of consultation	Summary of outcome of discussions
Natural Resources Wales (NRW)	<p>Generic flood risk enquiry sent on the 11 June 2024</p> <p>Data request for hydraulic model data of the River Alyn and Foundry Drain sent on the 11 June 2024</p> <p>Pre-planning enquiry submitted on NRW's website on the 14 June 2024</p> <p>Discretionary Advice Service (DAS) request sent on the 14 January 2025</p>	<p>A preliminary advice consultation request was submitted to Natural Resource Wales and due to their limited resources at the time of the request only a reduced responses has been received. Responses were received on the Scoping Report submitted (see Appendix 1.1, Document Reference: PW.3.3.1.1). Other responses received are summarised as follows:</p> <ul style="list-style-type: none"> • NRW's North Planning team suggested submitting a pre-planning enquiry online and a separate data request to the Data Distribution team. • NRW's Data Distribution team provided some hydraulic model output data for the River Alyn. No data exists for Foundry Drain. • NRW's North Planning team suggested to submit an enquiry through the DAS once design information has been confirmed. NRW suggested that the mitigation measures for the previous HyNet Main Onshore Carbon Dioxide Pipeline DCO scheme are relevant to the Padeswood Spur Pipeline Proposed Development. • A DAS request was submitted to NRW on the 14 January 2025, a response was received on the 24 January 2025 and included the following key item <i>"We understand that the pipeline will be situated below ground and will therefore not have an impact on flood storage or flow routes. Based on this and the information provided, we have no further specific advice to provide regarding flood risk matters in relation to planning."</i>

17.4. SCOPE OF THE ASSESSMENT

- 17.4.1. The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Chapter 5: EIA Methodology (Document Reference: PW.3.2.5)** of this ES.
- 17.4.2. This section provides an update to the scope of the assessment and reiterates the evidence base for scoping out elements following further iterative assessment.

ELEMENTS SCOPED OUT OF THE ASSESSMENT

- 17.4.3. Although within the study area (**Section 17.56**), the receptors shown in **Table 17.2** are not considered to give rise to likely significant effects as a result of the Padeswood Spur Pipeline Proposed Development and have therefore not been considered within this assessment.

Table 17.2: Elements Scoped Out of the Assessment

Element Scoped Out	Stage	Justification
Main Rivers, Ordinary Watercourses and Ponds/Lakes		
Golf Course Drain	Construction, Operation and Decommissioning	Golf Course Drain is the upstream tributary of Black Brook Padeswood. The water body drains into the Padeswood Pool and is not hydrologically connected to Black Brook Padeswood.
River Alyn Foundry Drain Wepre Brook Wats Dyke Tributary of River Alyn 5 Tributary of River Alyn 6 Tributary of Wepre Brook 1 Tributary of Wepre Brook 3	Operation and Decommissioning	As part of the Operation and Decommissioning Stages of Padeswood Spur Pipeline Proposed Development, no works are anticipated to be undertaken which could impact the listed watercourses or their floodplains. The listed watercourses are not hydrologically connected to the proposed infrastructure associated with the Operation and Decommissioning Stages. Therefore, the listed watercourses are scoped out of further assessment during these stages.
Ditch 1 at Padeswood Cement Works	Construction, Operation and Decommissioning	Ditch 1 at Padeswood Cement Works is located approximately 200 m south and upstream of the Padeswood Spur

Element Scoped Out	Stage	Justification
		Pipeline Proposed Development and upstream of Black Brook Tributary 1 and no impacts from the Padeswood Spur Pipeline Proposed Development on this watercourse are anticipated.
Bannel Drain	Construction, Operation and Decommissioning	Bannel Drain is upstream of Black Brook Padeswood and is approximately 500 m from the Padeswood Spur Pipeline Proposed Development and is not hydrologically connected to any potentially impacted watercourse.
Black Brook Tributary 2a	Construction, Operation and Decommissioning	Black Brook Tributary 2a is the upstream tributary of Black Brook Tributary 2. Black Brook Tributary is located approximately 100 m upslope of the Padeswood Spur Pipeline Proposed Development and is therefore unlikely to be impacted during construction.
Black Brook Mold	Construction, Operation and Decommissioning	Black Brook Mold is located 315 m upstream of the Padeswood Spur Pipeline Proposed Development. There is no hydrological connection from the Padeswood Spur Pipeline Proposed Development to Black Brook Mold and is therefore unlikely to be impacted during construction. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.
Drainage Ditch north of A5118	Operation and Decommissioning	The drainage ditch north of A5118 is located 30 m downslope of the Padeswood Spur Pipeline Proposed Development. There are no impacts anticipated to the hydrological elements of Drainage Ditch north of A5118 with the Operation or subsequent Decommissioning Stage of the

Element Scoped Out	Stage	Justification
		Padeswood Spur Pipeline Proposed Development.
Drainage Ditch 2 north of A5118	Operation and Decommissioning	Drainage Ditch 2 north of A5118 is located 220m downslope of the Padeswood Spur Pipeline Proposed Development. There are no impacts anticipated to the hydrological elements of Drainage Ditch 2 north of A5118 with the Operation or subsequent Decommissioning Stage of the Padeswood Spur Pipeline Proposed Development.
Bryn-y-Baal Drain	Operation and Decommissioning	Bryn-y-Baal Drain is located approximately 250 m south of the Padeswood Spur Pipeline Proposed Development. There are no impacts anticipated to the hydrological elements of Bryn-y-Baal Drain with the Operation or subsequent Decommissioning Stage of the Padeswood Spur Pipeline Proposed Development.
Drainage ditch at Mold WWTW	Construction, Operation and Decommissioning	Drainage Ditch at Mold WWTW is located approximately 500 m south of the Padeswood Spur Pipeline Proposed Development. Drainage Ditch at Mold WWTW is not hydrologically impacted by the Padeswood Spur Pipeline Proposed Development and is therefore unlikely to be impacted during the Construction Stage. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.
Drainage Ditch 1 at Wastewater Treatment works (WTW)	Construction, Operation and Decommissioning	Drainage Ditch 1 at WTW is located approximately 50 m south of the Padeswood Spur Pipeline Proposed Development. Drainage ditch 1 at WTW is not hydrologically connected by the

Element Scoped Out	Stage	Justification
		Padeswood Spur Pipeline Proposed Development due to existing road drainage intercepting and overland flow.
Drainage Ditch 2 at WTW	Construction, Operation and Decommissioning	Drainage Ditch 2 at WTW is located approximately 150 m south of the Padeswood Spur Pipeline Proposed Development. Drainage Ditch 2 at WTW is not hydrologically connected by the Padeswood Spur Pipeline Proposed Development due to existing road drainage intercepting and overland flow.
Drainage Ditch south of A541	Construction, Operation and Decommissioning	Drainage Ditch south of A541 is located approximately 500 m south of the Padeswood Spur Pipeline Proposed Development. Drainage Ditch south of A541 is not hydrologically impacted by the Padeswood Spur Pipeline Proposed Development.
Drainage Ditch north of A5118	Operation and Decommissioning	Drainage Ditch north of A5118 is located approximately 250 m south of the Padeswood Spur Pipeline Proposed Development. Drainage Ditch north of A5118 will not be hydrologically impacted by the Padeswood Spur Pipeline Proposed Development during Operation and Decommissioning Stages due to no activities being undertaken within 500 m of the watercourse.
Drainage Ditch 2 north of A5118	Operation and Decommissioning	Drainage Ditch north of A5118 is located approximately 25 m south of the Padeswood Spur Pipeline Proposed Development. Drainage Ditch north of A5118 will not be hydrologically impacted by the Padeswood Spur Pipeline Proposed Development during the Operation and Decommissioning Stages due to no activities being undertaken within 500 m of the watercourse.

Element Scoped Out	Stage	Justification
Tributary of Afon Alun Mold Bypass	Construction, Operation and Decommissioning	Tributary of Afon Alun Mold Bypass is located approximately 500 m north of the Padeswood Spur Pipeline Proposed Development. The tributary of Afon Alun Mold Bypass is located upstream of the Tributary of River Alyn 6 and is not hydrologically impacted by the Padeswood Spur Pipeline Proposed Development and is therefore unlikely to be impacted during the Construction Stage. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.
Wats Dyke north of Mold Road	Construction, Operation and Decommissioning	Wats Dyke north of the Mold Road is located approximately 20 m upstream of the Padeswood Spur Pipeline Proposed Development Centralised Compound. The watercourse is sufficiently upstream to have no impact from the Padeswood Spur Pipeline Proposed Development and is therefore unlikely to be impacted during the Construction Stage. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.
Cobblers Wood Farm Ditch	Construction, Operation and Decommissioning	Cobblers Wood Farm Ditch is located approximately 150 m southeast of the Padeswood Spur Pipeline Proposed Development. Cobblers Wood Farm Ditch is located on the east side of Alltami Road and is therefore not hydrologically connected to the Padeswood Spur Pipeline Proposed Development and is

Element Scoped Out	Stage	Justification
		therefore unlikely to be impacted during the Construction Stage. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.
Drain to Pond 1 Cobblers Wood Farm	Construction, Operation and Decommissioning	Drain to Pond 1 Cobblers Wood Farm is located 245 m north of the Padeswood Spur Pipeline Proposed Development. Drain to Pond 1 Cobblers Wood Farm is located within a Special Area of Conservation (SAC) and is not hydrologically connected to the Padeswood Spur Pipeline Proposed Development and is therefore unlikely to be impacted during the Construction Stage. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.
Drain to Pond 3 Cobblers Wood Farm	Construction, Operation and Decommissioning	Drain to Pond 3 Cobblers Wood Farm is located 245 m north of the Padeswood Spur Pipeline Proposed Development. Drain to Pond 3 Cobblers Wood Farm is located within an SAC and is not hydrologically connected to the Padeswood Spur Pipeline Proposed Development and therefore unlikely to be impacted during the Construction Stage. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.

Element Scoped Out	Stage	Justification
Tributary of Wepre Brook 2	Operation and Decommissioning	Tributary of Wepre Brook 2 is located approximately 300 m from the Padeswood Spur Pipeline Proposed Development. The ditch is located upstream of Wepre Brook and is not hydrologically connected to the Padeswood Spur Pipeline Proposed Development during operation and decommissioning due to no activities being undertaken within 500 m of the watercourse.
Ditch at Northop Golf Club	Construction, Operation and Decommissioning	The ditch at Northop Golf Club is located approximately 300 m from the Padeswood Spur Pipeline Proposed Development. The ditch is located upstream of Wepre Brook and is not hydrologically connected to the Padeswood Spur Pipeline Proposed Development and therefore unlikely to be impacted during the Construction Stage. Additionally, it is not within the operational footprint of the Padeswood Spur Pipeline Proposed Development, therefore no impacts during the Operation or Decommissioning Stages are anticipated.
Ditch 1, 2 and 3 at Galchog Farm	Construction, Operation and Decommissioning	Ditch 1, 3 and 3 at Galchog Farm is located 130 m northeast of the Padeswood Spur Pipeline Proposed Development. The ditches are not hydrologically connected to the Padeswood Spur Pipeline Proposed Development.

Element Scoped Out	Stage	Justification
Ponds/ Lakes within 250 m Padeswood Spur Pipeline Proposed Development	Construction, Operation and Decommissioning	<p>Ponds upslope of the Padeswood Spur Pipeline Proposed Development are not hydrologically connected and therefore will not be impacted.</p> <p>More generally, ponds within the Padeswood Spur Pipeline Proposed Development Red Line Boundary are small ephemeral features which have very local land drainage use and therefore the Padeswood Spur Pipeline Proposed Development is not anticipated to cause a significant impact on the hydrological value of these features. The value of these ponds is in the habitat they provide and therefore any impacts associated with this attribute are assessed in Chapter 9 - Biodiversity (Document Reference: PW.3.2.9).</p>
Dee Estuary / Aber Dyfrdwy Special Area of Conservation (SAC)/Special Protection Area (SPA)/Ramsar; River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid SAC	Construction, Operation and Decommissioning	<p>These statutory biodiversity conservation sites of international importance are a sufficient distance from the Padeswood Spur Pipeline Proposed Development. They are not hydrologically connected to the Padeswood Spur Pipeline Proposed Development and are therefore scoped out of further assessment.</p>
WFD Receptors		
Alyn – Leadmill to Hope (GB111067052172)	Decommissioning	<p>Although within the Red Line Boundary, no impacts are likely to occur during the Decommissioning Stage, and therefore, the Alyn to Leadmill WFD Water Body can be screened out of further assessment at this stage.</p>
Wepre Brook (GB111067056880)	Decommissioning	<p>Although within the Red Line Boundary, no impacts are likely to occur during the Decommissioning Stage, and therefore, the Wepre WFD Water Body can be</p>

Element Scoped Out	Stage	Justification
		screened out of further assessment at this stage.
Alyn – Dolfechlas to Leadmill (GB111067052171)	Operation and Decommissioning	The Alyn - Dolfechlas to Leadmill water body is located upstream of the Padeswood Spur Pipeline Proposed Development and there will be no operational footprint in this water body. Therefore, this water body is scoped out of further assessment for the Operation and Decommissioning stages.
Dee – Chester Weir to Ceiriog (GB111067057080)	Construction, Operation and Decommissioning	Sufficiently downstream (5 km) of the Padeswood Spur Pipeline Proposed Development for potential indirect impacts to be insignificant.
Dee Carboniferous Coal Measures (GB41102G204800)	Operation and Decommissioning	Although within the Red Line Boundary, no impacts are likely to occur during the Operation and Decommissioning Stages, and therefore, the Dee Carboniferous Coal Measures can be screened out of further assessment at this stage.
Groundwater		
Secondary (undifferentiated)	Construction, Operation and Decommissioning	These aquifers generally have only minor value in terms of water quantity and flows.
GWDTE	Construction, Operation and Decommissioning	No GWDTE within 1 km.
Groundwater Abstractions	Construction, Operation and Decommissioning	No groundwater abstractions (licensed or unlicensed) within 1 km.
Flood Risk		
Watercourses, fluvial, coastal, reservoir and surface water flood zones	Construction, Operation and Decommissioning	All water bodies, fluvial, coastal, reservoir and surface water flood zones beyond a 100 m distance from the proposed Red Line Boundary. Given their status, location and proximity, the potential impacts have been assessed to be insignificant.

ELEMENTS SCOPED INTO THE ASSESSMENT

Construction, Operation and Decommissioning Stage

Table 17.3: Elements Scoped into the Assessment

Element Scoped In	Stage	Justification
Sites of Special Scientific Interest (SSSI) & Special Areas of Conservations (SAC)		
Maes y Grug, Deeside and Buckley Newt Sites	Construction and Operation	The Padeswood Spur Pipeline Proposed Development mitigation areas are located approximately 10 m from the SSSI and SAC. Therefore, there are possible impacts on the SSSI and SAC during the Construction and Operation Stages and are therefore scoped in for further assessment.
Main Rivers, Ordinary Watercourses and Ponds/Lakes		
River Alyn	Construction	River Alyn is located adjacent to the Padeswood Spur Pipeline Proposed Development. Therefore, the watercourse has been scoped in for further assessment.
Foundry Drain, Wepre Brook, Black Brook Tributary 2, Wats Dyke, Tributary of River Alyn 5, and Tributary of River Alyn 6, Tributary of Wepre Brook 3	Construction	The listed watercourses will be crossed by the Padeswood Spur Pipeline Proposed Development. Therefore, the watercourses have been scoped in for further assessment.
Black Brook Tributary 1	Construction and Decommissioning	Black Brook Tributary 1 will be crossed by the Padeswood Spur Pipeline Proposed Development. The Black Brook Tributary 1 is located directly adjacent to the Padeswood Spur AGI and could be impacted during construction and decommissioning. Therefore, the watercourse has been scoped in for further assessment.

Element Scoped In	Stage	Justification
Brackens Drain, Wells Drain	Construction and Operation	<p>Brackens Drain is located within the Padeswood Spur Pipeline Proposed Development mitigation area. Therefore, the watercourse has been scoped in for further assessment.</p> <p>Wells Drain is located adjacent to the Padeswood Spur Pipeline Proposed Development mitigation area. Therefore, the watercourse has been scoped in for further assessment.</p>
Tributary of Wepre Brook 1, Tributary of Wepre Brook 2, Tributary of River Alyn 7, Bryn-y-Baal Drain, Tributary of Alltami Brook 1, Drainage Ditch north of A5118, Drainage Ditch 2 north of A5118	Construction	The listed watercourses are located within the Red Line Boundary. There will likely be construction activities undertaken within the vicinity of the watercourses. Therefore, they are scoped in for further assessment.
WFD Receptors		
Alyn - Leadmill to Hope (GB111067052172) Wepre Brook (GB111067056880)	Construction and Operation	The listed WFD-designated waterbodies could be directly impacted by the Padeswood Spur Pipeline Proposed Development due to a range of activities that will interact with the local watercourse network. Therefore, these water bodies are scoped in for further assessment.
Alyn – Dolfechlas to Leadmill (GB111067052171)	Construction	The Alyn - Dolfechlas to Leadmill water body is located upstream of the Padeswood Spur Pipeline Proposed Development. However, construction methodologies could impact the water body (in relation to fish migration and spawning). Therefore, this water body is scoped in for further assessment.
Dee Carboniferous Coal Measures (GB41102G204800)	Construction	Dee Carboniferous Coal Measures could be directly impacted by the Padeswood Spur Pipeline Proposed Development due to a range

Element Scoped In	Stage	Justification
		of activities that will interact with the groundwater. Therefore, this water body is screened in for further assessment.
Groundwater		
Secondary A aquifers (Superficial)	Construction	Along the Padeswood Spur Pipeline Proposed Development, intrusive works for open cut and trenchless crossing methods are potentially planned within secondary A (superficial) aquifers (Etruria Formation, Hollins Rock, Pennine Middle Coal Measures, Pennine Lower Coal Measures, Gwespys Sandstone Formation) groundwater quantity and quality will therefore need to be assessed.
Secondary A aquifers (Bedrock)	Construction	Along the Padeswood Spur Pipeline Proposed Development, intrusive works for open cut and trenchless crossing methods are potentially planned within secondary A (bedrock) aquifers (Alluvium, Alluvial Fan Deposits) groundwater quantity and quality will therefore need to be assessed.
Springs/ Inferred springs	Construction	Springs and inferred springs may potentially be affected by changes in groundwater quantity and quality therefore have been scoped in.
Flood Risk		
NRW fluvial flood Zones 1,2 & 3	Construction and Operation	The Padeswood Spur Pipeline crosses areas that are within Flood Zones 1,2 and 3. This risk is associated with open watercourse channels and overland runoff routes.
Wepre Brook (fluvial)	Construction and Operation	Wepre Brook – the Padeswood Spur Pipeline crosses Fluvial Flood Zone 3 (previously Flood Zone C) at the Wepre Brook crossing.
River Alyn (fluvial)	Construction and Operation	River Alyn – the Padeswood Spur Pipeline is located within Fluvial Flood Zone 3 (previously Flood Zone C) adjacent to the River Alyn.

Element Scoped In	Stage	Justification
Tributary of River Alyn 2, Tributary of River Alyn 5, Tributary of River Alyn 6, Wats Dyke, Black Brook Tributary 1, Black Brook Tributary 2, and Foundry Drain)	Construction and Operation	The remainder of the Padeswood Spur Pipeline crossings (Tributary of River Alyn 2, Tributary of River Alyn 5, Tributary of River Alyn 6, Wats Dyke, Black Brook Tributary 1, Black Brook Tributary 2, and Foundry Drain) are located within Fluvial Flood Zone 1.
Surface water flood zones (pluvial)	Construction and Operation	The Padeswood Above Ground Installation (AGI) is located within surface water flood zones 2 and 3.
Small watercourses	Construction and Operation	The Padeswood AGI is also associated with the risk of overland flow from Black Brook Tributary 1.
Residents and users of surrounding land	Construction and Operation	Residents and Users of surrounding land.

17.5. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

STUDY AREA

Surface Water Quality, Hydromorphology and Hydrology

- 17.5.1. The Study Area for assessing the impacts on water quality, hydrological and hydromorphological receptors and process is defined as water bodies within 500 m of the Red Line Boundary. This distance is considered appropriate for the assessment of both direct and indirect effects on surface water receptors and processes considering that the identified potential impacts are of a localised and/or temporary nature.

Hydrogeology

- 17.5.2. The Study Area for assessing the hydrogeological impacts is defined as the area within and up to 1 km of the Red Line Boundary. This distance is considered appropriate for the assessment of direct effects on groundwater receptors considering that the identified potential impacts are of a localised or temporary nature.

Flood Risk

- 17.5.3. The Study Area for assessing the impact from flood risk has included all land and property with the potential to experience a change in flood risk as a result of the Padeswood Spur Pipeline Proposed Development activities. This has included an initial review of land, property, all relevant watercourses, floodplains and significant surface water flow routes located within 500 m of the Padeswood Spur Pipeline Proposed.
- 17.5.4. As flood risk influence area cannot be defined based on distance only, following the initial review of the proposals, flood risk information available and based on the professional judgement of the assessor, the relevant extent has been modified to within 100 m of the Study Area. This distance is considered appropriate for the assessment of flood risk from local sources for this development.

Water Framework Directive

- 17.5.5. The Study Area for the Water Framework Directive (WFD) assessment includes the WFD water bodies in the Red Line Boundary as well as any other water bodies which are likely to be affected, such as water bodies immediately upstream or downstream. More information is provided in **Appendix 17.3 of Chapter 17 (Document Reference: PW.3.3.17.3)**.

BASELINE DATA COLLECTION

- 17.5.6. Information on the baseline environment, including hydrology, hydromorphology and water quality of the surface water receptors within the relevant Study Areas has been collated through desk study and field surveys.

Desk Study

- 17.5.7. The baseline information has been collated from the following sources:
- Natural Resources Wales Dee River Basin Management Plan; (National Resources Wales, 2015);
 - National Resource Dee and Wales Western Wales River Basin Management Plan 2021-2027 (National Resources Wales, 2024);
 - Natural Resources Wales Water Watch Wales (Natural Resource Wales, 2021);
 - Natural Resources Wales National Biodiversity Network (NBN) Atlas Wales (Natural Resource Wales, 2021);
 - Natural Resources Wales Flood Map for Planning (Natural Resource Wales, 2024);
 - Natural Resources Wales Development Advice Map (National Resources Wales, 2024);

- Ordnance Survey Mapping (Ordnance Survey, 2021);
- DEFRA 'Magic Map' online GIS portal (DEFRA/EA, 2021);
- British Geological Survey (BGS) Geology of Britain Viewer (British Geological Survey, 2024);
- BGS GeoIndex online database (British Geological Survey, 2021);
- Google Maps, Aerial Imagery (Google, 2021);
- National Library of Scotland, Historical mapping (National Library of Scotland, 2021);
- Flood Estimation Handbook Web Service (Centre For Ecology and Hydrology., 2021);
- Flintshire County Council Preliminary Flood Consequence Assessment ((Flintshire County Council, 2018);
- Flintshire County Council Strategic Flood Consequence Assessment (Flintshire County Council, 2018);
- Natural Resources Wales Public Registry (Natural Resources Wales, 2024);
- Hydrogeological Map of Clwyd and the Cheshire Basin (British Geological Survey, 1989); and,
- Welsh Government DataMap Wales (Welsh Government, 2024)

Site Visits and Surveys

- 17.5.8. A flood risk walkover study was undertaken on the 5 June 2024 for all relevant watercourses. The location of the relevant watercourses was informed by the DF1a Red Line Boundary. The walkover consisted of assessing the general topography and land use surrounding the watercourses. Subsequent analysis of the walkover data was used to determine the potential impacts that the watercourses could pose to the Padeswood Spur Pipeline Proposed Development. Photographs and survey notes were taken for the purpose of this assessment and are incorporated in **Appendix 17.2 – Baseline (Document Reference: PW.3.3.17.2)**.
- 17.5.9. Hydromorphology walkovers were undertaken between the 4 and 6 June and on the 20 June 2024 for all relevant watercourses within the DF1a Red Line Boundary. The walkover consisted of identifying the baseline characteristics of the watercourses which included channel substrate, habitat features, aquatic vegetation types, bank vegetation structure, any artificial modification of the channel and signs of channel instability.
- 17.5.10. During the Hydromorphology walkovers, the River Habitat Survey (RHS) methodology was applied, following the RHS field survey guidance manual (Environment Agency, 2003), where there was at

least 500 m of watercourse length within the Red Line Boundary. The RHS data was then used to characterise the hydromorphology and habitats of watercourses along the Padeswood Spur Pipeline Proposed Development. The results of the surveys are incorporated into **Appendix 17.2 – Baseline of Chapter 17 (Document Reference: PW.3.3.17.2).**

17.5.11. Aquatic ecology walkover surveys were undertaken between the 4 and 6 June 2024 for all watercourses within the DFla Red Line Boundary where land access permissions had been granted. Aquatic habitat scoping assessments were conducted using the standard aquatic habitat proformas. The potential for the water bodies to support legally protected and/or notable aquatic species was assessed through field observations of various channel and bank characteristics. The characteristics recorded included, substrate type, water depth, riparian vegetation, large wood habitat, artificial modifications, and notable features.

17.5.12. Several watercourses and water bodies surveyed were found to have a variety of channel substrates and flow types, habitat complexity and marginal, emergent and riparian vegetation. These watercourses exhibited a diversity of aquatic habitats and are likely to be ecologically valuable. Conversely, many of the watercourses surveyed exhibited signs of human pressures, including poaching by livestock, physical modification (including culverted sections), and agricultural runoff. In the vicinity of these pressures identified above, the watercourses were typically more homogenous and less fluvially diverse in nature.

IMPACT ASSESSMENT METHODOLOGY

17.5.13. The assessment methodology used in this chapter builds on and adapts the classification contained in LA 113 Road Drainage and the Water Environment (Highways England, 2019) and the TAG Unit A3 Environmental Impact Appraisal – Impacts on the Water Environment (HM Government, 2019).

17.5.14. The above guidance was developed to assess the potential impacts that road projects may have on the water environment. However, given that the Padeswood Spur Pipeline Proposed Development is also a linear infrastructure project, DMRB LA113 provides a suitable framework and basis to develop a consistent classification of both the magnitude of impact and sensitivity of potential water receptors.

17.5.15. This method is not applied to the WFD assessment as the assessment of impacts on WFD catchments and receptors has specific assessment guidance. The WFD assessment follows the methodology guidance set out in the Planning Inspectorate Advice Note Eighteen: The Water

Framework Directive (HM Government, 2024) (HM Government, 2024) and NRW's Operational Guidance Note 072 (Natural Resources Wales, 2017).

Hydrogeology

- 17.5.16. The methodology of the groundwater impact assessment includes:
- Establishing baseline conditions (aquifer types, groundwater level and quality information) within the Study Area through a review of desk-based sources, literature review and consultation with relevant authorities;
 - Determining the anticipated groundwater receptors and their sensitivity;
 - Assessment of predicted impact prior to mitigation measures being applied; and
 - Identifying opportunities for enhancements within the groundwater environment.
- 17.5.17. Impacts associated with maintenance activities during Operation Stage are considered to involve similar techniques to those during Construction and Decommissioning Stages. Therefore, typical pipeline replacement works, if required in the future, are assumed to be similar to the Construction Stage and therefore not specifically considered further.
- 17.5.18. Baseline conditions have been informed using publicly available information listed in Section 17.5. Natural Resources Wales provided information on licensed abstractions, while local authorities provided information on Private Water Supplies. Additional information has been obtained from the Groundsure Report (see **Appendix 11.1 Preliminary Risk Assessment, Document Reference: PW.3.3.11.1**).
- SIGNIFICANCE CRITERIA**
- 17.5.19. The general approach in determining the criteria for sensitive receptors ranges from low/medium/high/very high.
- 17.5.20. However, for consistency with risk classifications as defined in TAN15 (Welsh Government, 2004) flood risk is only categorised as low/medium/high. Therefore, for the purposes of this report, in relation to flood risk sensitivity only and given that 'Very High' category is not a formal flood risk classification within TAN15, the 'Very High' and 'High' risk categories have been combined.
- 17.5.21. The criteria used to determine the sensitivity is presented in **Table 17.4**.

Determining the Magnitude of Impact

- 17.5.22. The criteria used to determine the magnitude of impacts are presented in **Table 17.5**.

Table 17.4: Criteria for determining the sensitivity of receptors

Sensitivity of Receptor	Definition of Sensitivity	Typical Examples
Very High	Nationally significant attribute of high importance	<p>Watercourse having a WFD classification shown in a River Basin Management Plan (RBMP) and with $Q95 > 1 \text{ m}^3/\text{s}$;</p> <p>Site protected/designated under EU or UK habitat legislation (SAC, SPA, SSSI, Ramsar site, salmonid water), or species protected by EC Legislation Ecology and Nature Conservation;</p> <p>Groundwater Source Protection Zone (SPZ) 1;</p> <p>Groundwater locally supports a Ground Water Dependent Terrestrial Ecosystem (GWDTE) or any other very significant feature; and,</p> <p>A principal aquifer providing a regionally important resource or protected site.</p>
High	Locally significant attribute of high importance	<p>Watercourse having a WFD classification shown in a RBMP and with $Q95 < 1 \text{ m}^3/\text{s}$;</p> <p>Species protected under EC or UK Legislation Ecology and Nature Conservation;</p> <p>Groundwater SPZ 2;</p> <p>Groundwater supports a GWDTE or any other significant feature;</p> <p>A Principal aquifer providing locally important resources or supporting a river ecosystem;</p> <p>Emergency services (as defined in Figure 2 of the Nature of development or land use section of TAN15) and associated users,</p> <p>Fluvial Flood Zone 3 of the Flood Map For Planning (Natural Resource Wales, 2024) and Zone C (including C1 and C2) of the Development Advice Map (National Resources Wales, 2024); and,</p>

Sensitivity of Receptor	Definition of Sensitivity	Typical Examples
		Surface Water Flood Zone 3.
Medium	Moderate quality and rarity	<p>Watercourse not having a WFD classification shown in an RBMP and with $Q_{95} > 0.001 \text{ m}^3/\text{s}$;</p> <p>Aquifer providing water for agriculture or industrial use with limited connection to surface water;</p> <p>Groundwater SPZ 3;</p> <p>Highly vulnerable development (as defined in Figure 2 of the Nature of development or land use section of TAN15) and associated users;</p> <p>Fluvial Flood Zone 2 of the Flood Map for Planning (Natural Resource Wales, 2024)) and Zone B of the Development Advice Map ((National Resources Wales, 2024); and,</p> <p>Surface Water Flood Zone 2.</p>
Low	Lower quality	<p>Watercourse not having a WFD classification shown in an RBMP and with $Q_{95} < 0.001 \text{ m}^3/\text{s}$;</p> <p>Unproductive strata;</p> <p>Less vulnerable development (as defined in Figure 2 of the Nature of development or land use section of TAN15);</p> <p>Fluvial Flood Zone 1 of the Flood Map for Planning (Natural Resource Wales, 2024) and Zone A of the Development Advice Map (National Resources Wales, 2024); and,</p> <p>Surface Water Flood Zone 1.</p>

Table 17.5: Criteria for determining the magnitude of impact

Level of Magnitude	Definition of Magnitude	Typical Examples
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute.	<p>Loss or extensive change to a fishery;</p> <p>Loss or extensive change to a designated nature conservation site;</p> <p>Loss of regionally important public water supply</p> <p>Reduction in WFD classification;</p> <p>High likelihood of pollution from solubles and sedimentation</p> <p>Risk of pollution from spillage >2% annually;</p> <p>Loss of, or extensive change to, an aquifer;</p> <p>Potential high risk of pollution to groundwater from routine runoff;</p> <p>Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies;</p> <p>Loss or significant damage to major structures through subsidence or similar effects;</p> <p>A major increase in the likelihood, depth or extent of flooding as a consequence of the development (existing receptors) sufficient to put life at risk;</p> <p>High probability/risk of flooding potentially affecting receptors introduced as part of the development, sufficient to put life at risk; and,</p> <p>Large increase in discharge in sewerage network combined with significant capacity issues of the network.</p>

Level of Magnitude	Definition of Magnitude	Typical Examples
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute.	<p>Partial loss in productivity of a fishery;</p> <p>Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies;</p> <p>Contribution to reduction in WFD classification;</p> <p>Moderate likelihood of pollution from solubles and sedimentation;</p> <p>Risk of pollution from spillage <2% annually;</p> <p>Partial loss or change to, an aquifer;</p> <p>Potential high risk of pollution to groundwater from routine runoff;</p> <p>Partial loss of the integrity of GWDTE;</p> <p>Damage to major structures through subsidence or similar effects or loss of minor structures;</p> <p>Some increase in the likelihood, depth or extent of flooding as a consequence of the development (existing receptors) which can cause significant damage;</p> <p>Medium probability/risk of flooding potentially affecting receptors introduced as part of the development, which can cause significant damage; and,</p> <p>Moderate increase in discharge in the sewerage network combined with some lack of capacity of the network.</p>
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability	<p>Moderate likelihood of pollution from either solubles or sedimentation;</p> <p>Risk of pollution from spillage <1% annually;</p> <p>Minor effects on water supplies;</p>

Level of Magnitude	Definition of Magnitude	Typical Examples
		<p>Potential high risk of pollution to groundwater from routine runoff;</p> <p>Minor effects on an aquifer, GWDTEs, abstractions and structures;</p> <p>Measurable but limited in size or magnitude increase in the probability, depth or extension of flooding (existing receptors); and,</p> <p>Measurable but limited risk of flooding potentially affecting receptors introduced as part of the development.</p>
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	<p>The proposed project is unlikely to affect the integrity of the water environment;</p> <p>No risk to water quality from solubles or sedimentation;</p> <p>Risk of pollution from spillage <0.5% annually;</p> <p>No measurable impact upon an aquifer and/or groundwater receptors; and,</p> <p>Negligible change in flood risk as a consequence of the development (existing receptors)/negligible flood risk affecting receptors introduced as part of the development.</p>
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	<p>Reduction in baseline pollution from either solubles or sedimentation;</p> <p>Reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually);</p> <p>Reduction of groundwater hazards to existing structures;</p> <p>Reductions in waterlogging and groundwater flooding; and,</p>

Level of Magnitude	Definition of Magnitude	Typical Examples
		Measurable but limited in size or magnitude increase in the probability, depth or extension of flooding (existing receptors).
Moderate Beneficial	Results in moderate improvement of attribute quality	<p>Reduction in baseline pollution from both solubles or sedimentation;</p> <p>Reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually);</p> <p>Contribution to improvement in WFD classification;</p> <p>Improvement in water body catchment abstraction management strategy classification;</p> <p>Support to significant improvements in damaged GWDTE;</p> <p>Some reduction in the likelihood, depth or extent of flooding as a consequence of the development (existing receptors) which can cause reduce potential damage caused by flooding; and,</p> <p>Moderate reduction in discharge in sewerage network providing some improvement in capacity.</p>
Major Beneficial	Results in major improvement of attribute quality	<p>Removal of existing pollution from solubles and sedimentations;</p> <p>Improvement in WFD classification;</p> <p>Recharge of an aquifer;</p> <p>A major reduction in the likelihood, depth or extent of flooding as a consequence of the development (existing receptors) sufficient to reduce risk to life; and,</p>

Level of Magnitude	Definition of Magnitude	Typical Examples
		Large reduction in discharge into the sewerage network freeing up significant capacity.
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.

- 17.5.23. The methodology for assessing the significance of effect will vary between environmental factors but in principle, will be based on the environmental sensitivity of a receptor and the magnitude of impact on receptor baseline conditions. The significance of each effect will be assessed against the magnitude of impact and the sensitivity of the receptor or receiving environment using the matrix provided in **Table 17.6**. This matrix is based on that provided in Table 3.8.1 of the DMRB LA 104 (Highways England, 2019). For the purpose of this assessment, effects which are moderate or above are considered significant.

Table 17.6: Significance Matrix

Sensitivity of Receptor	Magnitude of Impact				
	Major	Moderate	Minor	Negligible	No Change
Very High	Very Large	Large	Moderate	Slight	Neutral
High	Large	Moderate	Slight	Slight	Neutral
Medium	Moderate	Moderate	Slight	Neutral	Neutral
Low	Slight	Slight	Neutral	Neutral	Neutral

ASSUMPTIONS AND LIMITATIONS

- 17.5.24. To ensure transparency within the EIA process, the following limitations and assumptions have been identified:
- It is assumed that the mitigation measures recommended in the assessment and presented within the Outline Environmental Management Plan (OEMP), will be adopted in the future detailed CEMP prepared by the Construction Contractor. As the design progresses in the detailed design stage, the recommended measures for the CEMP may require revising to capture additional recommendations to protect the water environment during the Construction Stage. The controls and measures within the detailed CEMP will be implemented to mitigate against the identified impacts during the construction stage.
 - The environmental assessment has been based on the current design as shown on the Planning Application drawings (**Document Reference: PW.2.2.5 - Padeswood AGI Proposed Layout**). If there are any changes to these elements of the design, as more data becomes available, including from the ground investigation, further assessment may be required.

- A consultation request has been submitted to Natural Resource Wales. Due to limited resources, only some initial feedback has been received on the Scoping Report.
- There has been engagement with FCC in their roles as LLFA, however, at the time of writing, the LLFA has not yet provided their formal responses to the enquiries. The **FCA (Appendix 17.1, Document Reference: PW.3.3.17.1)** has been written in accordance with best practices and in compliance with national and local policy. Hydraulic modelling has not been undertaken to inform the assessment given the type of watercourse crossings proposed and the construction methodologies.
- Historic borehole records and 1:50,000 bedrock and superficial geology maps were provided publicly by the BGS. It should be noted that this historical data may not be representative of current conditions. Reasonable worst-case water level assumptions were made for the assessments.
- Aquatic ecology surveys and data processing had not yet been completed at the time of writing; the ecological baseline was instead informed by publicly available ecological data from NRW. The ecological data included is from within the last five years, and within the vicinity of the Padeswood Spur Pipeline Proposed Development. Aquatic ecology surveys and data will be provided as an addendum to the ES for the Padeswood Spur Pipeline Proposed Development.
- A review of the existing baseline conditions has been undertaken as part of this assessment. Consideration of the future baseline of the site and its surroundings has also been undertaken given the proposed works at the adjacent proposed Padeswood AGI site as part of the Padeswood CCS Project. It is understood that the Padeswood CCS Project will be developed prior to the Padeswood Spur Pipeline Proposed Development commencing.
- The construction programme is expected to last 18 months with underground works to be executed during the summer periods as far as practicable.
- The maximum duration for open cut watercourse crossings is estimated to be 2 weeks. Temporary culverts installed for access along the haul route are likely to be in place for up to 6 months during the Construction phase to facilitate the installation of the pipeline.
- Activities impacting watercourses must legally have a permit, which would specify conditions that would ensure discharge at appropriate volumes, rates, and quality.

BASELINE CONDITIONS - SURFACE WATER

- 17.5.25. The following sections provide a summary of the baseline conditions of surface water and flood risk receptors. Further details on surface water receptors are provided in **Appendix 17.2– Baseline Information** (Document Reference: PW.3.3.17.2).

EXISTING BASELINE

Surface Water

- 17.5.26. There are two NRW-designated main rivers within the Padeswood Spur Pipeline Red Line Boundary, namely Foundry Drain and the River Alyn. Black Brook Padeswood is located within 500 m downstream of the Red Line Boundary and are presented in **Figure 17.1 Watercourses** (Document Reference: PW.3.4.17.1).
- 17.5.27. In addition, there are 10 ordinary watercourses located within the Red Line Boundary and a further 9 located within 500 m as listed in **Table 17.3** and are presented in **Figure 17.1 Watercourses** (Document Reference: PW.3.4.17.1).
- 17.5.28. Further information on the main rivers and ordinary watercourses is available in **Appendix 17.2 – Baseline Information** (Document Reference: PW.3.3.17.2).
- 17.5.29. There are 23 ponds located within 250 m of the Red Line Boundary. These ponds provide very local land drainage, and many are located within fields or at field boundaries. They are likely to be ephemeral with their value related to the habitat they provide for biodiversity. Therefore, the impacts on these receptors will be assessed within **Chapter 9 – Biodiversity** (Document Reference: PW.3.2.9.).
- 17.5.30. Deeside and Buckley Newt sites SAC statutory biodiversity conservation site of international importance is designated for aquatic habitats and species and is located within close proximity to the Padeswood Spur Pipeline Proposed Development.
- 17.5.31. Maes y Grug Site of Special Scientific Interest (SSSI) statutory biodiversity conservation site of national importance, with aquatic habitats and species as reasons for designation is located within close proximity to the Padeswood Spur Pipeline Proposed Development.

BASELINE CONDITIONS - GROUNDWATER

Existing Baseline

- 17.5.32. The following sections provide a summary of the baseline conditions of groundwater receptors. Further details on groundwater receptors are

provided in **Appendix 17.2– Baseline Information** (Document Reference: **PW.3.3.17.2**).

Geology

- 17.5.33. Table 17.7 summarises the superficial and bedrock geology underlying the Padeswood Spur Pipeline Red Line Boundary.

Table 17.7 Summary of Superficial and Bedrock layers and Formations

Geology type	Geological Formation/ Layer	Aquifer Designation
Superficial	Alluvial fan deposits – clay, silt, sand and gravel. Low, outspread, relatively flat to gently sloping masses of loose rock material, shaped like a fan or segment of a cone (British Geological Survey, 2024).	<i>Secondary A</i>
	Alluvium - clay, silt, sand and gravel. Unconsolidated detrital material deposited by a river, stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope (British Geological Survey, 2024).	<i>Secondary A</i>
	Glacial till – Diamicton Unstratified drift, consisting of a heterogeneous mixture of clay, sand, gravel and boulders (British Geological Survey, 2024).	<i>Secondary (Undifferentiated)</i>
Bedrock	Etruria Formation – mudstone, sandstone and conglomerate Red, purple, brown, ochreous, green, grey and commonly mottled mudstone, with lenticular sandstones and conglomerates referred to as 'espleys'. Common pedogenic horizons, but coal seams are rare (British Geological Survey, 2024)	<i>Secondary A</i>
	Hollin Rock – sandstone Fine to coarse or pebbly, commonly feldspathic, cross laminated and channel bedded sandstone (British Geological Survey, 2024).	<i>Secondary A</i>

Geology type	Geological Formation/ Layer	Aquifer Designation
	<p>Pennine Middle Coal Measures – mudstone, siltstone and sandstone</p> <p>Interbedded grey mudstone, siltstone, pale grey sandstone and commonly coal seams, with a bed of mudstone containing marine fossils at the base (British Geological Survey, 2024).</p>	<i>Secondary A</i>
	<p>Pennine Lower Coal Measures – mudstone, siltstone and sandstone</p> <p>Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part (British Geological Survey, 2024)</p>	<i>Secondary A</i>
	<p>Bowland Shale Formation – mudstone</p> <p>Mainly dark grey fissile and blocky mudstone, weakly calcareous, with subordinate sequences of interbedded limestone and sandstone, fossiliferous in more-or-less discrete bands (British Geological Survey, 2024)</p>	<i>Secondary (Undifferentiated)</i>
	<p>Gwespyr Sandstone</p> <p>Fine-grained, feldspathic and micaceous sandstones, cross-stratified on a variety of scales, with conglomerate-lined scours and intercalated siltstone and mudstone beds (British Geological Survey, 2024)</p>	<i>Secondary A</i>
<p><i>Table notes:</i></p> <p><i>*Secondary A aquifers comprise “permeable layers that can support local water supplies and may form an important source of base flow to rivers”.</i></p> <p><i>**Secondary (Undifferentiated) aquifers are “aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value.”</i></p>		

17.5.34. Within the Red Line Boundary, there are 3 sections where BGS 1:50000 superficial mapping indicates that no superficial coverage is present, and bedrock is expected to outcrop.

Groundwater Quantity and Quality

- 17.5.35. Groundwater information has been recorded from 22 BGS boreholes located within the Study Area. Rest water levels (RWL) have been recorded to be between 2 to 9 mbgl, and groundwater strikes recorded to be from 1.3 to 12 mbgl, with most identifying the groundwater to be situated within the superficial glacial till and alluvium as perched water tables. While not recorded on the local BGS borehole search there is a high probability that additional separate groundwater levels may exist within the underlying more permeable bedrock (sandstones and siltstones). The Ground Investigation (GI) undertaken at the Padeswood Spur Pipeline Proposed Development confirms similar evidence as the local BGS borehole search, with the majority of borehole logs indicating groundwater strikes within the superficial glacial tills and more permeable sandstone horizons, indicating perched water tables.
- 17.5.36. The Padeswood Spur Pipeline Proposed Development is part of, and underlain by, the Dee Carboniferous Coal Measures groundwater body (GB41102G204800) which has a current 2021 Cycle 3 assessment of Poor chemical status (Good quantitative status) and Poor overall status under the WFD (Natural Resource Wales, 2021).
- 17.5.37. While the northern and southern sections of the Padeswood Spur Pipeline Proposed Development are not in an area designated as a Nitrate Vulnerable Zone (NVZ), the central section around Mold is situated within a NVZ (Soughton to Padeswood).
- 17.5.38. The majority of the Red Line Boundary is designated as having 'medium to low' groundwater vulnerability. A small area where the Padeswood Spur Pipeline Proposed Development passes to the northeast of Mold is classed as 'medium to high' groundwater vulnerability. Some small, localised areas are designated as 'low' 'groundwater vulnerability'. To the south near Padeswood, the Padeswood Spur Pipeline Proposed Development passes through an area designated as having 'medium' groundwater vulnerability.

Groundwater Abstractions

- 17.5.39. The Padeswood Spur Pipeline Proposed Development is not within a Source Protection Zone (SPZ). The closest SPZ (Zone 3) is located approximately 4.1 km east of the Padeswood Spur Pipeline Proposed Development.
- 17.5.40. Data abstracted from DataMapWales provides information on licenced groundwater abstractions within 2 km of the Padeswood Spur Pipeline Proposed Development. The Environmental Health Departments of Flintshire County Council provides information regarding private water supplies within 2 km of the Padeswood Spur Pipeline Proposed

Development. Abstractions and discharges beyond 1 km of the Padeswood Spur Pipeline Proposed Development were scoped out as it was determined by professional judgment that the development would have a negligible effect on resources beyond this distance. It remains a possibility that some local properties rely on a private water supply that has not been recorded within the data received, or their locations are not known.

Springs

- 17.5.41. Within the Padeswood Proposed Development 1 km buffer zone OS 1:10000 mapping records one marked spring, referred to as 'spring 1 (marked)'.
- 17.5.42. A desk study was carried out to scope a further 16 possible springs, of these, three potential springs have been scoped in and have been named as 'inferred springs 2/3/4'. These three 'inferred' springs have been included in this assessment.
- 17.5.43. **Table 17.9** summarises the springs (marked and inferred) which have been included in this assessment.

Table 17.8: Summary of the springs being assessed within this chapter

Spring ID	NGR	Easting	Northing	Underlying Geology
1 (marked)	SJ 25820 64923	325820	364923	Pennine Lower Coal Measures Formation
2 (inferred)	SJ 26051 67365	326051	367365	Pennine Middle Coal Measures Formation
3 (inferred)	SJ 26053 63196	326053	363196	Pennine Lower Coal Measures Formation
4 (inferred)	SJ 26146 62992	326146	362992	Pennine Lower Coal Measures Formation

Groundwater Dependant Terrestrial Ecosystems

- 17.5.44. A desk review of GWDTE was undertaken to identify any areas of importance near the Padeswood Spur Pipeline Proposed Development. Results from the desk study identified no peatlands mapped around the Red Line Boundary or within 1 km (Welsh Government, 2022) and no GWDTE mapped around the Red Line Boundary or within 1 km.

WATER FRAMEWORK DIRECTIVE

- 17.5.45. All water bodies either crossed by the Padeswood Spur Pipeline Proposed Development or immediately downstream of the existing pipeline are presented in **Table 17.10** and **17.11**, along with their current WFD status. The location of these watercourses is shown in **Figure 17.1 Watercourses** (Document Reference: PW.3.4.17.1).

Table 17.9: WFD water bodies crossed by, or immediately downstream of, the Padeswood Spur Proposed Development and their baseline WFD status (Ordered from south to north)

WFD water body name	WFD water body ID	Water body type	Connection with Proposed Development	Overall Status	Ecological Status	Chemical Status
Alyn – Leadmill to Hope	GB111067052172	River	Three main rivers and 14 ordinary watercourses are within the water body and interact with the Padeswood Spur Pipeline Proposed Development.	Moderate	Moderate	High
Wevre Brook	GB111067056880	River	One main river and 11 ordinary watercourses are within the water body and interact with the Padeswood Spur Pipeline Proposed Development.	Moderate	High	High
Alyn – Dolfechlas to Leadmill	(GB111067052171)	River	Main river (River Alyn) within the water body which interacts with the Padeswood Spur Pipeline Proposed Development	Moderate	Moderate	High

Table 17.10: WFD groundwater bodies crossed by the Padeswood Spur Proposed Development and their baseline WFD status

WFD water body name	WFD water body ID	Water body type	Connection with Padeswood Spur Pipeline Proposed Development	Overall Status	Quantitative Status	Chemical Status
Dee Carboniferous Coal Measures	GB41102G204800	Groundwater	Padeswood Spur Pipeline Proposed Development underlain by the groundwater body.	Poor	Good	Poor

- 17.5.46. The land within the Wepre Brook WFD water body catchment drains via watercourses regarded as non-reportable (as described in NRW's Operational Guidance Note 072 (Natural Resources Wales, 2017)); the Wepre Brook WFD water body drains directly to the Dee Estuary transitional water body which drains to the North Wales coastal water body watercourses. The Dee Estuary transitional water body is located approximately 6.7 km (as measured fluvially downstream) from the Padeswood Spur Pipeline Proposed Development. The Dee Estuary has WFD Protected Areas (SAC, SPA, and shellfish waters) as well as a mixture of higher and lower sensitivity habitats (saltmarsh, mussel beds, polychaete reef, subtidal soft sediments, cobbles, gravel and shingle, intertidal soft sediment, subtidal rocky reef and rocky shore).
- 17.5.47. The land within the River Alyn catchment also eventually drains to the River Dee (Chester Wier to Ceiriog) via the Alyn (Hope to Dee catchment). The River Dee (Chester Wier to Ceiriog) is located >10 km (as measured fluvially) from the Padeswood Spur Pipeline Proposed Development.
- 17.5.48. The Padeswood AGI and pipeline is located above the Dee Carboniferous Coal Measures groundwater body.

FLOOD RISK

Fluvial/Tidal Flood Risk

- 17.5.49. A review of the Development Advice Map (DAM) (National Resources Wales, 2024) and Flood Map for Planning (FMfP) (Natural Resource Wales, 2024) indicated that the entire Padeswood Spur Pipeline Proposed Development is not located within close proximity to the sea or any tidally influenced watercourses e.g. River Dee.
- 17.5.50. The FMfP (Natural Resource Wales, 2024) also indicates that a small proportion of the Padeswood Spur Pipeline Proposed Development is located within fluvial Flood Zone 3 (previously Flood Zone C in the Development Advice Map). This is attributed to the River Alyn and Wepre Brook watercourses. Flood Zone 3 is defined as the combined 1% risk of flooding from rivers and the sea, including climate change.
- 17.5.51. The Padeswood AGI lies within Flood Zone 1 (previously Flood Zone A in the Development Advice Map) and therefore has low fluvial flood risk. Flood Zone 1 is defined as the combined <0.1 % risk of flooding from rivers and the sea, including climate change.
- 17.5.52. Historical records available on the FMfP indicated that there have been two incidents of past flooding of which both occurred in Mold. The incidents occurred in 2000 and 2007 and were attributed to the River Alyn flooding.

Surface Water Flood Risk

- 17.5.53. There are areas of surface water flooding located throughout the entire Red Line Boundary. These are associated with small ordinary watercourses and overland flow routes. Notable sources include:
- Black Brook Tributary 1
 - Black Brook Tributary 2 and 2a
 - Wats Dyke
 - River Alyn Tributary 7
 - Cobblers Wood Farm Ditch
- 17.5.54. The Padeswood AGI is located within surface water flood zones 2 and 3 (medium and high risk). This risk is associated with Black Brook Tributary 1, which when in flood, flows towards a natural low point in the topography in the southwest corner of the Padeswood AGI.
- 17.5.55. In addition, there is an overland runoff route which originates from the hardstanding area at the Padeswood CCS Plant. This overland runoff route flows from the northeast corner of the Padeswood AGI, before joining the natural low point in the southwestern corner of the AGI, following the local topography.

Groundwater Flood Risk

- 17.5.56. Groundwater flooding usually occurs in low-lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Shallow groundwater levels can be expected near surface watercourses which are typical receptors for groundwater flow.
- 17.5.57. Information from the Groundsure report identified that for the majority of the Padeswood Spur Pipeline Proposed Development, the risk of groundwater flooding is Low, with one small location north of the Padeswood Spur Pipeline Proposed Development identified as at moderate risk.
- 17.5.58. Groundwater flooding is caused by the emergence of water from beneath the ground, either at point source or diffuse locations. The occurrence of groundwater flooding is usually local and, unlike flooding from rivers and the sea, does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.
- 17.5.59. A review of the Flintshire County Council's Strategic Flood Consequence Assessment (Flintshire County Council, 2018) 5 m

Resolution Groundwater Flood Map shows that the Padeswood Spur Pipeline Proposed Development generally runs through areas with 'No Risk' of groundwater flooding. The Padeswood Spur Pipeline Proposed Development crosses some small areas of 'Possibility of Groundwater emerging at the surface' (Classified as an area with groundwater levels between 0.025 m and 0.5 m below ground level in the 100-year return period flood). There appears to be one section with 'Significant risk of groundwater flooding to both surface and subsurface assets' (classified as where groundwater levels are within 0.025 m of the ground surface in the 100-year return period flood). This area is located where the Padeswood Spur Pipeline Proposed Development crosses the A55 near Northop Hall.

FUTURE BASELINE

- 17.5.60. The future baseline scenario has considered the Padeswood Cement Works CCS Project as developed prior to the Padeswood Spur Pipeline Proposed Development commencing.
- 17.5.61. A review of information from **Chapter 7 Climate Resilience (Document Reference: PW.3.2.7)** has also been undertaken to confirm a Future Baseline and assess any impacts within the context of climate change.

Surface Water

- 17.5.62. The future scenario at the Padeswood Spur Pipeline Proposed Development AGI will be the decommissioning, demolition and restoration of the terminal to greenfield whilst the buried pipeline will be left in situ. This will reduce the impermeable area and therefore surface water runoff locally at the Padeswood AGI site and remove the existing operational and maintenance activities.
- 17.5.63. Both the Alyn – Leadmill to Hope (GB111067052172) and Wepre Brook (GB111067056880) have overall WFD status targets which are aimed to be reached by 2027. The Alyn – Leadmill to Hope (GB111067052172) has a 'moderate' status target, while the Wepre Brook (GB111067056880) has a 'good' status target.

Groundwater

- 17.5.64. The future baseline of the Padeswood Spur Pipeline Proposed Development is expected to include a rise in groundwater levels in coastal areas due to rising sea levels.
- 17.5.65. The Dee Carboniferous Coal Measures groundwater body (GB41102G204800) has overall WFD status target of 'good' which are aimed to be reached by 2027.

Flood Risk

- 17.5.66. Climate Change is expected to influence hydrological processes in the Padeswood Spur Pipeline Proposed Development Boundary (and elsewhere). Climate Change will impact rainfall intensity, tidal and coastal levels and peak river flows, which in turn will likely lead to increase flood risk.
- 17.5.67. Peak rainfall intensity is predicted to increase between 20 % to 40 % (Central and Upper estimate, respectively) by the 2080s (2070 to 2115). Peak river flows for the Dee River basin district are predicted to rise between 20 % to 45 % (Central and Upper estimate, respectively) by the 2080s (2070 to 2115).

17.6. SENSITIVE RECEPTORS

- 17.6.1. The scoped in receptors are provided in **Table 17.12** alongside their assigned sensitivity.

Table 17.11 - Sensitive Receptors

Sensitivity	Criteria	Receptors
Very High	<ul style="list-style-type: none"> Watercourse having a WFD classification shown in a RBMP and with Q95 > 1 m³/s; Site protected/designated under EU or UK habitat legislation (SAC, SPA, SSSI, Ramsar site, salmonid water), or species protected by EC Legislation Ecology and Nature Conservation; Groundwater Source Protection Zone (SPZ) 1; Groundwater locally supports a Ground Water Dependent Terrestrial Ecosystem (GWDTE) or any other very significant feature; Principal aquifer providing a regionally important resource or protected site. 	Sites of Special Scientific Interest: <ul style="list-style-type: none"> Maes y Grug, SAC – There will be additional planting adjacent to the SAC. Tributary of River Alyn 2 Greenbank farm – Located within the Maes y Grug, SAC
		Special Areas of Conservations: <ul style="list-style-type: none"> Deeside and Buckley Newt sites – there will be additional planting adjacent to these sites
		Surface Water Receptors: <ul style="list-style-type: none"> River Alyn – The River Alyn is a WFD-designated waterbody shown in the RBMP. This waterbody is not included in the Red Line Boundary
		Groundwater Receptors: <ul style="list-style-type: none"> N/A
		Flood Risk Receptors: <ul style="list-style-type: none"> N/A

Sensitivity	Criteria	Receptors
High	<ul style="list-style-type: none"> Watercourse having a WFD classification shown in a RBMP and with $Q95 < 1 \text{ m}^3/\text{s}$; Species protected under EC or UK Legislation Ecology and Nature Conservation; Groundwater SPZ 2; Groundwater supports a GWDTE or any other significant feature; Principal aquifer providing locally important resources or supporting a river ecosystem; Emergency Services, highly vulnerable and less vulnerable development (as defined in Figure 2 of the Nature of development or land use section of TAN15) and associated users, including residents; Fluvial Flood Zone 3 of the Flood Map For Planning (Natural Resource Wales, 2024) and Zone C (including C1 and C2) of the Development Advice Map (National Resources Wales, 2024); and, Surface Water Flood Zone 3. 	<p>Surface Water Receptors</p> <ul style="list-style-type: none"> Foundry Drain – The Foundry Drain is not designated under the WFD or shown in a RBMP and with $Q95 > 0.001$ and $< 1 \text{ m}^3/\text{s}$. This will be crossed via trenchless crossing techniques. Wepre Brook - The Wepre Brook is designated under the WFD with an overall designation of Moderate, with $Q95 > 0.001$ and $< 1 \text{ m}^3/\text{s}$. This will be crossed via trenchless crossing techniques. <p>Groundwater Receptors:</p> <ul style="list-style-type: none"> N/A <p>Flood Risk Receptors:</p> <ul style="list-style-type: none"> Wepre Brook – the Padeswood Spur Pipeline crosses Fluvial Flood Zone 3 (previously Flood Zone C) at the Wepre Brook crossing. River Alyn – the Padeswood Spur Pipeline is located within Fluvial Flood Zone 3 (previously Flood Zone C) adjacent to the River Alyn. The Padeswood Spur Pipeline crosses areas that are within Flood Zones 1, 2 and 3. This risk is associated with open watercourse channels and overland runoff routes. The Padeswood AGI is located within surface water flood zones 2 and 3. This risk is associated with Black Brook Tributary 1 and existing overland surface water runoff.
Medium		<p>Surface Water Receptors:</p>

Sensitivity	Criteria	Receptors
	<ul style="list-style-type: none"> Watercourse not having a WFD classification shown in a RBMP and with $Q95 > 0.001 \text{ m}^3/\text{s}$; Aquifer providing water for agriculture or industrial use with limited connection to surface water; Groundwater SPZ 3; Highly vulnerable development (as defined in Figure 2 of the Nature of development or land use section of TAN15) and associated users for example office employees. Fluvial Flood Zone 2 of the Flood Map for Planning (Natural Resource Wales, 2024) and Zone B of the Development Advice Map (National Resources Wales, 2024); and, Surface Water Flood Zone 2. 	<ul style="list-style-type: none"> Black Brook Tributary 2 -is not a WFD-designated waterbody or shown in an RBMP with $Q95 > 0.001 \text{ m}^3/\text{s}$. Shows evidence of returning to equilibrium within current constraints. This will be crossed using open cut methods. <p>Groundwater Receptors:</p> <ul style="list-style-type: none"> Secondary A aquifers (Superficial) Secondary A aquifers (Bedrock) Springs/ Inferred springs <p>Flood Risk Receptors: Construction Workers</p> <ul style="list-style-type: none"> The Padeswood Carbon Dioxide Spur Pipeline crosses areas that are within Flood Zones 1, 2 and 3. This risk is associated with open watercourse channels and overland runoff routes. The Padeswood AGI is located within surface water flood zones 2 and 3. This risk is associated with Black Brook Tributary 1.
Low	<ul style="list-style-type: none"> Watercourse not having a WFD classification shown in a RBMP and with $Q95 < 0.001 \text{ m}^3/\text{s}$; Unproductive strata; Less vulnerable development (as defined in Figure 2 of the Nature of Development or land use section of TAN15). Fluvial Flood Zone 1 of the Flood Map for Planning (Natural Resource Wales, 2024) and Zone A of the 	<p>Surface Water Receptors trenchless crossings:</p> <ul style="list-style-type: none"> Wats Dyke, Tributary of River Alyn 5, and Tributary of River Alyn 6 are not designated under the WFD or shown in the RBMP with $Q95$ of $<0.001 \text{ m}^3/\text{s}$. These will be crossed via trenchless techniques. <p>Surface Water Receptors open cut crossings:</p> <ul style="list-style-type: none"> Black Brook Tributary 1, and Tributary of River Alyn 2 are not designated under the WFD or shown in the RBMP with $Q95$ of $<0.001 \text{ m}^3/\text{s}$. These will be crossed via open cut.

Sensitivity	Criteria	Receptors
	<p>Development Advice Map (National Resources Wales, 2024); and,</p> <ul style="list-style-type: none"> • Surface Water Flood Zone 1 	<p>Surface Water Receptors potential indirect impacts:</p> <ul style="list-style-type: none"> • Brackens Drain, Wells Drain, Tributary of Wepre Brook 1, Tributary of Wepre Brook 2, Tributary of Wepre Brook 3 are not designated under the WFD or shown in the RBMP with Q95 of $<0.001 \text{ m}^3/\text{s}$. These are not crossed by the Padeswood Spur Pipeline Proposed Development, however, could potentially be indirectly impacted. • Tributary of River Alyn 7, Bryn y Baal Drain, Tributary of Alltami Brook 1, Drainage Ditch north of A5118, Drainage Ditch 2 north of A5118, Ditch 1 at Padeswood Cement Works, are not designated under the WFD or shown in the RBMP with Q95 of $<0.001 \text{ m}^3/\text{s}$. These are not crossed by the Padeswood Spur Pipeline Proposed Development, however, could potentially be indirectly impacted. <p>Groundwater Receptors:</p> <ul style="list-style-type: none"> • N/A <p>Flood Risk Receptors:</p> <ul style="list-style-type: none"> • The remainder of the Padeswood Carbon Dioxide Spur Pipeline crossings (Tributary of River Alyn 2, Tributary of River Alyn 5, Tributary of River Alyn 6, Wats Dyke, Black Brook Tributary 1, Black Brook Tributary 2, and Foundry Drain) are located within Fluvial Flood Zone 1 • The Padeswood Carbon Dioxide Spur Pipeline crosses areas that are within Flood Zones 1, 2 and 3. This risk is associated with open watercourse channels and overland runoff routes.

17.7. DESIGN DEVELOPMENT, IMPACT AVOIDANCE AND EMBEDDED MITIGATION

- 17.7.1. Consideration has been given to the potential environmental effects throughout the design progress, for which embedded mitigation is included in the design as far as practicable to remove/reduce/offset potential impacts on the water environment. This includes route-wide design measures and more specific design measures associated with the development of the pipeline route and associated infrastructure. Embedded mitigation measures for the Padeswood Spur Pipeline Proposed Development are summarised in **Chapter 4: Consideration of Alternatives** of this ES (Document Reference: PW.3.2.4). A brief summary of mitigation measures relevant to this chapter is provided below. This section should be read in conjunction with **Appendix 17.4 – Summary of Assessment of Effects** (Document Reference: PW.3.3.17.4) which provides further information regarding design development impact avoidance and embedded mitigation measures.

CONSTRUCTION

Surface Water

- 17.7.2. Considerations regarding the impacts to surface water bodies have been undertaken as part of the design development. As part of the design process, the Red Line Boundary has been refined to eliminate the potential crossing of sensitive receptors including the River Alyn.
- 17.7.3. For waterbodies crossed by the Padeswood Spur Pipeline Proposed Development, trenchless crossing methods have been implemented where necessary to limit impacts.

Groundwater

- 17.7.4. In areas of shallow groundwater, sheet piles may be used as a hydraulic control measure to limit the ingress of water into excavations. To ensure minimal loss of groundwater quantity from the water environment, water recycling practices, including the re-use of hydrotest water, if possible, will be considered.

Flood Risk

- 17.7.5. As part of the Padeswood Spur Pipeline Proposed Development, where crossings have been proposed for open watercourses, open cut methods for the small watercourses have generally been proposed. Measures will be in place to manage the flow and prevent flood risk elsewhere during the construction works.

- 17.7.6. Where the open cut methods are not feasible, these crossings will be installed by trenchless methods to avoid work within floodplains and limit flood risk impacts to construction workers, plant and prevent increase in flood risk elsewhere.
- 17.7.7. The proposed Padeswood AGI will be designed with a surface water drainage scheme complying with the local, regional and national requirements of the SUDS Approval Body (SAB). This will prevent an increase in flood risk elsewhere due to the increase in impermeable areas of the proposed AGI. This surface water drainage from the Padeswood AGI will connect to the wider Padeswood CCS Project where provision for compliance with the relevant requirements will have already been implemented.
- 17.7.8. As part of the wider Padeswood CCS Project, it is understood that additional drainage measures will be implemented to mitigate overland surface water flood risk from offsite sources onto the Padeswood AGI.
- 17.7.9. The embedded design mitigation measures will be presented in the **OEMP (Document Reference: PW.4.1)** for the Padeswood Spur Pipeline Proposed Development.

OPERATION

Groundwater

- 17.7.10. The Padeswood AGI drainage plan (**Document Reference: PW.2.2.5 - Padeswood AGI Proposed Layout**) contains indicative information regarding proposed measures to attenuate and discharge surface runoff.
- 17.7.11. Trench breakers (clay plugs) will be placed at appropriate locations within the open trench sections of buried pipeline which intercept groundwater to avoid preferential groundwater (and therefore pollutant transport) pathways being created.

Flood Risk

- 17.7.12. The proposed pipeline has been designed to be buried throughout its alignment from the Padeswood AGI to the Northop Hall AGI. Therefore, although it crosses fluvial and surface water Flood Zones 1, 2 and 3 it is unlikely to impact the flood risk.
- 17.7.13. The design of the proposed Padeswood AGI will incorporate measures so that it remains unaffected by surface water flood risk impacts from adjacent overland sources.

17.8. PRELIMINARY ASSESSMENT OF LIKELY IMPACTS AND EFFECTS

- 17.8.1. This section details the preliminary assessment of predicted impacts and effects for the Padeswood Spur Pipeline Proposed Development during the Construction, Operational and Decommissioning Stages. This section should be read in conjunction with **Appendix 17.4 – Summary of Assessment of Effects (Document Reference: PW.3.3.17.4)** which provides further information regarding preliminary assessment of likely impacts and effects.

CONSTRUCTION STAGE

- 17.8.2. The likely significant effects on the water environment associated with the Construction Stage are set out below.

Impacts on water quality and hydrology by entrainment of materials

- Sites of Special Scientific Interest: Maes y Grug watercourse specifically Tributary of River Alyn 2 Greenbank farm and SAC Special Areas of Conservations: Deeside and Buckley Newt Site; and,
- River Alyn.

Impacts on water quality by spillage of pollutants

- Sites of Special Scientific Interest: Maes y Grug watercourses: Tributary of River Alyn 2 Greenbank farm and SAC Special Areas of Conservations: Deeside and Buckley Newt Site
- River Alyn; and,
- Black Brook Tributary 2.

Impacts on hydrological and hydromorphological processes from temporary crossing of watercourses for access

- Black Brook Tributary 2.

Impacts to hydrological and hydromorphological processes from open cut crossing of watercourses

- Black Brook Tributary 2.

- 17.8.3. Impacts on groundwater levels and flows for groundwater receptors during Construction Stage dewatering. This is a potentially significant effect on Secondary A aquifers and springs.

- 17.8.4. Impacts on groundwater receptors from pollution. This is a potentially significant effect on Secondary A aquifers and springs.

- 17.8.5. No significant effect has been identified on flood risk during the Construction Stage of the buried pipeline and Padeswood AGI.

OPERATIONAL STAGE

- 17.8.6. The likely significant effects on the water environment associated with the Operational Stage are set out below.

Impacts associated with the Padeswood Spur Pipeline Proposed Development installed beneath watercourses

- Wepre Brook,
- Black Brook Tributary 2

- 17.8.7. No significant effects were identified for groundwater resources during the Operational Stage of the Padeswood Spur Pipeline Proposed Development.

- 17.8.8. No significant effects have been identified on flood risk during the Operational Stage of the buried pipeline and Padeswood AGI.

DECOMMISSIONING STAGE

- 17.8.9. No significant effects are identified for surface water, groundwater resources and flood risk during the Decommissioning Stage of the Padeswood Spur Pipeline Proposed Development.

17.9. MITIGATION AND ENHANCEMENT MEASURES

- 17.9.1. This Section sets out the preliminary avoidance, mitigation and compensation measures which are likely to be required to address the significant effects as assessed in **Section 17.8.**

- 17.9.2. An **Outline Environmental Management Plan (OEMP) (Document Reference: PW.4.1)** has been prepared for the Padeswood Spur Pipeline Proposed Development which lists the controls and measures recommended to be adopted by the Construction Contractor during the Construction Stage and suggestions for the Decommissioning Stage. This document will include the collated mitigation relied upon in the EIA in order to manage the environmental impacts of the Padeswood Spur Pipeline Proposed Development.

- 17.9.3. An overview of all mitigation proposed for the Padeswood Spur Pipeline Proposed Development is presented in **Appendix 17.4 – Summary of Assessment of Effects. (Document Reference: PW.3.3.17.4)** This appendix provides a summary description of relevant mitigations for all scoped receptors and impacts.

CONSTRUCTION AND DECOMMISSIONING STAGE

Surface Water and Flood Risk

- 17.9.4. Mitigations to minimise the potential impacts during the Construction Stage on surface water and flood risk receptors include: PW-BD-038, PW-BD-042, PW-WR-002, PW-WR-005, PW-WR-018 and PW-WR-027 of the OEMP (Document Reference: PW.4.1).

Groundwater

- 17.9.5. A Groundwater Management and Monitoring Plan (GWMMP) will be implemented alongside the detailed CEMP (produced by the Construction Contractor) as part of the Environmental Management Plans. The GWMMP will detail the groundwater monitoring strategy where any dewatering activities are proposed and ensure all groundwater abstracted through construction is appropriately managed.

OPERATION STAGE

Surface Water

- 17.9.6. Mitigations to minimise the potential impacts during the Operation Stage to surface water. As Black Brook Tributary 2 and Wepre Brook have shown evidence of lateral adjustments, additional erodibility corridor assessment was undertaken and is presented in **Appendix 17.3 – Water Framework Directive (Document Reference: PW.3.3.17.3)** and **17.4 – Assessment of effects appendix (Document Reference: PW.3.3.17.4)**. Following this assessment, it was determined that the Proposed Padeswood Spur Pipeline will be buried at least 2 m below the bed level of Black Brook Tributary 2 and Wepre Brook for the whole width of the erodible corridor. This will prevent future pipeline exposure as Wepre Brook laterally adjusts (PW-WR-031 of the OEMP (Document Reference: PW.4.1)).

17.10. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

- 17.10.1. This section details the assessment of significant effects taking account of the mitigation detailed in **Section 17.8** above. The assessment includes the predicted impacts and effects for the Padeswood Spur Pipeline Proposed Development during the Construction and Operational. The detailed assessment is presented in **Appendix 17.4 – Summary of Assessment of Effects (Document Reference: PW.3.3.17.4)**.

CONSTRUCTION STAGE

- 17.10.2. There are no likely significant effects for surface water, groundwater and flood risk associated with the Construction Stage of the Padeswood Spur Pipeline Proposed Development.

OPERATIONAL STAGE

- 17.10.3. There are no likely significant effects for surface water, groundwater and flood risk associated with the Operation Stage of the Padeswood Spur Pipeline Proposed Development.

17.11. ASSESSMENT AGAINST FUTURE BASELINE

- 17.11.1. Climate change impacts associated with the water environment are considered for the Operational Stage of the Padeswood Spur Pipeline Proposed Development.
- 17.11.2. The Padeswood AGI will be served by a bespoke surface drainage system which will connect to the wider Padeswood CCS Project and will be designed to accommodate the increase in rainfall frequency and intensity due to climate change. The increases in rainfall intensity and impacts of climate change are presented within the Flood Consequence Assessment report (**Document Reference: PW.3.3.17.1**).
- 17.11.3. The pipeline is below ground and therefore not at risk of climate change effects on the water environment and flood risk.

17.12. MONITORING

- 17.12.1. As part of mitigation the following will be adopted which have a monitoring requirement:
- A Surface Water Management and Monitoring Plan (OEMP Reference: PW-WR-018);
 - Turbidity Monitoring (OEMP Reference PW-WR-025);
 - A Groundwater Management and Monitoring Plan (OEMP Reference: PW-WR-016); and,
 - A Dewatering Management Plan (OEMP Reference: PW-WR-017);

17.13. RESIDUAL EFFECTS

- 17.13.1. **Table 17.13** summarises the residual effects associated with the Padeswood Spur Pipeline Proposed Development during Construction, Operation and Decommissioning. The mitigation codes for each potentially significant impact are identified in **Table 17.13**. A summary of these mitigation items is provided in **Appendix 17.4 – Summary of Assessment of Effects** (**Document Reference: PW.3.3.17.4**). A Full

description is provided within the OEMP(Document reference: PW.4.1). Additionally, the temporal and spatial extent of any residual effects reported in **Table 17.3** is reported as per Table 1.2 in **Appendix 17.4 – Summary of Assessment of Effects** (Document Reference: PW.3.3.17.4).

Table 17.12 - Summary of Residual Effects

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
Construction				
Impacts on water quality and hydrology by entrainment of materials	Sites of Special Scientific Interest: Maes y Grug watercourses: Tributary of River Alyn 2 Greenbank farm, Drain to Pond 3 Cobblers Wood Farm, Drain to Pond 1 Cobblers Wood Farm & Cobblers Brook SAC Special Areas of Conservations: Deeside and Buckley Newt Site	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to PW-WR-025.	Slight (Not Significant)
	River Alyn	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to PW-WR-025.	Slight (Not Significant) D/S/T

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
	Black Brook Tributary 2	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to PW-WR-025.	Slight (Not Significant) D/S/T
Impacts to water quality by spillage of pollutants	Sites of Special Scientific Interest: Maesy Grug watercourses: Tributary of River Alyn 2 Greenbank farm, Drain to Pond 3 Cobblers Wood Farm, Drain to Pond 1 Cobblers Wood Farm & Cobblers Brook SAC Special Areas of Conservations: Deeside and Buckley Newt Site	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to PW-WR-006.	Slight (Not significant) D/S/T
	River Alyn	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to PW-WR-006.	Slight (Not significant) D/S/T

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
	Black Brook Tributary 2	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to PW-WR-006.	Slight (Not significant) D/S/T
Impacts to hydrological and hydromorphological processes from temporary crossings of watercourses for access	Black Brook Tributary 2	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including but not limited to: PW-BD-040 and PW-WR-025.	Slight (Not significant) D/S/T
Impacts to hydrological and hydromorphological processes from open cut crossings of watercourses	Black Brook Tributary 2	Moderate (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to: PW-BD-040, PW-BD-042, PW-WR-025 and PW-WR-003.	Slight (Not significant) D/S/T

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
Impacts to groundwater levels and flows	Alluvium (Secondary A Aquifer)	Moderate (Significant)	<p>Implementation of measures outlined in the OEMP (Document Reference: PW.4.1), including production of a GWMMP (PW-WR-016) and DMP (PW-WR-017) by the Construction Contractor.</p> <p>Sheet piling to limit ingress of water to excavations (PW-WR-019).</p> <p>Permitting requirements which regulate dewatering potential (PW-WR-017).</p> <p>Specific mitigation (PW-WR-032). has been put in place at the Tributary to River Alyn 2 for the pipeline to be buried at shallow depths to reduce the interaction with bedrock.</p>	Slight (Not Significant) D/S/T
	Alluvial Fan Deposits (Secondary A Aquifer)	Moderate (Significant)	<p>Implementation of measures outlined in the OEMP (Document Reference: PW.4.1), including production of a GWMMP (PW-WR-016) and DMP (PW-WR-017) by the Construction Contractor.</p> <p>Sheet piling to limit ingress of water to excavations (PW-WR-019).</p>	Slight (Not Significant) D/S/T

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
			<p>Permitting requirements which regulate dewatering potential (PW-WR-017)</p> <p>Specific mitigation (PW-WR-032) has been put in place at Tributary to River Alyn 2 for the pipeline to be buried at shallow depths to reduce the interaction with bedrock.</p>	
	Etruria Formation (Secondary A Aquifer)	Moderate (Significant)	<p>Implementation of measures in the OEMP (Document Reference: PW.4.1), including production of a GWMMP (PW-WR-016) and DMP (PW-WR-017) by the Construction Contractor.</p> <p>Sheet piling to limit ingress of water to excavations (PW-WR-019).</p> <p>Permitting requirements which regulate dewatering potential (PW-WR-017)</p> <p>Specific mitigation (PW-WR-032) has been put in place at Tributary to River Alyn 2 for the pipeline to be buried at shallow depth as to reduce the interaction with bedrock.</p>	Slight (Not Significant) D/S/T

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
	Hollins Rock Formation (Secondary A Aquifer)	Moderate (Significant)	<p>Implementation of measures in the OEMP (Document Reference: PW.4.1), including production of a GWMMP (PW-WR-016) and DMP (PW-WR-017) by the Construction Contractor.</p> <p>Sheet piling to limit ingress of water to excavations (PW-WR-019).</p> <p>Permitting requirements which regulate dewatering potential (PW-WR-017)</p> <p>Specific mitigation (PW-WR-032) has been put in place at Tributary to River Alyn 2 for the pipeline to be buried at shallow depth as to reduce the interaction with bedrock.</p>	Slight (Not Significant) D/S/T
	Pennine Coal Measures Group (Secondary A Aquifer)	Moderate (Significant)	<p>Implementation of measures in the OEMP (Document Reference: PW.4.1), including production of a GWMMP (PW-WR-016) and DMP (PW-WR-017) by the Construction Contractor.</p> <p>Sheet piling to limit ingress of water to excavations (PW-WR-019).</p>	Slight (Not Significant) D/S/T

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
			<p>Permitting requirements which regulate dewatering potential (PW-WR-017)</p> <p>Specific mitigation (PW-WR-032) has been put in place at Tributary to River Alyn 2 for the pipeline to be buried at shallow depth as to reduce the interaction with bedrock.</p>	
Impacts to groundwater quality	Alluvium (Secondary A Aquifer)	Moderate (Significant)	Implementation of measures in the OEMP (Document Reference: PW.4.1). Compliance with standard pollution prevention measures including (PW-GN-002 and PW-WR-003).	Slight (Not Significant) D/S/T
	Alluvial Fan Deposits (Secondary A Aquifer)	Moderate (Significant)	Implementation of measures in the OEMP (Document Reference: PW.4.1). Compliance with standard pollution prevention measures including (PW-GN-002 and PW-WR-003).	Slight (Not Significant) D/S/T
	Etruria Formation (Secondary A Aquifer)	Moderate (Significant)	Implementation of measures in the OEMP (Document Reference: PW.4.1). Compliance with standard pollution prevention measures including (PW-GN-002 and PW-WR-003).	Slight (Not Significant) D/S/T

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
	Hollins Rock Formation (Secondary A Aquifer)	Moderate (Significant)	Implementation of measures in the OEMP (Document Reference: PW.4.1). Compliance with standard pollution prevention measures including (PW-GN-002 and PW-WR-003).	Slight (Not Significant) D/S/T
	Pennine Coal Measures Group (Secondary A Aquifer)	Moderate (Significant)	Implementation of measures in the OEMP (Document Reference: PW.4.1). Compliance with standard pollution prevention measures including (PW-GN-002 and PW-WR-003).	Slight (Not Significant) D/S/T
	Gwespyr Sandstone (Secondary A Aquifer)	Slight (Not Significant)	Implementation of measures in the OEMP (Document Reference: PW.4.1). Compliance with standard pollution prevention measures including (PW-GN-002 and PW-WR-003).	Slight (Not Significant) D/S/T
	Spring/ Inferred Springs	Moderate (Significant)	Implementation of measures in the OEMP (Document Reference: PW.4.1). Compliance with standard pollution prevention measures including (PW-GN-002 and PW-WR-003).	Slight (Not Significant) I/S/T
Operation				

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
Assessment of impacts to hydromorphological forms and processes due to channel and bank reinstatement following open cut crossings	Black Brook Tributary 2	Moderate Adverse (Significant)	Implementation of measures outlined in the OEMP (Document Reference: PW.4.1) including and not limited to; PW-WR-040, PW-BD-044 and PW-WR-031 as referenced in the Appendix 17.3: WFD Assessment (Document Reference: PW.3.3.17.3).	Slight (Not significant) D/L/P
Impacts associated with the Proposed Padeswood Spur Pipeline Proposed Development installed beneath watercourses	Wepre Brook	Moderate Adverse (Significant)	<p>An erodible corridor assessment has been undertaken for Wepre Brook. The outcomes of this assessment are presented in Appendix 17.3 WFD Assessment (Document Reference: PW.3.3.17.3).</p> <p>The Proposed Padeswood Spur Pipeline will be buried at least 2m below the bed level of Wepre Brook for the whole width of the erodible corridor. This will future prevent pipeline exposure as Wepre Brook laterally adjusts (PW-WR-031 of the OEMP (Document Reference: PW.4.1).</p>	Neutral (Not Significant) D/L/P

Description of the Effect	Receptor	Pre-mitigation significance of effects	Mitigation measure	Residual effect
	Black Brook Tributary 2	Moderate Adverse (Significant)	undertaken for Black Brook Tributary 2. The outcomes of this assessment are presented in Appendix 17.3: Water Framework Directive Assessment (Document Reference: PW.3.3.17.3). The Padeswood Carbon Dioxide Spur Pipeline will be buried at least 2 m below the bed level of Black Brook Tributary 2 for the whole width of the erodible corridor. This will aid in preventing pipeline exposure as Black Brook Tributary 2 laterally adjusts. (PW-WR-031 of the OEMP (Document Reference: PW.4.1).	Neutral (Not Significant) D/L/P
Impacts to groundwater levels and flows	No Impact of Moderate or above anticipated			
Impacts groundwater quality	No Impact of Moderate or above anticipated			

Key: Direct/Indirect – D/I; Short / Medium / Long term – ST/MT/LT; Permanent/Temporary – P/T

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