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10 WATER RESOURCES

10.1 Introduction

10.1.1 This chapter of the Environmental Statement (ES) identifies and assesses the effects of the development proposals during the construction and operational stages on water resources and the water environment of the local area, including flood risk.

10.1.2 The baseline situation is considered, before any likely significant environmental effects of the proposed development upon the current environment are identified, during the construction and operational phases, taking into account any cumulative effects. Mitigation measures to reduce negative environmental effects are identified as appropriate, before the residual environmental effects are assessed.

10.1.3 This chapter has been prepared by Wardell Armstrong (WA). The accompanying Flood Risk Assessment (FRA) and Drainage Strategy (Appendix 10.1) have been prepared by Systra.

10.1.4 The International Advanced Manufacturing Park (IAMP) is a development located on land to the north of the A1290, Washington Road. Figure 1.1 shows the location of the Site in context of the surrounding area. The IAMP development is separated into two areas referred to as IAMP ONE and IAMP TWO. Figure 1.2 identifies the different parcels of land within the overall IAMP site. IAMP ONE is separated into IAMP ONE Phase One and IAMP ONE Phase Two. This ES refers to IAMP ONE Phase Two, hereafter referred to as 'the Site.' The Site is located to the west of IAMP ONE Phase One as shown within Figure 2 of Appendix 10.1.

10.2 Policy Context

Legislation

10.2.1 Following the exit of the UK from the European Union (EU), the Environment (EU Exit) Regulations 2019[1] came into force on exit day. This includes updates to some of the legislation (outlined below) to ensure that they continue to function properly following exit. There are outstanding changes yet to be made to the 1991 Water Resources Act following the exit of the UK from the EU.[2]

[1] The Environment (Amendment etc.) (EU Exit) Regulations 2019 [online]. Accessed 22/04/2021. Available at: https://www.legislation.gov.uk/uksi/2019/458/contents/made
[2] Water Resources Act 1991 (as amended) [Online] Accessed 21/04/2021. Available at: https://www.legislation.gov.uk/ukpga/1991/57/contents

European Directive: The Water Framework Directive (2000/60/EC)

10.2.2 Directive 2000/60/EC of the European Parliament and Council (the Water Framework Directive (WFD)) came into force on the 22nd of December 2000 and established a framework for community action in the field of water policy. The WFD required member states to aim to reach good chemical and ecological status in inland and coastal waters by 2015. The WFD is designed to enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, to promote sustainable water use, to reduce pollution of water and to ensure a progressive reduction in groundwater pollution. The WFD established a strategic framework for managing the water environment and requires a Management Plan for each river basin to be developed every six years. In cases where good status / potential could not be achieved by 2015, a provision is given under Article 4.4 of the WFD extending the deadline to 2021 or 2027; the date has been extended to 2027 in respect of a large number of waterbodies. The WFD is transcribed into English and Welsh law under the Water Environment (WFD) (England & Wales) Regulations 2017 and the competent authority (in England) for delivering the WFD is the Environment Agency (EA). The Site lies within the Northumbria River Basin Management Plan area.

European Directive: The Groundwater Daughter Directive (2006/118/EC)

10.2.3 Directive 2006/118/EC of the European Parliament and Council (the Groundwater Daughter Directive) came into force on the 12th of December 2006 and aims to protect groundwater against pollution and deterioration. The Groundwater Daughter Directive was developed in response to the requirements of Article 17 of the WFD (2000/60/EC) and specifies measures to prevent and control groundwater pollution (by providing criteria for the assessment of good groundwater chemical status, criteria for the identification and reversal of significant and sustained upward trends and for defining a baseline status).

European Directive: The Priority Substances Directive (2008/105/EC)

10.2.4 Directive 2008/105/EC of the European Parliament and Council (the Priority Substances Directive) came into force on the 16th of December 2008 and sets environmental quality standards in the field of water policy. The Priority Substances Directive amended and subsequently repealed Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amended the WFD of the European Parliament and Council. The Priority Substances Directive was developed in

response to the requirements of Article 16 of the WFD and requires the identification of priority substances to set Environmental Quality Standards (EQSs) for the concentrations of the priority substances in surface waterbodies and to periodically review the list of priority substances.

Act of Parliament: The Environment Protection Act 1990

10.2.5 The Environmental Protection Act 1990 brought in a system of integrated pollution control for the disposal of wastes to land, water and air and covers statutory nuisances.

Act of Parliament: The Land Drainage Act 1991

10.2.6 The Land Drainage Act 1991 requires the owner of a watercourse to maintain the watercourse in such a condition that the free flow of water is not impeded. The owner must accept the natural flow from upstream but need not undertake works to cater for increased flows resulting from some types of works carried-out upstream (e.g., a new housing development).

Act of Parliament: The Water Resources Act 1991, Water Act 2003 & Water Act 2014

10.2.7 The Water Resources Act 1991 aims to prevent and minimise pollution of water (surface and groundwater) and tasks the policing of this Act to the EA. The Water Act 2003 amended the Water Resource Act 1991 to improve long-term water resource management by making changes to licencing. The Water Act 2003 also aims to promote water conservation, increase competition, strengthen the voice of consumers, and promote the suitable use of water resources. The Water Act 2014 aims to reform the water industry to make it more responsive to customers and to increase the resilience of water supplies to droughts and flooding. It also brings in measures to address the availably and affordability of insurances in high flood risk areas.

Policy

National Policy: The Revised National Planning Policy Framework

10.2.8 The Department for Communities and Local Government (DCLG) first published the National Planning Policy Framework (NPPF) in March 2012; this was revised in February 2019 and them again, in July 2021. The NPPF replaces the guidance previously contained within Planning Policy Statement 25 (PPS25): Development & Flood Risk. All local development plans and neighbourhood plans must take account

of the NPPF and the NPPF is a material consideration in planning decisions. The NPPF contains numerous paragraphs concerning water resources, flooding, water quality and protection of the environment during development.

National Policy: Planning Practice Guidance: Flood Risk & Costal Change (2014)

10.2.9 In March 2014, the DCLG published the Planning Practice Guidance (PPG), which replaced the Technical Guidance to the NPPF. This document provides additional guidance to local planning authorities to ensure the effective implementation of the planning policies set out in the NPPF on development in areas at risk of flooding. It identifies that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary, it should be made flood resilient without increasing flood risk elsewhere.

Local Policy: Sunderland Core Strategy and Development Plan 2015-2033

10.2.10 The Sunderland Core Strategy & Development Plan (CSDP) was adopted in January 2020. In relation to water, strategic priority 9 of the CSDP is: "*To adapt to and minimise the impact of climate change by reducing carbon emissions, maximising the use of low carbon energy solutions and seeking to reduce the risk/impact of flooding.*"

10.2.11 This strategic priority is supported by policies BH1, BH2, NE1, WWE1, WWE2, WWE3, WWE4, WWE5 and WWE10. The relevant policies to this assessment of effect on water resources are BH2, NE1, WWE2, WWE3, WWE4 and WWE5.

10.2.12 CSDP Policy BH2, Sustainable design and construction, notes at point 3 that major development should "*conserve water resources and minimise vulnerability to flooding.*"

10.2.13 CSDP Policy NE1, Green and blue infrastructure, looks to maintain and improve the Green Infrastructure Network through the enhancement, creation and management of multifunctional green and blue spaces that are to be well connected to each other and the wider countryside. The policy sets out the requirements for developments to achieve this, including:

- (at iv) applying climate change mitigation and adaptation measures, including flood risk and watercourse management;
- (at vi) including and/or enhancing formal and natural greenspace and bluespace provision; and

- (at ix) the protection, enhancement and restoration of watercourses, ponds, lakes, and water dependent habitats.

10.2.14 There are green infrastructure corridors identified to the north of the Site (i.e., the River Don corridor) and to the west of the Site (running north along the eastern edge of the Washington conurbation).

10.2.15 CSDP Policy WWE2 Flood risk and coastal management seeks to reduce flood risk through following the sequential approach to determining the suitability of land for development, applying the exception test where necessary; Flood Risk Assessments will be required to show that development will not increase flood risk onsite or elsewhere (and, if possible, reduce the risk of flooding); and developments will be required to include or contribute to flood mitigation, compensation and/or protection measures, where necessary to manage flood risk. The policy also requires development to comply with the WFD by contributing to the Northumbria River Basin Management Plan (see para.10.2.2 above). Development adversely affecting the quantity of surface or groundwater flow must demonstrate that no significant adverse impacts would occur (with mitigation implemented as necessary).

10.2.16 CSDP Policy WWE3 Water management relates to flood risk (onsite and offsite) and sets out the requirements that developments must comply with in order to manage the risk of flooding. These requirements can be summarised as:

- Provision of a Flood Risk Assessment (FRA).
- Demonstrating that they pass the sequential test and (of relevant) exceptions test.
- Meeting specific greenfield run-off rates.
- Incorporating Sustainable Drainage Systems (SuDS) to manage surface water drainage, including arrangements for whole life management and maintenance.
- Setting-out in order the means by which surface water run-off is to be discharged.
- Ensuring adequate protection against overland flooding.
- Incorporating allowances for climate change in accordance with EA guidance;
- Making any necessary developer contribution to drainage infrastructure.
- Demonstrating control of surface water run-off during construction and operation, in addition to the management of water generally.
- Not adversely impacting on aquifers and groundwater protection zones and improving water quality where possible.

10.2.17 CSDP Policy WWE4 Water quality sets out the means by which the quantity and quality of surface and groundwater bodies and bathing water are to be protected and, where possible, enhanced in accordance with the Northumbria River Basin Management Plan. This includes the incorporation of appropriate water pollution control measures within infiltration-based SuDs.

10.2.18 CSDP Policy WWE5 relates to the disposal of foul water and identifies the hierarchy to be applied to foul drainage, as well as any disposal of trade effluent.

International Advanced Manufacturing Park Area Action Plan (IAMP AAP)

10.2.19 As stated within the IAMP ONE ES 2018, "*The IAMP AAP was developed in accordance with the requirements of the NPPF."* IAMP AAP highlights that policies within adopted and emerging development plans will continue to apply, except where IAMP AAP provides site specific policy. The IAMP AAP lists the IAMP objectives, including "*improve flood alleviation, water quality and habit connectivity along the River Don*." Specific policies with the IAMP AAP that relate to water are:

- Policy D1: Masterplan Design[3] – This policy formalises the design concept and masterplan objectives for the IAMP, to encourage a compact, permeable development, which is attractive to future occupiers and flexible enough to accommodate a range of businesses;
- Policy IN2: Flood Risk & Drainage[3] – The River Don corridor runs through the centre of the overall IAMP area and, therefore, represents a key constraint to development. The River Don, however, does not run through the Site, nor does any watercourse. The IAMP AAP needs to take account of flood risk and drainage issues to mitigate the risks of fluvial and surface water flooding and maintain effective operation of the Site*;* and
- Policy EN2: Ecology[3] – This policy sets out principles to protect and enhance the ecological value of the IAMP and to encourage development based on sound sustainability principles.

10.2.20 Further information relating to the IAMP AAP is provided within Chapter I: Water Resources & Flood Risk of the 2018 IAMP ONE ES.

[3] IAMP (2017). Area Action Plan 2017 -2032. Last Accessed: 21/04/2021. Available at: https://www.sunderland.gov.uk/media/19834/International-Advanced-Manufacturing-Park-Area-Action-Plan-2017-2032-Adopted-Nov-2017/pdf/International_Advanced_Manufacturing_Park_(IAMP)_Area_Action_Plan_2017-2032_-_Nov_2017.pdf?m=636477263205830000

10.3 Consultation & Scope of Assessment

10.3.1 The informal consultation undertaken with Sunderland City Council (SCC) between June and November 2019 for the Site concluded that, given the extensive work completed to date in relation to the wider development area (IAMP ONE), which has been designed to take account of the potential drainage requirements of the Site, an assessment of effects on water resources (including flood risk) would be undertaken. An assessment under the WFD is not proposed as this has been completed separately as part of IAMP TWO and covers the whole IAMP area. As shown on Figure 10.1 the site is located on the watershed of two surface water catchments. To the north of the watershed, water drains to the River Don, to the south of the watershed, water drains to watercourses/drains that are not located within a WFD surface water catchment. The IAMP TWO WFD assessment covers the same catchments and same activities as the site and the assessment of the site does not change the finding of the IAMP TWO WFD assessment.

10.3.2 Two indicative masterplans were prepared for the 2020 outline planning application; the water resources assessment that accompanied the outline planning application considered the layout included for the multiple unit development as the worst-case option. A series of detailed drawings have been prepared for the detailed planning application which provide details of the design proposals; the building envelope and design parameters do not exceed the previously assessed worst case scenario. See Chapter 3 Site & Scheme Description for further details pertaining to the design proposals.

10.3.3 Recent consultations with SCC were undertaken in March and April 2021 with regards to private water supplies, as well as with the EA with regards to local water resources information (including groundwater and surface water quality). WA made the data request to the EA on 31/03/2021 and to SCC on 21/04/2021. A response from the EA was received 29/04/2021. A response from SCC was received on 11/05/2021.

10.3.4 A desk-based study of the Site and its surroundings (including for the presence of water-related infrastructure, water management and WFD status) has made use of the following sources of information:

- Meteorological Office UK Climate Averages – Tynemouth Long-Term Annual Average Rainfall data between 1981 to 2010.
- Meteorological Office – Land Projection Maps: Probabilistic Projections.

- British Geological Survey (BGS) geology maps.
- BGS Onshore GeoIndex interactive viewer.
- Historic borehole logs and records of groundwater strikes from borehole investigations undertaken in 2017 by Dunelm Drilling and Aecom within the Site and in the wider IAMP area.
- EA Flood map for planning interactive viewer.
- EA groundwater and surface water monitoring data including information on abstractions and discharges.
- Information requested from SCC.
- MAGIC website.
- EA Northumbria River Basin Management Plans (RBMP).

Extent of Study Area

10.3.5 A desk study has been undertaken to establish the baseline water environment and other relevant features located within a 2 km radius of the boundary of the Site. The 2 km study area was chosen following an initial review of potentially sensitive water environment receptors.

10.4 Assessment Methodology and Significance Criteria

General Approach

10.4.1 The aims of the assessment are to:

- Establish the water environment baseline conditions.
- Identify water environment sensitive receptors.
- Identify potential likely impacts as a result of the proposed development at the Site and arrive at a conclusion about the likely effects of this.
- Discuss embedded design mitigation and good industry practice that would be implemented during the site development.
- Determine the scale of any potential effects by assessing the sensitivity of the hydrological and hydrogeological receptors and, assuming design mitigation and good industry practice, the potential magnitude of change from the baseline conditions.
- Establish if the scale of the effect is considered to be Significant (in EIA terms).

- Provide mitigation measures (if required).
- Identify any cumulative and residual effects.

Assessment Methodology

10.4.2 The sensitivity of receptors to hydrological and hydrogeological impacts has been determined using Table 10.1, which details a hierarchy of factors relating to the water environment criteria. Examples of the criteria within Table 10.1 include international and national designations, and work undertaken by the EA together with the professional judgement of the assessment team. When a receptor meets multiple criteria or there is an absence of verified published data, the highest applicable sensitivity category is assigned to allow an assessment of the worst-case scenario.

Table 10.1 Criteria for Determining Receptor Sensitivity					
Sensitivity	**Criteria**	**Typical Examples**			
		Groundwater	**Surface Water**	**Abstractions**	**Hydro-ecological receptors**
Very High	Receptor has a high quality and rarity on a national or regional scale and limited potential for substitution. Receptor is highly vulnerable to impacts that may arise from the project and recoverability is long-term or not possible.	• Source Protection Zone (SPZ) 1.		• Abstractions for public or private drinking water supply.	
High	Receptor has a high quality and rarity on a local scale and limited potential for substitution. Receptor is generally vulnerable to impacts that may arise from the project and recoverability is slow and/or costly.	• Principal Aquifer providing a regionally important resource or supporting a site protected under EU and UK habitat legislation (i.e., Groundwater Dependent terrestrial ecosystems GWDTEs). • SPZ 2 or 3.	• Protected under EU or UK habitat legislation (e.g., SSSI, SAC, Ramsar Site). • Designated Salmonid / Cyprinid Waters and/or fishery present. • Surface water providing a regionally important resource or supporting a site protected under EU and UK habitat legislation (i.e., water dependent ecological receptors).	• Abstractions for non-potable use >20m^3/d (e.g., industry / process water, spray irrigation, river augmentation).	• Nationally and internationally designated sites where hydrology/ hydrogeology is a key factor in designation (e.g., Ramsar / Sites of Special Scientific Interest / Special Areas of Concern / Special Protection Areas sites).
Medium	Receptor has a medium quality and rarity, local scale, and limited potential for substitution / replacement. Receptor is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high recoverability.	• Secondary A Aquifer. • Secondary B Aquifer providing water supply to private abstractions. • Principal Aquifer providing a locally important resource or supporting river ecosystem. • Groundwater in peat deposits.	• Classified as a main river with no further designations Large lakes and non-potable reservoirs.	• Abstractions for non-potable use <20m^3/d (e.g., industry / process water, spray irrigation, river augmentation).	• Statutory designated sites where hydrology / hydrogeology is a key factor in designation. (National Nature Reserves, Local Nature Reserves).

Table 10.1 Criteria for Determining Receptor Sensitivity					
Sensitivity	**Criteria**	**Typical Examples**			
		Groundwater	**Surface Water**	**Abstractions**	**Hydro-ecological receptors**
Low	Receptor with a low quality and rarity, local scale, and limited potential for substitution. Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.	• Secondary B Aquifer. • Secondary Undifferentiated Aquifer. • Aquifers supporting potentially water dependent ecosystems i.e., Local Wildlife Sites LWS wetland.	• Ordinary watercourse and no designated features. • Non-sensitive water resources (non-EA/WFD classified i.e., small lakes, ponds). • Man-made feature not in hydraulic continuity (i.e., canal).	• Abstractions for industrial use (e.g., dust suppression/ washing machinery).	• Non-statutory designated sites where hydrology / hydrogeology is a key factor in designation. (Sites of Importance for Nature Conservation, Local Wildlife Sites).
Very Low	Attribute has a very low environmental importance and/or rarity on local scale. Receptor is of negligible value, not vulnerable to impacts that may arise from the project and/or has high recoverability.		• Man-made feature with no ecological importance (i.e., land drains).		
Note - Professional judgement based on the baseline condition of the receptor should be used to determine a receptor's sensitivity.					

10.4.3 Table 10.2 describes the guideline criteria used to assess the magnitude of change (i.e., impact) from the baseline condition that may result from the Site.

Table 10.2 Criteria for Determining the Magnitude of Change

Magnitude of Change	Typical Example
High	Total loss of or alteration to the baseline resource such that post- development characteristics or quality would be fundamentally and irreversibly changed.
Medium	Loss of or alteration to the baseline resource such that post-development characteristics or quality would be partially changed.
Low	Small changes to the baseline resource, which are detectable, but the underlying characteristics or quality of the baseline situation would be similar to pre-development conditions.
Negligible	A very slight change to the baseline conditions, which is barely distinguishable, and approximates to the 'no change' situation.

10.4.4 The scale of effects is determined in relation to the sensitivity of the receptor and the potential magnitude of change from baseline conditions, using the matrix shown in Table 10.3. Effects can be either beneficial or adverse; within a scale of negligible, minor, moderate, or major.

Table 10.3 Matrix for Determining Scale of Potential Effects

		Receptor Sensitivity				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Magnitude of Change from Baseline Condition	**High**	Major	Major	Moderate	Moderate	Minor
	Medium	Major	Moderate	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Significance Criteria

10.4.5 Guideline criteria for categories of effect are included in Table 10.4. Effects that have been determined to be Major or Moderate are considered to be 'Significant' (in EIA terms) and require mitigation measures to avoid, reduce or remedy them. Effects that are identified as Minor or Negligible are considered to be 'Not Significant' and mitigation measures are not required.

Table 10.4 Guideline Criteria for Categories of Effect			
Level of Effect	**Significant?**	**Definition**	**Guideline Criteria**
Major	Yes	A fundamental change to the environment.	Changes in water quality or quantity affecting widespread catchment or groundwater resources of strategic significance or changes resulting in substantial loss of conservation value to aquatic habitats and designations.
Moderate	Yes	A large, but non-fundamental change to the environment.	Changes in water quality or quantity affecting part of a catchment or groundwaters of moderate vulnerability, or changes resulting in loss of conservation value to aquatic habitats or designated areas.
Minor	No	A small but detectable change to the environment.	Localised changes in drainage patterns or groundwater flow, or changes resulting in minor and reversible impacts on surface and groundwater quality or aquatic habitats.
Negligible	No	No detectable change to the environment.	No impact on drainage patterns, surface and groundwater quality or aquatic habitat.

10.5 Baseline Conditions

Rainfall

10.5.1 Long-term average (LTA) monthly rainfall data has been obtained from Met Office freely available data[4]. Averages have been calculated over a 30-year period between 1981 to 2010 at the Tynemouth weather station, located at approximate national grid reference (NGR) NZ 37504 69429, c.12 km north-east of the Site. These data have been used to estimate monthly rainfall for the Site, as shown in Table 10.5. The UK Climate Projection (UKCP18)[5] are available on the Met Office website for the Northumbria River Basin District. Table 10.5 presents the percentage change in precipitation for the 90th percentiles for the four emission scenarios for winter and summer periods for the available time slices, referred to in the Table 10.5 note as Representative Concentration Pathways. The UKCP18 for the 2020-2039, 2040-2059, 2060-2079 and 2080-2099 time slices predicates a change in winter periods between +20 to 50% (i.e., wetter) and for the summer periods a change between -10% (i.e., reduced rainfall) and +20% (i.e., wetter).

[4] The Met Office (2020). Tynemouth Climate [online]. Last Accessed: 15/04/2021. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcybzz9xh.
[5] The Met Office (2018). Land Projection Maps: Probabilistic Projections. Last Accessed: 15/04/2021. Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/land-projection-maps.

Table 10.5 Average Rainfall and Climate Change Projections

Month	Average Rainfall (mm)	Projective Change in Precipitation (%) for the Northumbria River Basin for the Winter and Summer Periods			
		Time Slice: 2020 - 2039	Time Slice: 2040 - 2059	Time Slice: 2060 - 2079	Time Slice: 2080 - 2099
		RCP2.6*	RCP2.6*	RCP2.6*	RCP2.6*
		RCP4.5*	RCP4.5*	RCP4.5*	RCP4.5*
		RCP6.0*	RCP6.0*	RCP6.0*	RCP6.0*
		RCP8.5*	RCP8.5*	RCP8.5*	RCP8.5*
		Winter			
		20 - 30%	20 - 40%	20 - 40%	40 - 50%
		Summer			
		10 - 20%	0 - +10%	0 - +10%	(-10) - 0%

Month	Average Rainfall (mm)	Average Rainfall (mm) With Projective Change in Precipitation						
		-10%	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**
January	45.5	41.0	45.5	50.0	54.6	59.2	63.7	68.3
February	37.8	34.0	37.8	41.6	45.4	49.1	52.9	56.7
March	43.9	39.5	43.9	48.3	52.7	57.1	61.5	65.9
April	45.4	40.9	45.4	49.9	54.5	59.0	63.6	68.1
May	43.2	38.9	43.2	47.5	51.8	56.2	60.5	64.8
June	51.9	46.7	51.9	57.1	62.3	67.5	72.7	77.9
July	47.6	42.8	47.6	52.4	57.1	61.9	66.6	71.4
August	59.6	53.6	59.6	65.6	71.5	77.5	83.4	89.4
September	53.0	47.7	53.0	58.3	63.6	68.9	74.2	79.5
October	53.6	48.2	53.6	58.9	64.3	69.7	75.0	80.4
November	62.8	56.5	62.8	69.1	75.4	81.6	87.9	94.2
December	52.9	47.6	52.9	58.2	63.5	68.8	74.1	79.35
Annual Total	597.2	537.5	597.2	656.9	716.6	776.4	836.1	895.8

Notes

Average rainfall does not include provision for evaporation and evapotranspiration.

Emission Scenarios:

RCPs (Representative Concentration Pathways) are scenarios of future concentrations of greenhouse gases and other forces

RCP2.6 = 1.6°C (0.9-2.3°C) change in global temperature by 2081-2100

RCP4.5 = 2.4°C (1.7-3.2°C) change in global temperature by 2081-2100

RCP6.0 = 2.8°C (2.0-3.7°C) change in global temperature by 2081-2100

RCP8.5 = 4.3°C (3.2-5.4°C) change in global temperature by 2081-2100

* 90th Percentile selected - the three percentiles (10th, 50th and 90th) reflect the likelihood of those temperatures occurring under that emissions scenario.

Topography

10.5.2 The elevation of the Site varies between 34 m and 38 m Above Ordnance Datum (AOD). The Site is relatively flat with higher elevation within the central and western regions of the Site, and lower elevations towards the north-east.

Surface Water Features

10.5.3 There are no mapped surface watercourses onsite. The closest watercourse to the Site is the Usworth Burn (a tributary of the River Don) located approximately 195 m north of the Site. The River Don is located approximately 280 m north of the Site.

10.5.4 Both the River Don and its tributary are classified by the EA as 'Main Rivers' and both watercourses flow in a north-easterly direction parallel to the Site's northern boundary. The confluence of the two rivers is approximately 280 m north-north-east of the Site at NGR NZ 33216 59420. The River Don is a tributary of the River Tyne. The River Wear is located approximately 2 km south of the Site and flows in an easterly direction before discharging into the North Sea.

10.5.5 According to the IAMP ONE 2018 ES, a series of drainage channels and ditches are located along the road to the south of the Site and along field boundaries. These are not mapped on MAGIC[17] and rely on field-based data collected for the IAMP ONE 2018 ES. The majority of these discharge to the south-east via culverts beneath the A1290 (road). Two ponds are located approximately 850 m and 1,250 m to the south-west of the Site (near Barmston). There are two ponds located approximately 700 m and 1,100 m to the south of Site, just north of the Vantec Turbine Business Park. There is also a pond located 1,200m north-west of the Site, near the Washington Riding Centre. There are no other surface water features within 2 km of the Site. The surface water features present are illustrated by Figure 10.1.

10.5.6 The Site is located within the Northumbria River Basin District[6]. A watershed runs through the middle of the Site. The south-west and north areas of the Site lie within the Tyne Management Catchment, the Tyne and Lower Estuary Operational Catchment and the Don from Source to Tidal Limit Surface Water Catchment (ID: GB103023075690) (see Figure 10.1). The south-eastern and central areas of the Site are located within the Wear Management Catchment and the Wear Lower and Estuary Operational Catchment[6]. This area of the Site, however, is not located within an assigned surface water catchment (see Figure 10.1).

Surface Water Quality

10.5.7 The EA holds a list of the reasons why waterbodies in the Northumbria River Basin District are not achieving Good WFD status. The River Don, from source to tidal limit

[6] Environment Agency (2021). Data Catchment Explorer: Don from Source to Tidal Limit [online]. Last Accessed: 22/04/2021. Available at: https://environment.data.gov.uk/catchment-planning/WaterBody/GB103023075690.

surface water catchment, has an overall water catchment classification of Moderate, a chemical classification of Good and an ecological classification of Moderate. The ecological classification is a result of ecological supporting elements (mitigation measures assessment).[6] Reasons for not achieving Good status are attributed to urbanisation, agricultural and rural land management, sewage, water treatment and industry.[3]

10.5.8 The EA has one surface water monitoring station located within 2 km of the Site. The 'Don just downstream confluence of tributary at Wardley' sampling point is located at NGR NZ 31919 59686 c.1,200 m north-west of the Site and is shown on Figure 10.1. Results were available between April and December 2019. No measurements exceeded Environmental Quality Standards (EQS)[7]. Information from this monitoring point is limited and a small number of parameters were tested (see Appendix 10.2).

10.5.9 The Site is not located within a Surface Water Safeguard Zone[8] or within an existing or proposed surface water or eutrophic Nitrate Vulnerable Zone (NVZ).[9]

Flood Risk

10.5.10 A Flood Risk Assessment (FRA) has been undertaken by SYSTRA Ltd and is provided within Appendix 10.1. A summary of the results from the FRA are presented below:

- Fluvial Flood Risk – The majority of the Site is situated within Flood Zone 1 (i.e., less than 0.1% chance of flooding in any year). Medium to high flood risks are identified in the northern margins of the Site, with increasing climate change impact. Following mitigation, the risk to the Site is very low.
- Surface Water Flood Risk – The majority of the Site is at low risk from surface flooding. Small, isolated areas with medium to high risk of flooding are present within the Site boundary. Following mitigation, the risk to the Site is low.
- Groundwater – No groundwater risk identified within the Site boundary. Small, isolated areas to the north-west of the Site have identified shallow groundwater. Following mitigation, the risk to the Site is very low.
- Artificial Resources – No risk of flooding associated with artificial resources.

[7] Water Framework Directive (2015). Standards and Classification Directions (England and Wales). Last Accessed: 21/04/2021. Available at: http://www.legislation.gov.uk/uksi/2015/1623/pdfs/uksiod_20151623_en_auto.pdf.
[8] Environment Agency (2017) Drinking Water Safeguard Zones [online]. Accessed 09/01/2020. Available at: https://environment-agency.cloud.esriuk.com/farmers/.
[9] Environment Agency (2017) Nitrate Vulnerable Zones [online]. Accessed 09/01/2020. Available at: https://environment-agency.cloud.esriuk.com/farmers/.

- Sewer – No material risk of sewers flooding onsite. Following mitigation, the risk to the Site is very low.

Geology

Soils & Made Ground

10.5.11 According to Cranfield University 1:250,000 scale soil mapping (Soilscapes)[10], the soils onsite and within the surrounding area consist of slowly permeable, seasonably wet, slightly acid but base-rich loamy and clayey soil. Soils were experienced onsite between 0.1 – 0.6 m thick.

10.5.12 No made ground is recorded to be present on the BGS 1:50,000 scale published artificial land mapping.[11]

Superficial Geology

10.5.13 According to BGS 1:50,000 scale mapping, the Site is entirely underlain by the Pelaw Clay Member.[12] Seven boreholes and four trial pits were drilled onsite in August 2017 by Dunelm Drilling, supervised by Aecom (see Chapter I, Appendix 5 of the IAMP ONE 2018 ES for a figure indicating borehole and trial pit locations). Each borehole and trial pit excavated onsite encountered the Pelaw Clay Member.

10.5.14 The Pelaw Clay member was reported to comprise soft – stiff, dark brown – grey clay with varied amounts of sand and gravel (slightly sandy/gravelly to sandy/gravelly). The thickness of the clay deposits varied between 14.7 m (encountered between 0.6 m below ground level (m BGL) and 15.3 m BGL), recorded within the north-eastern areas of the Site in BH47, to 1.7 m (encountered between 0.4 m BGL and 2.1 m BGL) recorded in TP37 located in the south-western corner of the Site, indicating a potential shallowing of clay deposits from north-east to south-west. TP38, BH51 and BH52, also located within the south-western margins of the Site (see Chapter I, Appendix 5 within the IAMP ONE 2018 ES), also indicate a shallowing of clay deposits. The thickness of clay within these boreholes/trial pits varied between 1.7 m - 3.7 m. Weathered bedrock was encountered below the clay deposits in each of these boreholes/trial pits.

[10] Cranfield University (2021). Soilscapes. Last Accessed: 22/04/2021. Available at: http://www.landis.org.uk/soilscapes/.
[11] British Geological Survey (2021) GeoIndex Onshore [online]. Artificial Ground. Accessed 22/04/2021. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html.
[12] British Geological Survey (2021) GeoIndex Onshore [online]. Superficial Geology. Accessed 22/04/2021. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html.

Bedrock Geology

10.5.15 According to BGS 1:50,000 scale mapping, the bedrock that underlies the Site is comprised of the Pennine Middle Coal Measures Formation.[13] The Pennine Middle Coal Measures is characterised by interbedded mudstone, siltstone, sandstone and coal seams.[13] Boreholes drilled onsite recorded the upper boundary of the Pennine Middle Coal Measures between 2.1 m BGL in TP37 and 15.3 m BGL in BH47. No boreholes encountered the base of the Pennine Middle Coal Measures. Weathered bedrock was encountered within all boreholes drilled onsite at the boundary with the Pelaw Clay Member.

Hydrogeology

Groundwater Designations & Classifications

10.5.16 The Pelaw Clay Member is classified by the EA as an Unproductive Aquifer, defined as "*rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow*."[14] The Pennine Middle Coal Measures are classified by the EA as Secondary A aquifers, defined as "*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*."[14]

10.5.17 According to BGS Hydrogeology 1:625 000 scale mapping[15], the Pennine Middle Coal Measures comprises part of the Pennine Middle Coal Measures Formation and South Wales Middle Coal Measures Formation (Undifferentiated), a moderately productive aquifer. This group is summarised "*as a regional cyclic multi-layered aquifer with moderate yields from sandstones and many springs. Mine water quality poor, but elsewhere reasonable.*"[15]

10.5.18 The Site does not lie within a Source Protection Zone (SPZ) and there are no SPZs present within 2 km of the Site.

Groundwater Elevations and Flow

10.5.19 Groundwater strikes were recorded in the Pelaw Clay Member within one borehole drilled onsite (BH45). Information relating to groundwater strikes and rest elevation

[13] British Geological Survey (2021) GeoIndex Onshore [online]. Bedrock Geology. Accessed 22/04/2021. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html.
[14] Environment Agency (2017). Aquifers. Last Accessed 22/04/2021. Available at: http://apps.environment-agency.gov.uk/wiyby/117020.aspx.
[15] British Geological Survey (2021). Geoindex (onshore) – Hydrogeology Mapping 1:625,000 Scale (online). Last Accessed: 22/04/2021. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html.

is provided in Table 10.6. Rest elevation refers to the groundwater elevation measured 20 minutes after a water strike is encountered during drilling. Groundwater was also encountered within two other boreholes (BH32 and BH27), located within the wider IAMP area, to the east (see Chapter I, Appendix 5 of the IAMP ONE 2018 ES). Groundwater information is included in Table 10.6, below. In each of these boreholes superficial deposits exceeded 10 m in thickness. Each water strike was recorded toward the base of the Pelaw Clay Member.

Table 10.6 Occurrences of groundwater within the Pelaw Clay Member

Borehole ID	Groundwater Strike (mBGL / mAOD)	Groundwater Level (rest) (mBGL / mAOD)	Lithology where Groundwater was encountered
BH45	13.2 / 21.8	3.4 / 31.6	Sandy, gravelly clay. Directly underlain by weathered bedrock.
BH32	13.8 / 18.2	13.5 / 18.5	Gravelly sand lens, between thick clay horizons.
BH27	17.2 / 16.8	6.1 / 27.9	Gravelly sand at the base of the superficial deposits. Directly underlain by weathered bedrock.
mBGL = Meters Below Ground Level / mAOD = Meters Above Ordnance Datum			

10.5.20 Groundwater encountered within BH32 was recorded within a thin sand lens located between thick clay deposits. This is likely to be an isolated pocket of perched groundwater with minimal hydraulic connection to the rest of the formation. This is indicated by the small rise in groundwater elevations recorded following water strike.

10.5.21 Groundwaters rose considerably in BH45 and BH27 following water strike. Each of these strikes were recorded directly above the weathered bedrock. It is likely that the more permeable base of the superficial deposits within these areas are in continuity with the underlying Pennine Middle Coal Measures. The Pennine Middle Coal Measures are confined by the overlying clay, giving rise to an upward pressure head gradient. This would explain the pressurised nature of the water and rise in groundwater levels. The strikes may also represent errors in logging where the water strikes were actually within the upper weathered bedrock horizons.

10.5.22 The Middle Pennine Coal Measures form a multi-layered aquifer dominated by sedimentary strata including sandstones, siltstones, mudstones, shales, and coal. Low permeability strata act as aquitards and aquicludes, isolating thicker sandstone horizons, which act as individual aquifers. Sandstones within the Middle Pennine Coal Measures are very well cemented, dense, and hard, resulting in very limited primary

porosity (intergranular porosity). Groundwater flow and storage, therefore, predominantly occur within fractures and fissures within sandstone horizons.

10.5.23 BH47 and BH48 located onsite, recorded groundwater strikes at the top of the Pennine Middle Coal Measures within the weathered sandstone bedrock zone. Water was recorded to rise by 3.5 m and 12.7 m respectively, indicating that the bedrock aquifer is confined by the overlying clay and, therefore, possesses an upward pressure head gradient.

10.5.24 No other groundwater elevations and strikes within the bedrock were recorded onsite or within the wider IAMP area (it is unclear whether they were not recorded, or if water strikes were not encountered).

10.5.25 Groundwater elevations provided in Table 10.6 indicate that there is unlikely to be a laterally continuous water table within the superficial deposits. This is indicated by the absence and varying depths of water strikes associated with the presence of sand horizons and the strikes directly overlying weathered bedrock.

10.5.26 There are no BGS borehole logs within the surrounding area that indicate a potential groundwater flow direction within the Coal Measures. Owing to thick superficial deposits and the presence of various aquitard/aquiclude units within the formation, however, it is likely groundwater within the Middle Pennine Coal Measures is confined.

Groundwater Quality

10.5.27 The Site is located entirely within the Northumbria River Basin District, the Northumbria Groundwater Management Catchment, the Tyne Carboniferous Limestone and Coal Measures Operational Catchment and the Tyne Carboniferous Limestone and Coal Measures groundwater catchment (ID: GB40302G701500).[16] The Tyne Carboniferous Limestone and Coal Measures groundwater catchment was classified by the EA as having a quantitative status of Good and a chemical status of Poor.[16] The reasons relating to Poor chemical status are related to Chemical Dependant Surface Water Body Status and General Chemical Test classifications[16] as a result of point and diffuse pollution from abandoned mines.

[16] Environment Agency (2021). Catchment Data Explorer – Tyne Carboniferous Limestone and Coal Measures. Last Accessed: 22/04/2021. Available at: https://environment.data.gov.uk/catchment-planning/WaterBody/GB40302G701500.

10.5.28 The EA does not hold any groundwater quality information within 2 km of the Site.

Private Water Supplies, Abstractions and Discharges

10.5.29 A data request regarding Private Water Supplies (PrWS) was made to SCC on 21/04/2021. A response from SCC was received on 11/05/2021. SCC confirmed that they do not hold any information regarding PrWS within a 5km radius of the Site.

10.5.30 A data request regarding licenced Abstractions and Discharges was made to the EA on 31/03/2021. A response was received on 29/04/2021. One licensed abstraction is present within 2 km of the centre of the Site (NGR: NZ 33170 58798), see Table 10.7.

Table 10.7 Licensed abstractions within a 2km radius of the Site

Licence Number	Licence Holder Name	Abstraction Purpose	Source	Max Annual Quantity (m^3)	Abstraction NGR	Distance from the Site
1/23/05/028	North East Property Partnership	Industrial, Commercial and Public Services	Groundwater	79716	NZ 3392 6111	1.99 km north east

10.5.31 The EA have also provided data on discharges within 2 km of the centre of the Site (NGR: NZ 33170 58798), see Table 10.8. There is a total of 16 discharges within a 2 km radius from the Site.

Table 10.8 Discharges within 2 km of the Site

Licence Number	Holder Name	Site Name	Discharge Type	Receiving Water Body	Maximum Daily Quantity (m^3/d)	NGR	Distance from the centre of the Site
NE/245/1221/001	Unipress (UK) Limited	Unipress (UK) Limited	Trade	Wear estuary	2.4	NZ 33910 58370	0.759km east
NE/235/1676/001	J G Taylor and Sons	Hylton Grove Farm	Sewage - not water company	River Don	3.0	NZ 33410 59700	1.21km north
NE/235/C/0098/001	Unknown	Hylton Grove Farm	Agriculture	Tributary of the River Don	0.25	NZ 33400 59800	1.31km north
NE/245/1137/001	Tyne & Wear Fire & Rescue Service	Fire Brigade HQ Training Centre	Trade	Wear estuary	Unknown	NZ 32900 57200	1.34km south
NE/235/C/0097/001	J G Taylor and Sons	Hylton Grove Farm	Sewage - not water company	River Don	1.0	NZ 33300 59900	1.40km north
NE/245/1222/002	Nissan Motor Manufacturing (UK) Limited	Test Track, Nissan Motor Manufacture	Sewage - not water company	Land	4.5	NZ 34320 57550	1.50km south east
NE/245/1222/001	Nissan Motor Manufacturing (UK) Limited	Test Track, Nissan Motor Manufacture	Sewage - not water company	Land	4.5	NZ 34320 57550	1.50km south east
NE/235/1826/001	Nelson Petcare Limited	Triple A Animal Hotel & Care Centre	Sewage and Trade combined	Tributary of the River Don	10	NZ 32460 59950	1.60km north west
NE/235/1616/001	Mr W Wilson, Mr S Williams, Mr T Robson, Mr K Brown	East House Farm & Cottages	Sewage - not water company	River Don	0.5	NZ 31820 59470	1.65km north west
NE/235/C/0191/001	Unknown	East House Farm	Sewage - not water company	River Don	0.5	NZ 31800 59500	1.68km north west
NE/235/0752/001	RJB Mining (UK) LTD	Wardley Disposal Point	Sewage - not water company	Tributary of the River Don	Unknown	NZ 31940 59690	1.70km north west

Table 10.8 Discharges within 2 km of the Site							
Licence Number	**Holder Name**	**Site Name**	**Discharge Type**	**Receiving Water Body**	**Maximum Daily Quantity (m^3/d)**	**NGR**	**Distance from the centre of the Site**
NE/235/0642/001	RJB Mining (UK) LTD	Wardley Disposal Point	Trade	Tributary of the River Don	7.0	NZ 31940 59690	1.70km north west
NE/245/1062/001	ASDA Stores LTD	ASDA Distribution Depot Barmston LA	Trade	Spring Gill	Unknown	NZ 32950 56800	1.72km south
NE/245/1239/001	Mr M Boland	The Forge Septic Tank	Sewage - not water company	Wear Estuary	1.0	NZ 33740 56670	1.93km south
NE/245/1240/001	MR & MRS MAUDE PRITILLA	Stable Cottage Septic Tank	Sewage - not water company	Wear Estuary	1.0	NZ3376056 680	1.95km south
NE/245/1238/001	MR D WARDEN	Low Barmston Riding School Septic Tank	Sewage - not water company	Wear Estuary	1.0	NZ3373056 650	1.95km south

Hydro-Ecology and Designated Sites

10.5.32 According to the MAGIC website[17], there are no hydro-ecological or designated sites (e.g., Ramsar, Sites of Special Scientific Interest or Special Area of Conservation, *etcetera*) relating to water resources present within 2 km of the Site.

Modifying Influences

10.5.33 The UKPC18[5] have predicted an increase of up to 50% change in rainfall values by 2099. An increase in rainfall could affect runoff across the Site and may alter river processes (e.g., erosion, deposition and the frequency and intensity of river and groundwater flooding and ponding in depressions). A decrease in rainfall could lead to seasonal and prolonged drying out of watercourses and drains, which may affect aquatic ecology. In addition, a reduction in rainfall may also affect groundwater recharge time and decrease groundwater elevations.

10.5.34 If the proposed development did not occur, the sections of the Site within IAMP ONE would be constructed and operated as identified in the 2018 ES, with the remaining areas of the Site remaining as agricultural land. In this instance water would move through the Site much as it does at present; however, over time, changes in rainfall may affect water flow pathways as described above.

10.6 Conceptual Site Model

10.6.1 The Conceptual Site Model (CSM) illustrates the water movement pathways from the ground surface onsite to surface water features and bedrock. There are three main pathways, comprising of: surface runoff; soil water movement (i.e., infiltration, throughflow, percolation); and groundwater flow.

10.6.2 The key features affecting water movement through the Site include:

- The Site is located on the watershed of two surface water catchments (see Figure 10.1). Areas to the north of the watershed (south-western and northern areas of the Site) are located within the Don from Source to Tidal Limit Surface Water Catchment, within the Tyne and Lower Estuary Operational Catchment. Water in this area of the Site drains to the north/north-east towards the Usworth Burn and the River Don. Areas to the south of the watershed (south-eastern and central areas of the Site) are located within an area not designated in a surface water

[17] DEFRA, Magic Map (2021). Land-Based Designations. Last Accessed 22/04/2021. Available at: https://magic.defra.gov.uk/MagicMap.aspx.

catchment. Water in this area of the Site is collected within drains that flow in an easterly to south-easterly direction, discharging through culverts beneath the A1290. The Site is not located within the River Wear catchment.

- The Don from Source to Tidal Limit Surface Water Catchment has an overall WFD status of Moderate, which the EA has identified as being down to urbanisation, agricultural and rural land management, sewage, water treatment and industry, and has a target of achieving WFD status of Good by 2027;
- The amount of rainfall onsite will affect water levels and flow rates in the watercourses (Usworth Burn and the River Don), as well as onsite infiltration to the soil zone and surface water run-off volumes. Elevated levels of and/or prolonged rainfall can lead to flooding as watercourses overtop. Conversely, periods of prolonged absence of rainfall can lead to drought conditions onsite, leading to ephemeral watercourses drying up, reduction in groundwater recharge and reduction in vegetation cover.
- A number of ponds are located within 2 km of the Site (see Figure 10.1). It is unlikely that water within these ponds will come into contact with water onsite. The ponds are likely to be isolated, water filled depressions located on low permeability clays.
- The Site is entirely underlain by the Pelaw Clay Member, reported to comprise soft-stiff, dark brown-grey clay with varied amounts of sand and gravel, up to 14.7 m thick. The Pelaw Clay Member is classified by the EA as an Unproductive Aquifer.
- Superficial deposits with high clay content tend to have low vertical and lateral hydraulic conductivity, therefore reducing the rate of infiltration and percolation of rainwater. The superficial deposits are therefore likely to inhibit recharge to the underlying bedrock aquifer. Rainwater is, therefore, likely to move within the soil horizons, or as surface runoff when the soils are saturated.
- Perched groundwater was recorded within isolated sandy/gravelly lenses of the Pelaw Clay Member; however, these are limited. Groundwater strikes were also recorded at 13.2 m BGL and 17.2 m BGL. These strikes led to significant rises in groundwater elevations, suggesting that the Pelaw Clay Member is more permeable at depth, and the underlying bedrock groundwater may be in limited continuity with the superficial deposits. The bedrock is confined by the overlying clay deposits, giving rise to upward head gradients and confining pressures.

- The observed upward head gradient within the bedrock aquifer and the overlying low permeability clay deposits of the Pelaw Clay Member, indicate that there is unlikely to be a significant pathway for rainwater to naturally infiltrate and recharge the underlying bedrock aquifer.
- The bedrock underlying the Site belongs to the Pennine Middle Coal Measures Formation, which is formed of sequences of sandstones, siltstones, mudstones, and associated coal seams. The Pennine Middle Coal Measures Formation is classed by the EA as being a Secondary A Aquifer and by the BGS as being a moderately productive aquifer. Groundwater is largely confined to secondary permeability within sandstone bands. As demonstrated within BH47 and BH48 (IAMP ONE 2018 ES) groundwater within the bedrock is confined. Thick clay superficial deposits confine groundwater within the Pennine Middle Coal Measures, giving rise to an upward head gradient. Upward head gradients limit downward migration, affording the aquifer protection from the Site.
- Water quality within these sandstones has been affected by mining.
- There are no hydro-ecological or designated sites relating to water resources present within 2 km of the Site.

10.6.3 The following Source-Pathway-Receptor relationships have been identified for the Site in relation to the water environment.

Potential Contamination Sources:

Construction Sources

- Release or mobilisation of sediment through earthworks, laying of foundations, soil stripping, compaction of soils during the construction phase may increase the sediment contents of the watercourses within close proximity to the Site.
- Use of concrete, cement, and asphalt - risk of mobilisation through surface water run-off.
- Use of machinery and storage onsite - accidental spills or leakage of fuel and oil from machinery and storage onsite.

Operational Sources

- Contaminants associated to light industry, including (but not limited to) diesels, oils, solvents, paints, degreasers, and heavy metals.

- Contaminants associated with the production of Lithium-Ion Battery pouch cells including: Nickel Oxide, Lithium Hexafluorophosphate and N-Methyl-2-pyrrolidone (NMP).
- Use of de-icing salts - leading to mobilisation in surface run-off.
- Car Parking - Storage and use of motorised vehicles onsite may lead to the release of hydrocarbons onsite.

Potential Pathways

Construction Pathways

- Drainage ditches located onsite, along the road and along field boundaries.
- Surface water runoff.

Operation Pathways

- Remaining drainage ditches.
- Drainage infrastructure including networks of underground storage tanks, and filter drains.
- Surface water run-off.

Potential Receptors:

- Surface watercourses to the north-west of the Site: Usworth Burn and the River Don.
- Attenuation ponds.
- Existing onsite ditches receiving site discharge.
- Perched groundwater in the Pelaw Clay Member.
- Ponds located within 2 km of the Site.

10.7 Identification of Potential Effects

Sensitive Receptors

10.7.1 Table 10.9 summarises the potential sensitive receptors and the reasons for inclusion or exclusion from the assessment.

Table 10.9 Summary of Receptors and Sensitivity				
Receptor	**Distance from Site (m)**	**Summary of Receptor Characteristics**	**Receptor Sensitivity**	**Receptor at Risk from proposed development?**
Usworth Burn (tributary of the River Don)	195	EA Main River	Medium	**Yes** – the Site is located within the surface water catchment.
River Don	280	EA Main River	Medium	**Yes** – the Site is located within the surface water catchment.
Existing drainage ditches receiving site discharge	Onsite and along southern site margin	Field Drains located onsite and along southern boundary	Very Low	**Yes** – located onsite, potential influence from surface water run-off.
Groundwater in Pelaw Clay Member	Underlying Site	Pockets of groundwater within sandy/gravelly horizons.	Very Low	**No** – The Pelaw Clay Member is classified as an Unproductive Aquifer. Perched groundwater is either: confined to small pockets of sand and gravel which are likely to be hydraulic isolated; or within the base of the formation in continuity with the underlying bedrock aquifer. The thickness of low permeability clay along with the Bedrock aquifer confining pressures and upward head gradient limits downward migration.
North East Property Partnership Abstraction	1995	Groundwater Abstraction for non-potable use	High	**No** – The thickness of the low permeability clay within the Pelaw Clay Member may act as a confining unit to the underlying bedrock aquifer and limit downward migration. Groundwater abstractions are unlikely to be influenced by site activities given the distance from the Site.

Table 10.9 Summary of Receptors and Sensitivity				
Receptor	**Distance from Site (m)**	**Summary of Receptor Characteristics**	**Receptor Sensitivity**	**Receptor at Risk from proposed development?**
Ponds within 2 km of Site	700 -1,250	Small ponds	Very Low	**No** – The ponds are unlikely to be influenced by site activities due to their locations, at a higher elevation than the site. It is likely these are water filled depressions located on low permeability clay deposits.
Attenuation ponds	Onsite	Attenuation ponds associated with drainage	Very Low	**Yes** – Located onsite potential influence from surface water run-off.

10.7.2 Water resources receptors identified within Table 10.9 that are at very low risk from the Site have been scoped out of the assessment and are not considered further.

During Construction

10.7.3 Construction effects can be categorised into two types: i) those that relate to the act of carrying out construction (e.g. earthworks causing sedimentation of watercourses); and ii) those that relate to the construction of the development itself (e.g. the creation of impermeable surfaces, such as roads and buildings, within the catchment). Table 10.10 details potential effects that may arise from the activities of the development during construction.

Table 10.10 Potential Construction Phase effects	
Activity	**Potential effects**
Earthworks including excavation	Excavation and removal of the topsoil and superficial deposits has the potential to reduce the pathway to the underlying bedrock aquifers and therefore may increase the vulnerability of the aquifer to potential contamination/oil spills during construction. Mobilisation of sediment, which could enter watercourses and waterbodies causing increased erosion altering deposition. This may also result in harm to aquatic flora and fauna.
Soil stripping and vegetation removal	Soil stripping reduces soil moisture storage capacity and may increase runoff and lead to flooding. Removal of vegetation reduces interception and evapotranspiration rates, increases runoff, and may lead to flooding and increased suspended solids entrained in runoff.
Use of machinery and storage onsite	Accidental spills or leakage of fuel and oil from machinery and storage onsite during the construction phase could affect the underlying groundwater and enter surface water watercourses and waterbodies and lead to a degradation of water quality.
Soil compaction	Compaction due to use of heavy machinery reduces infiltration, increases runoff, and shortens the rainfall–runoff response time and may lead to flooding.

Table 10.10 Potential Construction Phase effects	
Activity	**Potential effects**
Construction of impermeable surfaces such as roads/pavements	Reduction in recharge to the underlying soils; thereby potentially reducing groundwater levels. This will also increase runoff to surface water drains/ponds and may lead to flooding.
Construction of subsurface infrastructure such as foundations	Impediment to shallow groundwater which can cause groundwater mounding on the upgradient side and reduce groundwater levels on the downgradient side. Potentially coming into contact with confined groundwater leading to dewatering requirements.
Laying foundations	Release of sediment and silt-laden water from the discharge of water removed from excavations to watercourse and/or ground, which could cause a degradation in water quality.

During Operation

10.7.4 There are two types of operational effects on the water environment: i) those which result from the creation of the Site (e.g. the creation of impermeable surfaces causing changes in the hydrologic regime); and ii) those that occur associated with the use of the Site (e.g. accidental releases of chemicals associated with, for instance, the production of batteries).

10.7.5 Table 10.11 details the potential effects that may arise from the activities of the Site during operation.

Table 10.11 Potential Operational Phase effects	
Activity	**Potential effects**
Use of Motorised Vehicles	Pollution from leaks or spills, which may cause a degradation in water quality.
Contaminants associated with Lithium-Ion Battery pouch cells	Substances including Nickel Oxide, Lithium Hexafluorophosphate and NMP are used in battery production. Other substances may include heavy metals used during welding, degreasers, oils and diesels for manufacturing, servicing, and machinery.
Impermeable surfaces such as roads/pavements	Reduction in infiltration and recharge to the underlying soils water. This would also increase runoff to surface water drains/ponds and may lead to flooding.
Subsurface infrastructure such as foundations	Impediment of shallow groundwater flow which can cause groundwater mounding on the upgradient side and reducing groundwater levels on the downgradient side.
Creation of new drainage regime in developed areas of the Site	The creation of a new drainage regime may alter the amount of runoff within the surface water catchments, thereby altering the flow rates and volumes within the watercourses in these catchments. An increase in flow rates may lead to a corresponding increase in flood risk.

Table 10.11 Potential Operational Phase effects	
Activity	**Potential effects**
De-icing of roads, walkways, and parking areas	The use of de-icing salts may cause the release of sodium chloride and anti-caking agents into the water environment may cause changes to water chemistry such as salination.

10.8 Mitigation Measures

10.8.1 Mitigation measures are required in order to avoid, reduce, remedy, or compensate for any adverse effects of the proposed development. The principle of mitigation commences with the design of the development and is an iterative process, in that measures are taken, wherever possible, to adjust the design to minimise adverse effects.

10.8.2 The development will be undertaken in-line with the current guidance and codes of best practice. Table 10.12 lists accepted, good practice industry guidance that is intended to prevent adverse environmental effects during construction. The measures detailed in the guidance documents will limit the potential for disturbance or contamination of water resources and will be adopted. This is considered to be embedded mitigation.

Table 10.12 Good Practice Guide and Guidance Documents to Protect the Water Environment
CIRIA C741: Environmental Good Practice on Site Guide (4th edition).
CIRIA C750: Groundwater control: design and practice (2nd edition).
CIRIA C753 Sustainable Urban Drainage Systems Manual.
CIRIA C768 Guidance on the Construction of SuDS.
CIRIA C532 Control of Water Pollution from Construction Sites.
CIRIA C650 Environmental Good Practice on Site (Expansion of C502).
CIRIA C689 Culvert Design & Operational Guide.
Pollution Prevention Guidelines (PPG) 1 General Guide to The Prevention of Pollution.
PPG2 Above Ground Oil Storage.
PPG4 Treatment & Disposal of Sewage Where No Foul Sewer.
PPG5 Works & Maintenance in, or near Water.
PPG6 Working at Construction and Demolition Sites.
PPG8 Safe Storage & Disposal of Used Oils.
PPG21 Polluting Incident Response Planning.
PPG22 Dealing with Spills.
UK Technical Advisory Group on the WFD, UK Environmental Standards & Conditions (Phase 2), Final, 2008.

10.8.3 Although all PPGs have been withdrawn by the EA (as the legislative requirements contained within the documents are, in many cases, no longer correct), the PPGs are still considered to be a relevant and effective source of best practice information and are widely used and accepted within the construction industry.

10.8.4 The same embedded mitigation measures stated within the IAMP ONE 2018 ES are considered for this proposed development:

- Incorporation of freeboard to design flood levels.
- Finished floor levels set 600 mm above design flood levels.
- ground raising/embankment.
- Flood storage compensation area.
- Development catchments to mimic baseline catchments.
- Attenuation of run-off to greenfield run-off rate using sustainable drainage.
- Provision of pollution hazard reduction by sustainable drainage.
- Sediment settlement prior to drainage discharge.
- Pollution incident response plans.
- Sediment run-off containment.

10.8.5 Further mitigation measures with regard to flood risk are provided with Section 6 of the FRA in Appendix 10.1.

During Construction

10.8.6 A Construction Environmental Management Plan (CEMP) (or equivalent) will be produced that will incorporate key principles of the good practice, legislation, regulations, and guidance. The CEMP will provide practical measures to avoid and minimise the effect of the proposed development on ground and surface waters, as well as providing emergency preparedness and corrective actions together with measures for monitoring, recording, and disseminating of information.

10.8.7 The key principles of the water-related components of the CEMP will include (but are not limited to) the following:

- Construction design to minimise disruption to the natural flow regime.
- Planning and preparation of works to ensure all precautions are taken to provide protection to watercourses, groundwater, and attenuation features, including the supervision of sub-contractors and liaison with SCC and the EA area staff.
- Adoption of measures to prevent and control the release of sediment, such as directing surface water across vegetated zones or through mesh fencing to capture the sediment. Sediment traps or settlement lagoons may be considered if the quantity of sediment-laden water is anticipated to be large. The CEMP will specify

the maintenance requirements to ensure that sediment control measures are put in place (e.g., sediment settlement prior to drainage discharge and sediment run-off containment).

- Drains and potholes are regularly inspected, cleared, infilled and/or repaired.
- Secure storage of all fuel, oils, and other polluting substances within suitably bunded containers and placed upon impermeable surfaces, in accordance with PPG2: Above Ground Oil Storage and PPG8: Safe Storage & Disposal of Used Oils.
- The use of integral drip trays (of 110% of the capacity of the fuel tank) for any static machinery/ plant, where practicable. All plant, vehicles and machinery will also be regularly inspected for leaks.
- Refuelling will be undertaken in a designated refuelling area and the use of biodegradable oils and lubricants will be considered where possible.
- The preparation of pollution incident response plans, identifying the type and location of onsite resources (spill kits, absorbent materials, oil booms etc.) available for the control of accidental releases of pollution and other environmental incidents. These resources will be available to contractors at all times of operation.
- Cement/concrete mixes will be calculated to ensure that sufficient quantities are supplied without the need to dispose of excess and cement: sand mix ratio will be monitored for consistency and suitability.

Embedded mitigation during operation

10.8.8 The mitigation of impacts upon flow rates and volumes of watercourses within the surface water catchments would be achieved through design of a suitable surface water drainage scheme for the Site, which takes into account climate change. The surface drainage approach for this scheme will rely upon underground storage tanks, porous paving for parking areas, filter drains for internal roads and proprietary oil separators in order to achieve the required train of treatments for the proposed outfalls. The surface water management scheme in the FRA (Appendix 10.1) has considered pollution hazard and mitigation indices for sustainable drainage systems (SuDs). The FRA indicates that the phases of SuDs used in the scheme will control any pollution hazard.

10.8.9 All fuel, oils, paints, lubricants, and other polluting substances will be stored within suitably bunded containers and placed upon impermeable surfaces in accordance with

PPG2: Above Ground Oil Storage and PPG8: Safe Storage & Disposal of Used Oils. Pollution incident response plans will also be used.

10.8.10 The use of integral drip trays (of 110% of the capacity of the fuel tank) for any static machinery/ plant, where practicable. All plant, vehicles and machinery will also be regularly inspected for leaks.

10.8.11 All workings using chemicals will take place on impermeable surfaces with appropriate bunding and separates to inhibit escape to the environment. All spilt/used fuels, oils and chemical will be disposed of in accordance with the relevant legislation.

10.8.12 The proposed development would have an operation and maintenance management team who, as part of their role, would ensure all drainage systems are fully maintained and managed in accordance with best practice/guidance. The British Standard: BS 3247:2011+A1:2016 Specification for salt for spreading on highways for winter maintenance and Highways Agency Trunk Road Maintenance Manual: Volume 2 – Routine & Winter Maintenance Code, would be followed for the use of de-icing and storage of salts onsite.

10.8.13 Further mitigation measures with regards to flood risk are provided with Section 6 of the FRA in Appendix 10.1.

10.9 Potential Effects Assessment

10.9.1 Table 10.13 identifies the assessment of residual effects after mitigation on the water environment, with appropriate mitigation (as detailed in Section 10.8) in place.

During Construction

10.9.2 With appropriate embedded mitigation in place, the magnitude of change from the baseline condition caused by the construction operations identified in Table 10.13 has been assessed as Negligible for all operations. The potential change to the water environment is likely to be Slight and barely distinguishable from the current baseline condition due to the use of such measures as sediment settlement prior to drainage discharge, pollution incident response plans and sediment run-off containment.

10.9.3 The assessment has concluded that, with mitigation and good industry practice in place, no effect was found to be greater than Negligible, which is **Not Significant**. As such, no additional receptor-specific mitigation is considered to be required.

During Operation

10.9.4 The magnitude of change from the baseline condition caused by the operational changes identified in Table 10.13 have all been assessed as Low to Negligible. The potential change to the water environment would be Slight and barely distinguishable from the current baseline condition due to the implementation of a suitably designed surface water drainage scheme, pollution control measures for the use of chemicals, including spill kits and storage facilities and mitigation measures associated to address the increased risk of flooding, including flood compensation areas and sustainable drainage schemes as outlined in the FRA.

10.9.5 The assessment of effects has found that, with appropriate embedded mitigation (and good industry practice in place), no effect was found to be greater than Negligible, which is **Not Significant**. As such, no additional receptor-specific mitigation is considered to be required.

Table 10.13 Summary of Assessment with Mitigation

Activity	Potential Effect	Nature & Geographical Significance of Effect	Receptor	Sensitivity of Receptor (Determined by Table 10.1)	Magnitude of Change (Determined by Table 10.2)	Scale of Effect* (Determined by Table 10.3)	Significant Effect? ** (Determined by Table 10.4)
Construction Phase							
Earthworks including excavation	Excavation and removal of the topsoil and superficial deposits has the potential to reduce the pathway to the underlying bedrock aquifers and therefore may increase the vulnerability of the aquifer to potential contamination/oil spills during construction. Mobilisation of sediment, which could enter watercourses and waterbodies causing increased erosion altering deposition. This may also result in harm to aquatic flora and fauna.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drainage ditches receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No
Soil stripping and vegetation removal	Soil stripping reduces soil moisture storage capacity, may increase runoff, and may lead to flooding.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No
	Removal of vegetation reduces interception and evapotranspiration rates, increases runoff, and may lead to flooding and increased suspended solids entrained in runoff.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No
Use of machinery and storage onsite	Accidental spills or leakage of fuel and oil from machinery and storage onsite during the construction phase could affect the underlying groundwater and enter surface water watercourses and waterbodies and lead to a degradation of water quality.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No
Soil compaction	Compaction due to use of heavy machinery reduces infiltration, increases runoff, and shortens the rainfall–runoff response and may lead to flooding.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No
Construction of impermeable surfaces such as roads/pavements	Reduction in recharge to the underlying soils therefore potentially reducing groundwater levels. This will also increase runoff to surface water drains/ponds and may lead to flooding.	Ir, Lt, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No
Construction of subsurface infrastructure such as foundations	Impediment of shallow groundwater which can cause groundwater mounding on the upgradient side and reduce groundwater levels on the downgradient side. Potentially coming into contact with confined groundwater leading to dewatering requirements.	Ir, Lt, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No
Laying foundations	Release of sediment and silt laden water from the discharge of water removed from excavations to watercourse and/or ground, which could cause a degradation in water quality.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Negligible	Negligible	No

Table 10.13 Summary of Assessment with Mitigation

Activity	Potential Effect	Nature & Geographical Significance of Effect	Receptor	Sensitivity of Receptor (Determined by Table 10.1)	Magnitude of Change (Determined by Table 10.2)	Scale of Effect* (Determined by Table 10.3)	Significant Effect? ** (Determined by Table 10.4)
Operational Phase							
Use of Motorised Vehicles	Pollution from leaks or spills, which may cause a degradation in water quality.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Low	Negligible	No
			Attenuation ponds	Very Low	Low	Negligible	No
Contaminants associated with Lithium-Ion Battery pouch cells production	Substances including Nickel Oxide, Lithium Hexafluorophosphate and NMP are used in battery production. Other substances including heavy metals used during welding, degreasers, oils and diesels for manufacturing, servicing, and machinery.	R, Lt, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Low	Negligible	No
			Attenuation ponds	Very Low	Low	Negligible	No
Impermeable surfaces such as roads/pavements	Reduction in infiltration and recharge to the underlying soils water. This would also increase runoff to surface water drains/ponds and may lead to flooding.	Ir, Lt, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Low	Negligible	No
Subsurface infrastructure such as foundations	Impediment of shallow groundwater flow which can cause groundwater mounding on the upgradient side and reducing groundwater levels on the downgradient side.	Ir, Lt, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Low	Negligible	No
Creation of new drainage regime in developed areas of the Site	The creation of a new drainage regime may alter the amount of runoff within the surface water catchments, thereby altering the flow rates and volumes within the watercourses in these catchments. An increase in flow rates may lead to a corresponding increase in flood risk.	Ir, Lt, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Low	Negligible	No
			Attenuation ponds	Very Low	Low	Negligible	No
De-icing of roads, walkways, and parking areas	The use of de-icing salts may cause the release of sodium chloride and anti-caking agents into the water environment and may cause changes to water chemistry such as salination.	R, St, Ad, Lo	Usworth Burn (tributary of the River Don)	Medium	Negligible	Negligible	No
			River Don	Medium	Negligible	Negligible	No
			Existing drains and drains receiving site discharge	Very Low	Negligible	Negligible	No
			Attenuation ponds	Very Low	Low	Negligible	No

Note

* The assessment has considered the magnitude of change from the baseline with mitigation (as described in Section 6) in place.

** Effects that have been determined to be major or moderate are considered to have a significant effect. Effects that are identified as minor or negligible are not considered to have a significant effect.

R= Reversible, Ir = Irreversible, Lt = Long Term, St = Short Term, Ad = Adverse, Be = Beneficial, Ne = Neutral, Lo = Local, Re = Regional, Na = National

10.10 Residual Effects

10.10.1 As detailed within Table 10.13, there are no aspects of the proposed development that are likely to give rise to a Significant effect. As such, no additional mitigation is required above the embedded measures already considered in the assessment (Section 10.8), such as the use of SuDS and good practice included in a CEMP. Consequently, the residual construction and operational effects remain Negligible and **Not Significant**).

10.11 Cumulative Effects

10.11.1 There is a possibility of cumulative effects on the water environment occurring when two or more major developments are constructed within the same catchment at the same time. Potential cumulative effects include deterioration in water quality as a result of pollutants entering waterbodies during construction and alteration to the hydrological regime from inappropriate drainage design resulting in increased flood risk downstream of both developments. In terms of the water environment, the greatest risk to water receptors generally occurs during construction periods. Therefore, this assessment considers where there is likely to be an overlap of construction periods. It has been assumed that other developments would be designed and implemented with mitigation measures (e.g., the use of SuDS and restriction of greenfield runoff rates) that would mitigate operational effects of these developments. This assessment, therefore, has not considered the cumulative operational effects of the proposed development and other developments.

10.11.2 The site (i.e., IAMP ONE Phase Two) forms part of the larger IAMP development, which also includes IAMP ONE Phase One, and IAMP TWO (see Figure 1.2). Chapter I (Water Resources) of the IAMP ONE ES 2018 concluded that the potential changes to the receptors during construction, operation and decommissioning are predicted to be low or negligible. The effects, considering embedded mitigation, are predicted to be neutral or minor adverse and, therefore, Not Significant. As a result, it is considered that any cumulative effects on the water resources of the local area as a result of the construction, operation or decommission of the two phases of the IAMP ONE development would be Negligible and **Not Significant**.

10.11.3 Of the other developments listed within Table 2.5 of Chapter 2, the following developments have been considered as they are all within 2 km of the site and located within the same surface water catchment and groundwater catchment as the site, and

could potentially be constructed at the same time:

- Application ref. 18/00092/HE4 – construction of light industrial, general industrial and storage distribution (IAMP ONE Phase One). The application boundary for IAMP ONE Phase one overlaps with IAMP ONE Phase two and is, therefore, located within the same catchment as IAMP One Phase two.
- Application ref. 18/02055/FUL – provision of solar panels on building roof, Unipres, Washington Road (approved but not constructed) - The Unipres site is directly to the south of the Site, on the south side of the A1290. The application proposes the installation of 17,500 photovoltaic (PV) panels on the roof of the existing building, delivering renewable energy for use by the Unipres site. Owing to the nature of works, there would be no scope for cumulative effects on the water resources of the local area. The Unipres site is not located within a WFD Surface Water Catchment but is located within the same groundwater catchment as the Site.
- Application ref. 18/01869/FUL and 19/02161/VAR – proposed 3 storey, 36 bed hotel on land adjacent to the Three Horse Shoes, Washington Road. The Three Horse Shoes pub is located on the west side and at the southern end of the Usworth Cottages road, on the north side of the declassified section of Washington Road, east of the A1290. This application relates to the development of land to the west and north of the public house, some 710 m to the east-north-east of the Site. The proposed hotel (reduced in size from 60 bed to 36 bed) would comprise a rectangular building, three storeys in height, with a flat roof, assumed to be some 9.1 m above ground level. The application area is not located within a WFD Surface Water Catchment but is located within the same groundwater catchment as the Site.
- Application ref. 18/01869/FUL and 19/02161/VAR - erection of two extensions to the existing press and assembly shop buildings to house additional production capacity and creation of external hardstanding area with associated landscaping and fencing on the Unipress Site. Located 420m south of the Site. The application area is not located within a WFD Surface Water Catchment but is located within the same groundwater catchment as the Site.
- Application ref. TR010024 - enhancement of the junction capacity to support IAMP, 662 m north east of the Site. The project will include the construction of a

bridge south of the existing (A1290) bridge across the A19 to create a more traditional roundabout layout above the A19. New slip roads will connect the A19 to the south. The application area is not located within a WFD Surface Water Catchment but is located within the same groundwater catchment as the Site.

- Application ref. 18/01964/FUL – extension to existing farm shop, tearoom and other facilities at Elm Tree Nursery, Washington Road. Elm Tree Farm Nursery lies west-south-west of and some 800 m from the Site, on the eastern side of Washington Road and is accessed from the northern end of Infiniti Drive. The existing nursery site lies within the Green Belt. This application proposed generally low-level extensions of the existing parking area, agricultural building, and canopy structure, in addition to an additional polytunnel, new outdoor eating area and new children's play area. Solar panels are proposed for the south-facing elevation of the existing building. The application area is not located within a WFD Surface Water Catchment but is located within the same groundwater catchment as the Site.
- Application ref. 21/00401/HE4 and 21/00605/OU4 - erection of light industrial, general industrial and storage distribution (awaiting determination) at Hillthorn Farm, 1.21 km south west of the Site. The application area is not located within a WFD Surface Water Catchment but is located within the same groundwater catchment as the Site.
- Application ref. 18/02226/FUL - extension to Unit 1 Spire Road Glover Washington located approximately 1.36 km south east of the site. The application area is not located within a WFD Surface Water Catchment but is located within the same groundwater catchment as the site.

10.11.4 Owing to strict planning guidance and regulation over the water environment, the other major developments within the same catchment as the Site, including IAMP TWO, will have to demonstrate that appropriate drainage design and pollution prevention measures have been incorporated into their site design and will be in place during the construction and operational periods. Any development requiring permitted activities would also be subject to control and regulation by the relevant issuing authority. Given the proposed SuDS for the Site, it is likely that any adjacent developments will involve the same or similar systems as those proposed for the Site and not use features such as deep soakaways, as they are not supported by the geology.

10.11.5 In addition, pollution prevention measures in a CEMP (or equivalent) including emergency response plans are likely to be implemented during the construction of other developments. The potential cumulative effects on the water environment arising from other major developments within the same catchments as the Site are, therefore, considered to be Negligible and **Not Significant**.

10.12 Summary and Conclusion

Summary

10.12.1 The Site is located on the watershed of two surface water catchments. To the north of the watershed, water drains to the River Don, to the south of the watershed, water drains to watercourses/drains that are not located within a WFD surface water catchment. The Site is located within the Tyne Carboniferous Limestone and Coal Measures groundwater catchment.

10.12.2 Superficial deposits that underlie the Site are comprised of the Pelaw Clay Member. According to the EA, these deposits are classified as Unproductive Strata (i.e., rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow). There are limited isolated pockets of groundwater within permeable horizons; likely to be small and hydraulically isolated from each other. Groundwater was also encountered at the base of the formation overlying weathered bedrock. In these areas, it is likely that the basal superficial deposits are in continuity with the underlying weathered bedrock and, therefore, are under confining pressure from the above clay deposits.

10.12.3 The bedrock underlying the Site belongs to the Pennine Middle Coal Measures Formation, which is formed of sequences of sandstones, siltstones, mudstones, and associated coal seams. The Pennine Middle Coal Measures Formation is a Secondary A Aquifer. The bedrock aquifer is entirely confined by the Pelaw Clay Member onsite. Owing to the low permeability of the Pelaw Clay Member and the upward head gradient within the bedrock aquifer there is no meaningful pathway between the Site and the bedrock; therefore, affording the aquifer protection from any potential contamination associated with the works onsite.

10.12.4 There are no surface water or groundwater private water supplies present within 2 km of the Site. There are no groundwater abstractions present within 2 km of the Site.

10.12.5 The assessment found that, with appropriate embedded mitigation in place, the level of potential effects on the water environment as a result of the proposed development is no greater than Negligible and **Not Significant**.

10.12.6 Appendix 10.1 (FRA and Drainage Strategy) found that the majority of the Site is located within Flood Zone 1 (less than 0.1% chance of flooding every year) from fluvial flooding. Climate change impacts are estimated to have potential medium to high flood risks within the northern corners of the Site, associated with fluvial flooding. These are, however, mitigated by the introduction of a set development platform the flood risk to the Site is considered to be very low. There are small areas of the Site located within areas of medium to high risk of surface water flooding; however, the majority of the Site is at a low risk of surface water flooding. With appropriate mitigation in place the risk level has been assessed as low. There is very low flood risk from groundwater or sewer flooding and no risk from artificial sources.

Conclusion

10.12.7 This ES chapter provides an assessment of the potential effects of the development of the Site upon the water resources of the Site and surrounding area, focusing on effects relating to changes to the hydrological and hydrogeological regime, and from potential pollution and degradation in water quality. The assessment has concluded that, with appropriate mitigation in place, the level of potential effects would be no greater than Negligible and **Not Significant**. Additionally, an assessment of potential cumulative impacts as a result of the wider IAMP development and additional nearby developments has concluded that any cumulative impacts on the water environment would be no greater than Negligible and **Not Significant**.