Rhydycar West

Environmental Statement

Volume 1: Main Text



March 2023

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1.0 Introduction

1.1 Introduction

1.1.1 This Environmental Statement (ES) and its associated Non-Technical Summary has been prepared on behalf of Marvel Ltd (the applicant). The ES accompanies a suite of documents, which together form the outline planning application submitted to Merthyr Tydfil County Borough Council (MTCBC) for the following mixed use tourism and leisure-led development at 'Rhydycar West':

> *"Outline planning application for the erection of a mixed leisure development comprising Indoor Snow Centre (up to 39,200 sq m), Waterpark (up to 7,500 sq m), Indoor Activity Centre (up to 9,000 sq m), Outdoor Activity Centre, Hotel Accommodation (up to 418 bedrooms), Woodland Lodge Accommodation (up to 30 units), car parking (up to 830 spaces) and associated earthworks, access, drainage, servicing and utilities connections/infrastructure."*

1.1.2 The proposals will include the UK's longest Indoor multi-slope and freestyle Snow Centre, including extensive beginners' slopes and children's fun play area. The scheme seeks to deliver a significant tourism and leisure investment into the South Wales Valleys, in an environmentally sensitive and conscious way, whilst delivering new skilled and unskilled jobs and reducing the high numbers of those economically inactive within the County Borough.

1.1.3 This ES is part of the Environmental Impact Assessment (EIA) process undertaken in accordance with the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (as amended 2019[1]).

1.1.4 In addition to CarneySweeney's input and coordination, supporting technical and specialist input into this ES has been provided by Tetra Tech, AECOM, Bioscan UK Ltd, EDP, Gleeds, Tir Collective, and Hoare Lea.

Site Location & Description

1.1.5 The proposed application site comprises 30.4 ha of land and is located south west of the A470/A4102 roundabout, to the north west of Abercanaid (as shown at **Figure 1.1**). The UK grid reference for the site is SO 04629 05014 (Eastings (304629), Northing (205014).

1.1.6 The site comprises an extensive area, forming a mix of woodland/grassland on predominantly east and south-east facing slopes. The southern area of the site encompasses a more enclosed woodland area. The Blaen-Canaid Valley lies to the south adjacent to Gethin Wood. The landform undulates with moderate to steep slopes and falls from circa 270m AOD in the west to between 175-200m AOD along the A470 which forms the lower level.

[1] The Town and Country Planning (Environmental Impact Assessment) (Wales) (Amendment) Regulations 2019

1.1.7 The principal access into the site is taken from the A470/A4102 roundabout. A second access is available via an underpass from Abercanaid Industrial Estate in the far south-east of the site. A recently declared bridle way runs from this underpass, skirting the southern boundary of the site before turning south to the Abernant Tunnel. Pedestrian and cycle access is also available over a bridge over the A470 adjacent to the A470/A4102 roundabout. Other rights of way have recently been established as a result of an application to modify the definitive map and a positive dialogue and collaboration between the landowners and MTCBC.

1.1.8 In terms of context, the site has historically been subject to coal and iron ore extraction and remains affected to differing extents by mining legacies, as well as legacies associated with the construction of the A470. Some spoil tips and derelict shallow workings therefore remain, and several disused former tramways and tracks and other associated structures occupy the site. Recent tip stabilisation work has been undertaken on site by MTCBC in the form of drainage channels and features.

1.1.9 Rhydycar West is rich in heritage, as an area that contributed to Merthyr's key role in the industrial revolution. The site's plentiful supplies of iron and coal contributed significantly to the industrial revolution and beyond, up until the mid-20th Century. Prior to that, the land was an important site related to the period of religious dissent in Wales. Important remains of this history are scattered across the site, albeit unfortunately some of these are degrading and disappearing.

1.1.10 The application site is likewise subject to a number of statutory and non-statutory nature conservation designations that comprise the following:

- Cwm Glo a Glyndrys SSSI (the proposed road access from the A470/A4102 roundabout and parts of the proposed Indoor Snow Centre directly affects the SSSI); and
- Rhydycar West SINC (SINC 36) (in the south).

1.1.11 In terms of physical constraints, there are no known utilities or service constraints within the application site, albeit utility service providers and operators' assets lie adjacent to the proposed development.

Surrounding Area

1.1.12 The surrounding area has a mixed-use character and the location of the site is highly accessible with numerous employers/jobs, shops, services and community facilities accessible by means of bus and rail, as well as an abundance of facilities within walking and cycling distance. The residential settlement of Heolgerrig lies approximately 1.5km to the north. The settlement is served by a number of community facilities. The town centre of Merthyr Tydfil sits just over 1 km walking distance to the east. Likewise, c.100m north east is Merthyr Leisure Village, which comprises various restaurants and leisure facilities including multiple national operators such as; McDonald's, Frankie & Benny's, Nando's, Subway, Vue Cinema and a Travelodge. Cyfarthfa Retail Park and Trago Mills lie approximately 2km to the north either side of the A470.

1.1.13 In regard to accessibility, the Taff Trail cycle route runs to the east of the A470 and forms part of the wider strategic cycle network. A number of bus stops are located within proximity of the site, which include:

- Heolgerrig Bus Stops
- Keir Hardie Health Park Bus Stops
- Merthyr Tydfil Leisure Centre Bus Stop
- Penlan View Bus Stops; and
- Quay Row Bus Stops.

1.1.14 The stops benefit from a regular level of services which operate throughout the week, providing connections to the town centre and wider parts of Merthyr Tydfil.

1.1.15 The proposal also includes a shuttle bus service to the new Merthyr Tydfil bus station, as well as the Merthyr Tydfil railway station. The new Bus Station offers vastly improve facilities and conditions for passengers in the town and the adjacent South Wales valleys and includes strategic connections to Newtown, Llandrindod Wells, Builth Wells, Brecon and Cardiff.

1.1.16 Merthyr Tydfil train station is located within the town centre and provides regular links to surrounding settlements, including direct links to Cardiff Central from where there are nationwide service linkages. Pentre-Bach Railway Station is an alternative option for future site users.

Site Planning History

1.1.17 A review of MTCBC planning history of the application site has been undertaken and the following section provides a brief summary of applications and submissions of key relevance.

1.1.18 During 2002, the following planning applications were made in respect of 224 ha of land, part of which included the application site and were more commonly known as the 'Merthyr Village' proposals. The first application was submitted in February 2002 for the following:

- **Phase 1 –** Full application for the reclamation and landscape restoration of 83 hectares out of 224 hectares of derelict and despoiled land including tip reprofiling and coal recovery from selected spoil tips (LPA ref: 020060)

1.1.19 Subsequent to this, an outline planning application was made in July 2002:

- **Phase 2** – Outline application for a comprehensive development scheme to provide retail, leisure, offices, hotel, football stadium, county park and residential uses with associated access servicing, parking and landscaping (LPA ref: 020260)

1.1.20 The Phase 1 planning application (ref: 020060) was resolved to be approved by planning committee in January 2003, which resulted in referral to the Welsh Assembly Government. On the 7th March 2003, both the Phase 1 and 2 planning applications were 'called-in' by the then National Assembly for Wales (NAW) by a Direction made under Section 77 of the Town & Country Planning Act 1990, on the grounds that:

"…the proposed development raises planning issues of more than local importance particularly as they may involve conflict with national planning policies, could have undue effects beyond the immediate locality, and are likely to significantly affect sites of scientific, nature conservation or historic interest, or areas of landscape importance". (A--PP152-07-018 and A--PP152-07-020)

1.1.21 Following the NAW call-in, the Council proceeded to formally determine the Phase 2 proposals. Again, the Council voted in favour of the proposals subject to agreement of matters relating to transport, leisure, retail and the content of the future Section 106 agreement.

1.1.22 On the 17th January 2007, the NAW issued their decision which concurred with the conclusions of the Inspector's Report dated 18th September 2006 (see **Appendix 1.1**) (paragraphs 15.1 to 15.127) resulting in the refusal of both applications.

1.1.23 It is noted that the legislative and national and local policy context has altered significantly since the time of the decision regarding the Merthyr Village proposals, as has the proposed development scheme itself and the physical extent of land proposed to be developed. This is considered and discussed in more detail in the accompanying Planning Statement.

1.1.24 In more recent years, a series of pre-application submissions and discussions have been undertaken with MTCBC, both in respect the tourism / leisure land (forming part of these current proposals) and other land within the applicants' ownership for residential use. These are briefly outlined below for reference:

LPA ref: PA/16/0068	A pre-application enquiry was made in July 2016 relating to the potential for built leisure (ski-dome, hotel, service station, restaurant and other leisure offerings), unbuilt / low density leisure (log cabins, glamping, adventure, nature and heritage park and farm based / equestrian centre), retail (Designer Outlet Centre) and residential (up to c. 1,335 homes) comprising c. 121 ha west of the A470.	LPA response received 2nd December 2016.
LPA ref: PA/18/0010	A pre-application enquiry was made relating to the abovementioned proposed tourist / leisure / hotel elements of development on at land west of the A470, relating to a smaller area of land comprising 22.38 ha during February 2018.	LPA response received 6th April 2018.
LPA ref: PA/22/0035	A pre-application enquiry was made relating to the scheme of development considered in this ES.	LPA response received 4th October 2022.

1.1.25 These proposals essentially form earlier iterations of the current proposal relating to the application site and are considered in more detail in **Chapter 4 (Reasonable Alternatives)**.

1.2 The Proposed Development

1.2.1 The current development proposals relate to the mixed-use tourism and leisure led development of the application site for the following:

- Indoor Snow Centre,
- Indoor Tropical Waterpark,
- Resort Hotel comprising of The Family Resort Wing (198 beds), The Luxury Spa Wing (100 beds), and The Sport & Value Wing (120 beds),
- Indoor Adventure Centre,
- Outdoor Adventure Centre,
- Woodland Lodges (up to 30),
- Car parking (up to 830 spaces), and
- Associated earthworks, access, drainage, servicing and utilities connections / infrastructure.

1.2.2 The proposals include the provision of all slope engineering operations, roads, parking, landscape, utilities and all other associated development necessary to deliver the above elements. The physical characteristics of the proposals are set out on the Outline Masterplan is provided at **Figure 1.2** and the associated Parameter plans.

1.2.3 In terms of access to the proposals, vehicular access will be gained from the A470/A4102 roundabout with a new western arm being provided. Pedestrian, cycle and vehicular access will be integrated with other parts of the site to allow sustainable travel options, walk-in / cycle in trade and scheme permeability.

1.2.4 A full description of the proposals is provided at **Chapter 3 (Description of the Proposed Development)**.

1.3 Discussions with Key Consultees

1.3.1 To date, significant effort has been made in the design of the development proposals to minimise impact on both statutory and non-statutory designations, wherever possible. This has been informed by extensive consultation and dialogue with NRW, Glamorgan Gwent Archaeological Trust (GGAT), Cadw, the Coal Authority and landscape, highways, planning, economic development and ecology officers within MTCBC over a number of years. A review of these discussions and comments from the key statutory and non-statutory consultees resulting from the ES Scoping process is provided in the relevant topic chapters.

1.4 Legislative Framework for the Environmental Statement

1.4.1 The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (hereafter termed the “2017 EIA Regulations”) require that before planning permission is granted for specific types of development an EIA must be undertaken. The 2017 EIA Regulations define “EIA Development” as:

- Development falling within Schedule 1 of the Regulations; or
- Development falling within Schedule 2 which is likely to have significant effects on the environment by virtue of factors such as its nature, size or location.

1.4.2 Taking into consideration the 2017 EIA Regulations, it is considered that the proposed development does not fall within Schedule 1 (where an EIA would be mandatory), however does falls under Schedule 2 of the Regulations, by virtue of it including/comprising:

(10)(b) Urban development project, exceeding 5ha;

(12)(a) Ski run exceeding 1 ha or 15m height;

(12)(c) Holiday villages and hotel complexes outside urban areas, exceeding 0.5ha;

(12)(e) Permanent camp site, exceeding 1ha.

1.4.3 Schedule 3 of the Regulations set out the 'selection criteria', which must be taken into account in determining whether a development falling within Schedule 2 is likely to have significant effects on the environment. The three broad criteria (including a number of detailed considerations in each criterion), are:

1. Characteristics of development
2. Location of development; and
3. Types and characteristics of the potential impact.

1.4.4 The application site is located within a 'sensitive area' as defined in Regulation 2(1) as it includes land notified under s28 of the Wildlife and Countryside Act 1981 (a Site of Special Scientific Interest (SSSI)) and includes scheduled monuments within the meaning of the Ancient Monuments and Archaeological Areas Act 1979.

1.4.5 Having regard to the proposal's characteristic, location and potential impact, it is concluded that the development will have likely significant environmental effects and represents "EIA development".

1.4.6 In view of this, an EIA Scoping Request was submitted to the LPA on 27th April 2021 and Scoping Opinion received on 16th July 2021 (see **Appendix 2.1 and 2.2**). This voluntary process was undertaken with the LPA in order to proactively determine the breadth of the ES assessment necessary in support of the planning application, with the aim of identifying the key topics to be considered and any particular surveys / investigations deemed necessary by the LPA and statutory consultees to inform the content and findings of the ES. Individual responses received from the statutory consultees are also provided at **Appendix 2.2**. A full summary of the outcome of the formal scoping process is provided at **Chapter 2 (Environmental Impact Assessment Approach)** of this ES.

1.5 Environmental Statement Structure

1.5.1 This ES contains the findings and the information of the full EIA, together with the information and data collected during the assessment process. The ES comprises three volumes, as described below:

Volume 1: Environmental Statement Main Text

1.5.2 The format of the ES written statement (Volume 1) is as follows:

Chapter 1: Introduction

Presents the context to the site and development, provides a summary of the proposals, the legislative process, an overview of the assessment process and statement of professional competence.

Chapter 2: Environmental Impact Assessment Approach

Describes the methodology followed when undertaking the EIA process and outlines the outcome of the EIA Scoping process.

Chapter 3: Description of Proposed Development

Identifies the main characteristics of the proposed development, that have been assessed as part of the EIA, encompassing both the construction and operational phases of the development.

Chapter 4: Reasonable Alternatives

Outlines the main alternatives studied and reasons for the selection of the development site and proposal, taking into account environmental effects associated with such alternatives.

Chapters 5-18: Impact Assessment and Mitigation

Describes the baseline conditions for the pertinent environmental topic, references the relevant legislative context and provides an assessment of significant environmental effects, taking into account mitigation measures to be implemented. Based on the outcome of the EIA scoping process, the following topics have been assessed:

- Community & Socio-Economic
- Greenhouse Gas Emissions & Climate Change
- Geology & Ground Quality
- Ecology
- Transportation & Movement

- Archaeology and Cultural Heritage
- Hydrology & Hydrogeology
- Water, Drainage and Flooding Landscape and Visual Impact Assessment Noise
- Landscape and Visual Impact
- Noise
- Air Quality
- Lighting
- Health
- Utilities

1.5.3 Each environmental topic listed above is reported in a similar format for ease of comparison, as outlined below.

- Introduction
- Methodology and scope
- Baseline environment
- Mitigation within the submitted design
- Potential environmental effects of the scheme
- Additional mitigation, compensation and enhancement measures
- Assessment summary and residual environmental effects
- References

Chapter 19: Conclusion & Cumulative Effects

1.5.4 Outlines of the conclusions drawn by the ES, including identification of any residual significant effects and a consideration of the potential for secondary, cumulative and synergistic effects. The chapter also contemplates the potential cumulative effects of the development, including the possible impacts caused by the actions of other projects (additive and synergistic impacts) and the impacts between different environmental aspects of the project itself. Other projects can include; those under construction, permitted and undetermined applications, plans on the Planning Inspectorates Programme of Projects; allocated sites in the adopted LDP and identified plans and programmes reasonably likely to come forward.

Volume 2: Figures

1.5.5 This comprises separately bound Figures referenced in chapters in Volume 1.

Volume 3: Appendices

1.5.6 This comprises the specialists' technical reports (as appropriate) and other supportive background and technical information referenced in chapters in Volume 1.

Volume 4: Non-Technical Summary

1.5.7 This Volume provides a summary of the ES in a non-technical language. The NTS presents the existing site conditions, provides a description of the scheme and details the predicted environmental effects of the proposals in lay-terms.

1.6 Availability of the ES

1.6.1 The Environmental Statement (Volumes 1-3) may be viewed on Merthyr Tydfil County Borough Council's online planning application search:

https://publicaccess.merthyr.gov.uk/online-applications/

or alternatively by visiting the Council's offices: Unit 5, Triangle Business Park, Pentrebach, Merthyr Tydfil, CF48 4TQ.

1.6.2 Printed copies of these documents and may be obtained on request from: peter.waldren@carneysweeney.co.uk or by calling 07519 911394, subject to printing and postage costs (£100 for the full submission). Alternatively, these documents are available electronically at no charge, by visiting the LPA's website as set out above.

1.7 Statement of Expertise

1.7.1 The EIA project team has been led by CarneySweeney with input from Tetra Tech, AECOM, Bioscan UK Ltd, EDP, Gleeds, Tir Collective, and Hoare Lea. CarneySweeney have coordinated and undertaken the review of the ES.

1.7.2 Regulation 17 (4) a) and b) of the 2017 EIA Regulations requires EIA to be prepared by persons who have sufficient expertise to ensure the completeness of the quality of the statement and contain a statement describing the expertise of the person who prepared the ES. As such, the following Statement of Expertise is provided in the table below.

Role / Topic	Authors	Qualifications
EIA Management & Co-ordination **(CarneySweeney)**	Peter Waldren (Director – Planning)	BA (Hons); BPI; MRTPI
Community & Socio-Economic **(AECOM)**	Bob Perkins (Regional Director)	BA (Hons); PG Dip, MIED
	Alex Heath (Senior Consultant)	BA; MSc
Greenhouse Gas Emissions & Climate Change **(Hoare Lea)**	Sam Shooter (Technical Director)	BSc (Hons); PIEMA
	Greg Jones	MSc, BSc, CEnv, CEng, MEI
	Emma Jolly	BSc, CEnv, MEI
Geology & Ground Quality **(Tetra Tech)**	Dr. Sarah Roberts (Principal Geo-Environmental Consultant)	BSc (Hons); MSc; PhD; FGS
Ecology **(Bioscan)**	Dominic Woodfield (Director)	CEcol CEnv MCIEEM
Transportation & Movement **(Tetra Tech)**	Antonio Pinto (Director)	BA (Hons); MSc; MCIHT; CMILT
	Ben Maliphant	BSc (Hons); MCHIT
Heritage & Archaeology **(EDP (Heritage))**	Andrew Crutchley (Director)	BA (Hons), PG Dip (Oxon), MCIfA
	Rob Skinner (Consultant)	BA (Hons); MA, ACIfA
Hydrology &Hydrogeology **(Tetra Tech)**	Conor Lydon (Director)	BASc; Msc
	Adam James (Principal Geo-Environmental Consultant)	BSc (Hons); MSc; FGS
Drainage and Flood Risk	Paul Cooke (Director)	BEng CEng CEnv MICE

Role / Topic	Authors	Qualifications
(Tetra Tech	Stephen McKeown (Principal Designer)	MEng (Hons) GMICE
Landscape & Visual **(Tir Collective)**	Lee Morris (Director – Landscape)	BSc; PGDipLA; MA; PIEMA; CMLI
	Emma Hayes (Associate)	BA (Hons); PgDip; MA; CMLI
Noise **(Tetra Tech)**	Gus Egan (Principal Environmental Consultant)	BSc, MSc,AMIOA
Air Quality **(Tetra Tech)**	Matt Smith (Associate Environmental Consultant)	BSc, AMIAQM, AMIEnvSc
	Maria Lopez Vera (Senior Environmental Consultant)	BSc, MSc, MIEnvSc MIAQM
Lighting **(Tetra Tech)**	Tom Jones (Environmental Consultant)	BSc, MSc, AILP
Health **(AECOM)**	Simon Long (Senior Consultant)	BSc (Hons), MSc
Utilities **(Hoare Lea)**	Sam Shooter (Technical Director)	BSc (Hons); PIEMA

1.8 Planning Application Submission

1.8.1 This ES has been prepared as part of the wider suite of planning application documents submitted to MTCBC in support of the determination of this application. The following key documents are submitted alongside the ES:

- Application Plans;
    - Site Locations Plan
    - Illustrative Masterplan
    - Illustrative Sections

  - Parameters Plan
  - Combined Constraints Plan drawing
- Pre-Application Consultation Report (CarneySweeney)
- Design & Access Statement (Holder Mathias Architects)
- Planning Statement (CarneySweeney)
- Strategic Economic Benefits (AECOM)
- Energy Strategy (Hoare Lea)
- Sustainability Strategy (Hoare Lea)
- Arboricultural Impact Assessment (EDP)
- Conservation Management Plan Heads of Terms (EDP)

2.0 EIA Process & Objectives

2.1 Introduction

2.1.1 The overall aim of this ES is to provide an objective and systematic account of the significant environmental effects resulting from the Rhydycar West development, and to assess the ability of the application site and the surrounding area to accept those impacts. Specifically, the objectives of EIA are to:

- Improve the environmental design of the proposal;
- Check the environmental acceptability of the proposal in relation to the capacity of the site and the receiving environment
- Ensure resources are used appropriately and efficiently
- Identify appropriate measures for mitigation of the potential impacts of the proposal
- Facilitate informed decision making, including setting the environmental terms and conditions for implementing the proposal

2.2 Scope of Work

Geographic Scope

2.2.1 The EIA directly covers the physical extent of the site, as shown on the Planning Application Boundary drawing included at **Appendix 2.1**. It is important to note that the influence of many predicted impacts can extend beyond the immediate site boundary and where identified as relevant, these impacts have also been assessed as part of the EIA within the relevant chapter. These areas of potential impact are referred to as 'Study Areas'.

2.2.2 The geographical extent of the EIA also considers the potential implications of other development activities that may have cumulative effects during the construction and operation phases (as required by Schedule 4, Paragraph 5(e) of the 2017 EIA Regulations).

Temporal Scope

2.2.3 Under the current programme, it is expected that construction will take place over an approximately three year period. The assumption has been made that the opening / operational year will be 2026 or 2027. Given the nature of the proposals, the consideration of decommissioning is not deemed necessary in this instance.

2.2.4 The assessments presented are predominantly based on the evaluation of expected impacts compared with baseline environmental conditions. This is except for certain topics (such as air quality and landscape and visual impact assessments, etc), which factor in future baseline changes into the assessments, in future year impact scenarios. These approaches are explained in detail within the relevant chapters concerned.

Technical Scope

2.2.5 On the 27 April 2021, an EIA Scoping Request was made to the LPA and a Scoping Opinion was received from MTCBC on 16 July 2021 (**Appendix 2.2**). The Opinion advised the following in respect of topic areas:

Topics Scoped In

Topic	Response
Community and Socio-Economic	"*This chapter needs to consider likely significant socio-economic effects (these maybe positive and negative and both inside and outside the County Borough) – see comments from Caerphilly County Borough Council and Brecon Beacons National Park*" (contained at **Appendix 2.2**).
Sustainability and Climate Change	"*A sustainability assessment of the proposal and its impact on climate change is welcomed, however, in line with Future Wales and Planning Policy Wales a comprehensive assessment of the overall development needs to be undertaken in line with the decarbonisation agenda. This not only involves the removal of vegetation/trees, the construction of buildings and infrastructure but also must take into account the location of the site and the number of vehicular movements etc. It should be less about mitigation and more about creating a development which is as close to carbon neutral as possible."*
Ground Conditions	"*See comments from The Coal Authority and Gerald Coughlan (Highways/Engineering Officer)"* (contained at **Appendix 2.2**).
Ecology	"*See comments from Natural Resources Wales (NRW) and Matthew Davies (Councils Ecologist). I would draw your attention to the points raised that refer to outdated reports."* (contained at **Appendix 2.2**)
Transportation and Movement	"*See comments from Welsh Government (Transport) and Gerald Coughlan (Highways/Engineering Officer)"* (contained at **Appendix 2.2**).
Heritage	"*See response from Cadw and Glamorgan Gwent Archaeological Trust*" (contained at **Appendix 2.2**).
Hydrology and Hydrogeology	*"See response from NRW and Gerald Coughlan (Highways/Engineering Officer). As highlighted by NRW, the proposed method(s) of sustainable drainage needs to be included"* (contained at **Appendix 2.2**).

Arboriculture	"*The method of assessment is noted, however, greater detail maybe required with regard to smaller unrecorded trees/vegetation and cross referenced with the 'Sustainability and Climate Change' topic area (i.e. Carbon emissions). These smaller trees/vegetation will also have ecological value which may need to be assessed depending on their species and/or value*."
Townscape and Landscape	"*It is questioned whether a 3km LVIA study area is acceptable and this needs to be considered further (with appropriate viewpoints). In addition to photomontages, wireframes must also be provided. A topographical survey of the site and relevant existing and proposed (illustrative) cross-sections must be provided. Also see comments from Tom Bramley (Landscape Architect)."* NB a 3km LVIA Study Area was agreed with MTCBC Landscape Officer, Mr Tom Bramley
Noise, Acoustics & Vibration	"*See Comments from Garin Eldred (Environmental Health Officer)."* (contained at **Appendix 2.2**)
Air Quality	"*See Comments from Garin Eldred (Environmental Health Officer) and NRW*" (contained at **Appendix 2.2**).
Lighting	"*Planning Policy Wales (PPW) (Edition 11) Paragraph 6.8 also needs to be addressed in the ES. Given the extremely sensitive setting and location of the development, vertical and horizontal light spillage diagrams/details (both within and outside the site) need to be provided. Light spillage not only needs to be assessed from external sources but also internally from the buildings/structures themselves. A night/sky glow assessment would also be required. As PPW points out there is also a need to reduce carbon emissions associated with lighting. Therefore, this assessment needs to be undertaken and included in the 'Sustainability and Climate Change' topic area."*
Services and Energy	"*The scoping report provides little detail in terms of services. How the proposed development connects to the gas mains, electricity network, sewerage network etc. could have significant environmental impacts both inside and outside of the application site. Such connections and their impacts need to be fully considered (including plans which identify how the development would connect to the existing infrastructure) in the ES."*

Topics not considered further in this ES

2.2.6 Issues which have been assessed as unlikely to give rise to significant environmental effects have been omitted or 'scoped out' from this ES. The reasoned justification for the omission is provided below:

Topic	Response
Waste	See Waste section of Scoping Request (Appendix 2.1 of this ES). In summary, however, it is considered that there is a sufficient waste management infrastructure in the local area to manage the waste arising from both the construction and operational phase of the development. Operational controls and site procedures would ensure that waste does not adversely affect human receptors or the local environment. It is considered, that with the implementation of an appropriate SWMP, construction waste would be managed sustainably in accordance with the Waste Hierarchy and that the proposed development would not give rise to any significant environmental impacts.
Major accidents and/or disasters	Major accidents and/or disasters was a new EIA topic introduced by the 2014/52/EU EIA Directive. The EIA Directive was transposed into UK legislation in the 2017 EIA Regulations with the Regulations requiring "a description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned." Paragraph 15 of Directive 2014/52/EU provides the underlying objective of the requirement, being to ensure that appropriate precautionary actions are taken for those developments which '…because of their vulnerability to major accidents and/or natural disasters (such as flooding, sea level rise, or earthquakes), are likely to have significant adverse effects on the environment.' The IEMA has published a guide "Major Accidents and Disasters in EIA: A Primer" (September 2021). This guide aims to increase awareness of the major accidents and/or disasters EIA topic and its application. It offers an assessment methodology based on known current practice within the UK to date and identifies key terminology that can be used. It has been structured around a typical assessment approach and offers a proportionate method for considering major accidents and/or disasters through screening, scoping and assessment. It has been developed to generate comment and discussion, from which future guidance and

	institutional and regulatory change can evolve over time. Regard has been had to this guide in relation to the consideration of major accidents and/or disasters. A major accident is an event that threatens immediate or delayed serious environmental effects to human health, welfare and/or the environment and requires the use of resources beyond those of the client or its appointed representatives (i.e. contractors) to manage. A disaster is a man-made/external hazard or a natural hazard causing an event or situation that meets the definition of a major accident. Legal requirements, codes and standards at the design, construction and operational stages adequately control the potential for major accident and/or disasters occurring (such as adherence to The Construction (Design and Management) Regulations 2015, Health and Safety at Work etc. Act 1974, The Management of Health and Safety at Work Regulations 1999, Electricity at Work Regulations and following the recommendations of geotechnical desk-based and intrusive assessments). Construction accidents and accidents during the course of operation can occur as part of any development, but these are not considered to be "major accidents" or "disasters" as any impacts of accidents/disasters would be isolated and unlikely to be beyond the resources of the client and its appointed representatives to manage. In any event, construction workers and operational staff will be fully trained and briefed on health and safety requirements and an accident book will be on site at all times to record any incidents. Measures will be taken during construction and operational phases to ensure codes of practice are followed, the development is not wilfully misused and to prevent wilful trespass. Those ignoring such measures are not considered to be valid receptors. As such, the proposed development is not considered to be particularly vulnerable to risks of major accidents and/or disasters. The development: • is not a source of hazard itself that could result in a major accident and/or disaster occurring; • does not interact with any sources of external hazards that may make it vulnerable to a major accident and/or disaster; and • if an external major accident and/or disaster occurred, the existence of the development would not increase the risk of a significant effect to an environmental receptor.

	Risks that are likely to be caused by the development are already accounted for in other topics of this ES and are specifically mitigated for. • Community & Socio Economic - the impact of major accidents and/or disasters associated with the development on the wider socio-economic characteristics of the area are considered to be negligible. • Greenhouse Gas Emissions & Climate Change - No highly significant effects have been identified as a result of greenhouse gas emissions or climate change. • Geology & Ground Conditions – Ground stability and mining/highway construction legacy are fully assessed within the chapter. There are not considered to be any relevant accidents or disasters that that are not dealt with by the mitigation described within the topic chapter. • Ecology – ecology impact is fully assessed with the chapter. There are not considered to be any relevant accidents or disasters that that are not dealt with by the mitigation described within the topic chapter. • Transport & Movement - no major accidents and/or disasters are anticipated. • Archaeology & Cultural Heritage – subject to usual safe working practices during construction, there are no anticipated potential accidents and/or disasters that would result in impacts on any aspect of the historic built environment. No accidents or disasters are identified which could relate to the archaeological resource. • Hydrology & hydrogeology - there are no major accidents or disasters that that are not dealt with by the mitigation described within the topic chapter. • Landscape & Visual – no major accidents or disasters are anticipated in respect of this topic area. • Water, Drainage and Flooding - there are no accidents or disasters that that are not dealt with by the mitigation described within the topic chapter. • Noise, Air Quality and Lighting - there are no accidents or disasters that that are not dealt with by the mitigation

	described within the topic chapter. • Health – any major accident or disaster could impact human health, however, the proposed development itself is not considered to give rise to serious environmental effects to human health, welfare and/or the environment in this regard. • Utilities - there are no accidents or disasters that that are not dealt with by the mitigation described within the topic chapter. It is not considered that further consideration is required to meet the requirements of the 2017 EIA Regulations in this regard. Likely significant effects of a development from major accidents and/or disasters are accordingly "scoped out".

2.3 Cumulative & Intra-relationship Scope

2.3.1 As required by Schedule 4, Paragraph 5(e) of the 2017 EIA Regulations, the ES will take into consideration other existing and / or approved projects. The LPA's Scoping Opinion identified the following surrounding developments which should be considered:

- Bike Park Wales: permission for 36 camping pods, 5 chalets, toilet/shower block, picnic area, 150 space car park, 46 space overflow car park and maintenance yard with associated works (permission ref P/19/0073 granted 9 January 2020). This is situated to the south of the application site.

- Trago Mills: as yet unbuilt permission for leisure development associated with the retail facilities which opened to the public in April 2018 (permission ref P/03/0130 granted 26 June 2003). N.B. a planning condition requires the leisure element to be brought into use within 2 years of the retail element opening (see permission P/17/0333). This time limit has passed. However, MTCBC planning officers confirmed that the Council still wishes the leisure element to be developed and are therefore unlikely to enforce the condition.

- Allocated sites in the Merthyr Tydfil County Borough Council Replacement Local Development Plan (2016 – 2031), in proximity of the site.

2.3.2 In respect of this last point, the existing development context has been considered in the baseline conditions described within each technical chapter. To identify allocated (and any relevant approved) developments within the vicinity of the proposed development, a review was carried out of the Merthyr Tydfil Replacement LDP proposals map and an online search of MTCBC's planning application database. In terms of nearby allocations, these include:

- Hoover Site 1 (EcW-1.1 / Hoover Strategic Regeneration Area SW6)

- Hoover Site 2 (SW3-1)

- Upper Georgetown Plateau (SW3-3)
- Brondeg, Heolgerrig (SW3-4)
- Penheolferthyr, Twynyrodyn (SW3-18)
- Former Mardy Hospital, Twynyrodyn (SW3-19)
- P&R Motors, Pentrebach (SW3-26)
- Land south of Merthyr Tydfil Industrial Park (EcW-1.4)

2.3.3 An assessment of intra-relationship of effects has also been made in relation to the proposed development. This is where there is more than one effect identified on an individual receptor (for example: noise, dust and visual impacts). The individual effects themselves may not be of a significant nature, however in combination an effect could potentially be of greater significance. The intra-relationship assessment of effects is therefore likewise carried out in **Chapter 19 (Conclusions)**.

2.4 Environmental Statement Content

2.4.1 EIA is a means of drawing together in a systematic way an assessment of the likely significant effects of a particular development. This helps to ensure that predicted effects are identified and assess and that the scope for minimising or mitigating them is considered at the time the decision is made.

2.4.2 The structure of this ES is guided by the provisions of Reg 17(3) and Schedule 4 of the 2017 EIA Regulations (Information for inclusion in Environmental Statements) and the following schedule cross-references to the relevant section of the ES:

Schedule 4 requirements	Location within the ES
1. A description of the development, including in particular— (a) a description of the location of the development; (b) a description of the physical characteristics of the whole development, including, where relevant, requisite demolition works and the land-use requirements during the construction and operational phases; (c) a description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used; (d) an estimate, by type and quantity, of expected residues and emissions (such as water, air, oil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during the construction and operational phases.	A description of the proposals is provided within **Chapter 3 (Description of Proposals)** and from a topic specific perspective within **Chapters 5 to 18 (Technical Chapters).**
2. A description of reasonable alternatives (for example in terms of development design, technology, location, size and scale) which are relevant to the proposed development and specific characteristics and an indication of the main reasons for selecting the chosen option;	A description and consideration of reasonable alternatives is provided in **Chapter 4 (Reasonable Alternatives).**
3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without	Each topic specific chapter provides an overview of the existing baseline and likely

implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.	evolution without development within **Chapters 5 to 18.**
4. A description of the factors likely to be significantly altered by the development (population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape)	An initial overview of the factors likely to be significantly altered by the development determined as part of the scoping process is provided within this Chapter. Each topic specific perspective then provides factors likely to be significantly altered by the development within **Chapters 5 to 18.**
5. A description of the likely significant effects of the development on the environment. The description of the likely significant effects should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.	A description of the likely significant effects of the development on the environment is provided within **Chapters 5 to 18.** Cumulative effects are discussed at **Chapter 19.**
6. A description of the forecasting methods or evidence used to identify and assess the effects on the environment including difficulties encountered and any uncertainties involved.	See topic-based **Chapters 5 to 18.**
7. A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of	See topic-based **Chapters 5 to 18 (Topic Specific Chapters).** Cumulative effects are discussed at **Chapter 19.**

any proposed monitoring arrangements.	
8. A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned.	See section 2.2, above.
9. A non-technical summary of the above information	See **Volume 4 (Non-Technical Summary).**
10. A reference list detailing the sources used for the descriptions and assessments included in the ES	See individual topic-based reference list detailing the sources at the end of each **Chapters 5 to 18.**

2.5 Assessment Methodology

2.5.1 Once the scope of the EIA has been established, it is then necessary to identify and predict the significance of the likely environmental impacts of the proposed development. The assessment methodologies applied are based on best practice and guidance for each topic.

Baseline & Predictions

Existing Baseline & Future Baseline

2.5.2 The likely significant effects resulting from the proposed development relate to the deviation from the baseline environment. The 2017 EIA Regulations necessitate a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution without implementation of the development, as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge. As previously mentioned, when reviewing the chapters, it should be acknowledged that the data set Study Area for each topic baseline will vary.

2.5.3 Similarly, the 2017 EIA Regulations requires description of the factors specified in the topics likely to be significantly affected by the development: population, human health, biodiversity, soil, water, air, climate, material assets, cultural heritage and landscape. This forms the overarching baseline for the application site and surroundings.

2.5.4 An understanding of the baseline existing environmental characteristics and conditions of the application site and surroundings (Study Area) are established on:

- Desk-based studies and background papers;
- Site visits and surveys over a number of years (since 2015);
- Review of published site-specific information;
- Modelling data;
- Discussions between the various project team specialists;
- On-going consultation with the statutory consultees as part of the EIA Scoping process.

2.5.5 All third-party data sets used to inform the baseline have been gathered from recognised sources. Any limitations and assumptions regarding the baseline environment are clearly set out in each topic chapter.

2.5.6 In terms of the 'future baseline' or 'do nothing' scenario, each chapter considers how the site and study area may alter assuming the site is not developed and the existing environment remains unchanged. Consideration is given to potential future sensitive receptors of other approved projects as a precautionary approach where relevant. Predictions are then necessary when forecasting future impacts, in order to ensure that expectations are as accurate as possible.

2.5.7 With regard to predictions, each assessment has been undertaken in accordance with best practice guidelines published by the relevant professional bodies associated with each topic. If there is no published / recognised topic specific guidance available, a common framework of assessment criteria and terminology has been developed drawing upon the assessment team's experience of undertaking EIA, for the presentation of predicted impacts. This is based on a widely used 'matrix approach' to EIA, which is established on the characteristics of the impact (magnitude and nature) and the sensitivity of the receptor, as described further below[1]. It is recognised that the level of transparency in the approach is comparatively high, with the sensitivity framework incorporating useful examples and the descriptors serving to provide a fuller account of decision factors (Wood, 2008). The approach looks to achieve simplicity and consistency, in so far as possible, in terms of the application of the assessment to allow the reader to be in a better position to 'calibrate' the language terms used by the specialists.

Receptor Sensitivity

2.5.8 In terms of identification of sensitive environmental receptors (for example; people, heritage assets, natural resources, ecological resources etc), the assessment set out in Chapters 5 – 18 has been informed by consultation with statutory consultees during the EIA Scoping Process.

2.5.9 The sensitivity of a receptor refers to its importance - i.e. the environmental value / attributes. This may include a feature's level of statutory designation (for example if a site has a

[1] This is known as a 'Type 3 assessment framework' by Wood (2008)

European designation (e.g. Site of Special Scientific Interest)), which will generally be regarded as more important/sensitive than another site with a national or local designation (e.g. Local Nature Reserve or Site of Importance for Nature Conservation). Sensitivity is likewise influenced by tolerance of the receptor to change and the capacity to withstand such change.

2.5.10 The terminology defining sensitivity can vary according to discipline or the methodology being used and is described in relevant chapters. Notwithstanding this, within this ES sensitivity is generally determined as:

Very High, **High**, **Medium** or **Low**

Impact Magnitude

2.5.11 Magnitude of impact is determined by predicting the scale of any potential change in the baseline conditions. Where possible, magnitude should be quantified, and mitigation identified on this basis (either primary, secondary or tertiary mitigation) to further reduce impacts. Therefore, the magnitude of impact is to be assessed both before and after secondary or tertiary mitigation is applied. The terminology defining magnitude can vary according to discipline or the methodology being used and is described in relevant chapters. Notwithstanding this, within this ES sensitivity is generally determined as:

Substantial, Moderate, Slight or **Negligible**

Significance and Nature of Effects

2.5.12 The assessment of likely significant environmental effects for the construction and operational phases requires the assessor to apply professional judgement to determine significance. This is based on:

- Relevant national and international legislation;
- Recognised local and national policies, standards and guidance;
- Professional standards and guidance;
- Probability of the occurrence of the effect;
- Geographical extent of the effect;
- Magnitude of the effect;
- Sensitivity of the receptor;
- Frequency or reversibility of the effect (temporary or permanent);
- Inter-relationship between the effects.



2.5.13 Evidently, the methodology guiding the assessment of significance of effects can vary between environmental topics. To determine the significance of an effect, the assessor combines the predicted magnitude of impact (change) with the assigned sensitivity of the receptor (value) – see **Table 2.1.**

Table 2.1 – Significance of Effects Matrix

		Magnitude of Impact (change)			
		Substantial	**Moderate**	**Slight**	**Negligible**
Sensitivity of Receptor (value)	**Very High**	Major	Major	Intermediate	Neutral
	High	Major	Intermediate	Minor	Neutral
	Medium	Major	Intermediate	Minor	Neutral
	Low	Intermediate	Minor	Neutral	Neutral

2.5.14 The table provides a guide to the assessor regarding the interaction between magnitude and sensitivity to determine the significance of an environmental effect. Professional judgement is to be applied in each instance. Likewise, deviation from this terminology may occur in cases where an alternative topic specific methodology is established and recognised, as will be explained in relevant chapters. The following definition given to the level of significance is provided:

- **Major** – Major effects and / or highly pronounced change in the environmental conditions;
- **Moderate** – Intermediate effects and / or pronounced change in environmental conditions;
- **Minor** – Noticeable, albeit slight effect and / or change in environmental conditions; and
- **Negligible** – No discernible change or neutral effect on environmental conditions.

2.5.15 The classification of significance and resulting impacts is provided within the topic-specific methodology section for each chapter. The 2017 EIA Regulations necessitates a description of the likely significant effects of the development which should cover the direct effects and any indirect, secondary, cumulative, short medium and long-term, permanent and temporary, positive and negative effects of the development. Therefore, the nature of the environmental effects are described in broad terms as:

- **Adverse** or **beneficial**
- **Direct** or **indirect**
- **Temporary** or **permanent**
- **Short, medium** or **long term**
- **Reversible** or **irreversible**
- **Cumulative** and **in-combination.**

2.5.16 Each individual topic chapter within this ES draws conclusions on the significance of effects, based on the application of professional judgement.

Assumptions and Limitations

2.5.17 The 2017 EIA Regulations outline that details of difficulties (for example: technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved are set out. As such, any assumptions or limitations associated with the conclusions regarding predicted impact and / or the sensitivity of receptors, due to the absence of data or for any other reason are outlined within each topic chapter.

Mitigation Measures

2.5.18 The 2017 EIA Regulations require a description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases. The following hierarchy has been applied in determining which mitigation measures are necessary, based on the impact:

Prevent - to prevent or avoid adverse effects as far as possible by designing out (primary mitigation) or by using preventative measures during the construction/operation process (secondary / tertiary mitigation) resulting in neutral effects;

Reduce - to minimise adverse effects as far as possible by improvements to the design (primary mitigation) or using reductive (but not fully preventative measures due to technical infeasibility without excessive cost) during the construction/operation process (secondary / tertiary mitigation) resulting in neutral effects.

Offset – to offset or compensate for adverse effects where it is not possible to avoid effects, or where the effect has been already reduced (minimised) as far as technically feasible (without excessive cost). With offsetting and compensation effects may not be fully neutralised.

Enhance - to identify opportunities where enhancement can be incorporated into the scheme where effects have been neutralised.

Figure 2.1 - The EIA mitigation hierarchy

2.5.19 IEMA guidance[2] identifies three categories of mitigation:

Primary Mitigation (inherent)	Modifications to the location or design of the development made during the design phase that are an inherent part of the project, and do not require additional action to be taken. *For example: identifying a key habitat or archaeological feature that should remain unaffected by the development's layout and operation.*
Secondary Mitigation (foreseeable)	Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning permission, or through inclusion in the ES. *For example: describing certain lighting emission limits to be confirmed by a lighting scheme which is conditioned.*
Tertiary Mitigation (inexorable)	Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects. *For example: applying considerate construction contractors practice guidance to manage activities which has potential nuisance effects.*

[2] IEMA (July 2016), Delivering Quality Development. Annex A: Classifying the three types of EIA mitigation

2.5.20 The identification of impacts in respect of primary mitigation is integral to the design process undertaken and is facilitated by the:

- Early identification of the baseline environment;
- Preliminary identification of potential significant impacts by the technical specialists; and
- Engagement with key stakeholders including statutory and non-statutory organisations and the public.

2.5.21 Secondary and tertiary mitigation is all other mitigation that has been identified as a result of the impact assessment, to be undertaken on the fixed design scheme. Clarification on when and how the mitigation measures identified in the chapter will be implemented, will be provided. An assessment of any 'residual' magnitude is likewise conducted following the determination of suitable secondary and tertiary mitigation measures.

2.5.22 The subsequent assessment of residual significance identifies the residual environmental effects and concludes on whether residual effects are significant. This is the final stage of the EIA process.

3.0 The Proposed Development

3.1 Introduction

3.1.1 The current development proposals relate to the mixed-use tourism and leisure led development of the application site for the following:

"Outline application for erection of a mixed leisure development comprising Indoor Snow Centre (up to 39,200 sq m), Waterpark (up to 7,500 sq m), Indoor Activity Centre (up to 9,000 sq m), Outdoor Activity Centre, Hotel Accommodation (up to 418 bedrooms), Woodland Lodge accommodation (up to 30 units), car parking (up to 830 spaces) and associated earthworks, access, drainage, servicing and utilities connections/infrastructure."

3.1.2 The proposals include the provision of all cut and fill, slope engineering operations, roads, parking, landscape drainage, servicing and utilities connections/infrastructure and all other associated development necessary to deliver the above elements. The physical characteristics of the proposals are set out on the Outline Masterplan provided at **Figure 1.2.**

3.1.3 The Rhydycar West development proposals seek to create a flagship indoor leisure resort. Indoor snow sports will be one of the anchor attractions at Rhydycar West which will host the Welsh & UK National Centre of Excellence for snow sport and be the training headquarters for the Welsh and UK national and Olympic and Paralympic teams. The resort will be home to a wide variety of indoor and outdoor pursuits including an Indoor Tropical Waterpark and Indoor & Outdoor adventure centres, plus conferencing facilities. Supported by a range of accommodation including Woodland Lodges and a Resort hotel with Sport & Value, Family Resort and Luxury Spa wings – all able to cater for the long and short stay visitor.

3.2 Resort Elements

Indoor Snow Centre

3.2.1 The proposals include a world-class Indoor Snow Centre, which will be the longest indoor multi-run snow centre in the UK and amongst the longest in the world at c.400m. The facility is supported by GB Snowsport and Snowsport Cymru Wales to establish the UK National Centre of Snowsport excellence and home and training base for the Welsh and GB national and Olympic and Paralympic snowsport teams and elite athletes.

3.2.2 The snow centre will be built to FIS (International Ski Federation) specification, enabling the venue to host regional, national, and international competitions together with international team training.

Indoor Tropical Waterpark

3.2.3 The Rhydycar West Waterpark will offer a whole host of the very latest attractions, including thrilling rides and experiences including slides, tubes, a lazy river, a standing wave and surf simulators. This signature element will attract both longer stay holiday makers and day visitors from further afield, offering adventurous and family fun for all ages.

Indoor and Outdoor Adventure Centre

3.2.4 This element will provide dynamic, multi-faceted and immersive indoor and outdoor experiences with the emphasis on activity. Activities under consideration include adrenalin fuelled powered zip wires, climbing / high ropes and immersive thrill-based experiences.

Resort Hotel, Spa and Conferencing Centre

3.2.5 The resort will offer the following three distinct hotel wings to cater for different visitor preferences and budgets. The accommodation offerings will serve as a hub and basecamp for visitors to explore the region and attract all types of visitors from short breaks to longer stays:

- The Family Resort Wing containing up to 198 bedrooms. To include resort reception, conferencing and other guest facilities.
- The Luxury Spa Wing containing up to 100 bedrooms. Incorporating indoor and outdoor fitness and spa facilities.
- The Sport & Value Wing with up to 120 bedrooms. Providing value, comfort, and a more casual and relaxed offering. This will be designed to ensure it appeals to and caters for groups, schools and visiting teams competing or training.

3.2.6 Each of the three offers will include a variety of dining options, as well as back-of-house and plant areas.

Woodland Lodges

3.2.7 Up to 30 free-standing, single-storey woodland lodges are proposed in the south of the site. Providing privacy and a close to nature ambience while still sleeping in comfort. The lodges will be located in existing woodland, creating the perfect setting. Situated away from the main resort area to provide a woodland environment, but just a short distance from all the leisure activities, connected by walking and biking paths providing easy access.

	Use Class	Site Area (ha)	Gross Floorspace /Area (m^2)	Max/Min Length (m)	Max/Min Width (m)	Max/Min Height (m)
Indoor Snow Centre	D2	2.76	39,200	400-424	90-93.5	283.5-287.5m AOD 15m -17m (general height along its length)
Indoor Tropical Waterpark	D2	0.49	7,500	91.3-97	57.2-61.3	203-213m AOD (localised high point for ride tower up to 218m AOD)

	Use Class	Site Area (ha)	Gross Floorspace /Area (m^2)	Max/Min Length (m)	Max/Min Width (m)	Max/Min Height (m)
The Family Resort Wing (c.198 beds)	C1	0.49	15,500	154.8-161.6	25.2-28.5	217.0-224.5m AOD
The Luxury Spa Wing (c.100 beds)	C1	0.13	7,000	39.8-42.8	27-40.3	223.4-231.9m AOD
The Sport & Value Wing (c.120 beds)	C1	0.14	4,900	58.7-31.5	31.5-37.3	209.8-214.8m AOD
Indoor Adventure Centre	D2	0.58	8,700	129.6-134.5	47.5-54.7	206.5-212.5m AOD (with localised high point for rides of 220m AOD)
Outdoor Adventure Centre	D2	1.5	-	-	-	20m max height of zip wire/high ropes poles
Woodland Lodges (up to 30)	C1	3.2	2,300	7.5-13	8	3.5-4.5
Lodge Welcome / Management Buildings:	C1	Included in above	Included in above	15.5-23	12-16.5	4-7
Surface Car Parking (c.650 spaces)	-	1.85	-	-	-	-
Covered Car Parking (c.180 spaces)	-	1.9	8,500	53.5	50.5	201-206m AOD

	Use Class	Site Area (ha)	Gross Floorspace /Area (m^2)	Max/Min Length (m)	Max/Min Width (m)	Max/Min Height (m)
Piazza and landscape approach	n/a	8.9	-	-	-	-
Red line site area (1)	-	30.4	-	-	-	-
Total built area (roads and buildings)	-	-	11	-	-	-
Total built area (incl. banks / ponds etc)			17.3			
SSSI included in site area (2)	-	6.1	-	-	-	-
SINC included in site area	-	30.4	-	-	-	-

(1) The Red line site area will be just under 14% of the land in the control of the applicant, with the remainder retained as countryside.

(2) We have limited the SSSI landtake to 3% of the total SSSI area.

3.3 Construction / Stages

3.3.1 In view of the scale of the Rhydycar proposals, it is anticipated that the delivery of the project will be over a number of years. Details of the construction methodology are set out in Construction Methodology Report at **Appendix 3.1.**

4.0 Reasonable Alternatives

4.1 Introduction

4.1.1 Reg 17(3), Paragraph 2 of Schedule 4 of the 2017 EIA Regulations requires an ES to include;

"A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the applicant which are relevant to the proposed development and its specific characteristics and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects".

4.1.2 The consideration of reasonable alternatives relating to this project began when Marvel Ltd first investigated the development options of their land ownership at Rhydycar West and were put in contact with Snowsports Cymru Wales (SCW) . by the Economic Development department of Merthyr Tydfil Council. SCW had long been seeking a site for an international and world class indoor snow facility that could serve as the headquarters and training centre for the national teams. GB Snowsport also support the development as it will create a UK national centre of excellence for snow sport and training headquarters for the GB Snowsport Olympic and Paralympic teams (see Chapter 5 for copies of letters of support). Both SSW and GB Snowsport have been involved in defining the technical design parameters in terms of requirements for a site to physically and commercially deliver a feasible development.

4.1.3 One of the development's anchor attractions is a world-class Snow Centre, which will be the longest indoor multi-run snow centre in the UK and amongst the longest in the world at c.400m. The facility is supported by GB Snowsport and Snowsport Cymru Wales to establish the UK National Centre of Snowsport Excellence and will be the official home and training headquarters for the Welsh and GB national and Olympic and Paralympic snow sports teams and elite athletes. It will be based on similar successful facilities in Europe, such as SnowWorld at Landgraaf (Netherlands), Neuss (Germany) www.snowworld.com and Alpincenter at Bottrop (Germany) www.alpincenter.com.

4.1.4 The snow centre will be built to FIS (International Ski Federation) specification, enabling the venue to host regional, national, and international competitions together with international team training. Providing a family friendly safe environment with guaranteed perfect piste conditions, 365 days of the year.

In accordance with the IEMA's Good Practice Guidance, various alternative development locations, alternative scenarios on the application site itself and alternative phasing of construction have been investigated as part of the design evolution process.

4.1.5 The consideration of 'alternatives' has been informed by on-going site visits, technical / environmental studies, correspondence with specialist consultees and legislative / planning policy reviews. As a result of this process, the application site has been found to be the preferred location suitable to support a mixed tourism/leisure-led development of the proposed nature, composition and scale required from an engineering, environmental and financial/commercial perspective, subject to further detailed assessment and clarification as part of the EIA process. These are discussed further within this Chapter.

4.2 Alternative Scheme Development

4.2.1 To ensure a comprehensive and robust approach is applied, the following sections consider:

- The 'No Development' Scenario
- Alternative Site Location Options
- Alternative Development Approach Options
- Alternative Phasing Options

4.2.2 Various Court judgements have established the parameters of what is considered to be a 'reasonable alternative.' In respect of the *Friends of the Earth England v The Welsh Ministers* [2015] EWHC 776 (Admin) judgement, albeit in respect of the slightly different SEA regime, Mr Justice Hickinbottom made the following points regarding 'reasonable alternatives':

"88.(v) "Reasonableness" in this context is informed by the objectives sought to be achieved. An option which does not achieve the objectives, even if it can properly be called an "alternative" to the preferred plan, is not a "reasonable alternative". An option which will, or sensibly may, achieve the objectives is a "reasonable alternative"

105. [A]n option which the decision-maker considers "viable … having regard to the full planning context", as suggested by Sales J in Ashdown Forest at [100] is, in my respectful view, also a helpful and appropriate way to characterise "reasonable alternatives";

113. I have set out the scope of "reasonable alternatives", namely they are options which are considered by the decision-maker to be viable in the sense of being capable of meeting the objectives".

4.2.3 The reference to paragraph 100 of *Ashdown Forest Development Ltd v the Secretary of State for Communities and Local Government* [2014] EWHC 406 (Admin) is set out below:

"WDC was only obliged to give an "outline of the reasons for selecting the alternatives dealt with", which in my view it undoubtedly did in chapters 6 and 8 of the Sustainability Assessment. In giving "outline reasons" it was entitled to focus, as it did, on the main reasons why particular alternatives (in particular, Scenarios A and B) were not considered to be viable or attractive having regard to the full planning context– and hence were not "reasonable alternatives" - without descending into great detail to set out each and every aspect of the case or of impediments to adoption of such alternatives."

4.2.4 Given this context, it is useful to set out the objectives of the proposed development, which are as follows:

- To provide an all year round leisure resort with a signature indoor snow centre facility as well as water park and accommodation on a single site and operated as a single facility;

- To provide a Wales and UK national centre of excellence and training headquarters for Welsh and British snow sport including an indoor multi-slope snow centre of c.400m in length with a minimum gradient of approximately 1:5 that is capable of capable of achieving International Ski Federation (FIS) and international standards;
- Indoor snow centre facility capable of hosting international competitions, including para snow sports competitions; and providing the necessary support infrastructure to do so (overnight and working accommodation for athletes and associated coaches, physiotherapists, conditioning and technical teams);
- To have multi-modal accessibility, with good connections to non-car modes of transport as well as to the primary highway network;
- To be within acceptable travel-time of target population by multiple modes;
- To be attractive to public partners willing to participate in marketing and education initiatives;
- To be set within a 'green' and wooded area capable of providing an appropriate natural environment for the snow sports, outdoor leisure and lodges.

No Development Scenario

4.2.5 The EIA process requires the consideration of the likely significant effects based on deviation from the baseline environment.

4.2.6 The following chapters provide a comprehensive assessment of the 'No Development' or 'Do Nothing' scenario (i.e. remaining as per the baseline). In conclusion, the chapters generally conclude that the identified likely significant environmental effects would not occur if the proposed development were not to take place. Notwithstanding this, without the development proposals, there would likewise be no regeneration / socio-economic benefits, no beneficial remediation / 'clean-up' of the coal and highways legacy of the site, no funded maintenance of heritage assets nor improved heritage access on the site and no active and funded ecological management of the local and National ecological designations in, and around the site. Furthermore, the Do Nothing scenario would not achieve the stated objectives for the development and so cannot be considered as a 'reasonable alternative'. In view of this, the alternative 'no development' scenario for the site has been ruled out.

Alternative Site Location Options

Operator Requirements

4.2.7 To comprehend the potentially suitable alternative site location options, it is first essential to understand the basic requirements of the proposals from the operators, Snowsport Cymru Wales and GB Snowsport.

4.2.8 Discussions have progressed with potential experienced operators of the proposed snow-anchored resort that currently operate attractions both in and outside the UK. The operations model will provide an extensive range of leisure, tourism, activity and sporting facilities within a resort complex. The UK has been identified as a key unserved market for this type of indoor snow centre as none exist in the UK. The demand for such a facility in the UK is well evidenced. The UK ski market alone is worth £2.9 billion[1], with around 4 million active skiers – 2 million of which travel abroad for ski holidays on an annual basis. Popular destinations for skiers from the UK include France (55% of trips), Austria (26% of trips), Italy (18% of trips) and Switzerland (13% of trips)[2]. According to the Ski Club of Great Britain[3], average expenditure per head for a week's skiing stands at £1,335, 70% of which is spent on travel, accommodation and passes, with the remaining 30% spent on in-resort entertainment, dining and retail. The Ski Club of Great Britain Consumer Research 2019 study found that the most important non ski related driver for destination was overall travel time. This suggests that having a stronger domestic ski offer could boost the number of domestic visitors. Furthermore, with 77% of travel to ski holidays taken by plane[4], changing travel habits in line with reduced flying as people look to reduce their carbon footprint may also boost a domestic offer. The demand picture is further bolstered by a report by Mintel[5] which surveyed attitudes towards skiing in the UK, which noted that 30% of respondents noted an interest in taking a ski holiday, 25% of which would be interested in taking a snow sports holiday in a trip within the UK. Moreover 33% of people interested in taking a snow sports holiday would like to practice/learn on an artificial/indoor slope in the UK before going. For further information please see the Strategic Economic Benefits Report.

4.2.9 The facility is supported by GB Snowsport and Snowsport Cymru Wales to establish the UK National Centre of Snowsport Excellence and will be the official home and training headquarters for the Welsh and GB national and Olympic and Paralympic snow sports teams and elite athletes. It will be based on similar successful facilities in Europe, such as SnowWorld at Landgraaf (Netherlands), Neuss (Germany) www.snowworld.com and Alpincenter at Bottrop (Germany) www.alpincenter.com. The snow centre will be built to FIS (International Ski Federation) specification, enabling the venue to host regional, national, and international competitions together with international team training. The snow centre itself is estimated to generate c. 750,000 visitors per annum, and will comprise the UK's largest multi-slope and freestyle snow park (including extensive beginners' slopes and children's fun play area).

4.2.10 The proposals will incorporate a hotel resort complex of varying different service levels (i.e. value through to premium) and will comprise on-site restaurants, spa facility and potentially, a location for events. In terms of other leisure facilities, the scheme will provide indoor/outdoor water park and indoor/outdoor activity centre. Likewise, up to 30 woodland lodges are proposed. In total, the proposals are expected to generate a need for 842 Full Time Equivalent

[1] The British Ski Holiday Market, LHM Marketing, 2019.

[2] State of the Snowsports Market Consumer Research May 2022

[3] Ski Club of Great Britain Consumer Research 2019

[4] State of the Snowsports Market Consumer Research May 2022

[5] Mintel UK Skiing and Snowboarding Market Report

employees across the various elements of the resort, and therefore will require a readily available employee base within commuting distance of the elected site.

4.2.11 Notwithstanding the existing provision of snowdomes in and across the UK including Glasgow, Castleford, Manchester, Tamworth, Milton Keynes, Hemel Hempstead and the forthcoming scheme in Swindon, there is not considered to be suitable existing provision to accommodate the Welsh and GB Olympic and Paralympic snow sport team's training requirements and a wider resort complex necessary to deliver the slope viably. None of the existing or proposed facilities can meet FIS standards and requirements nor do they provide suitable ancillary facilities. As such, the prospective operators have sought to identify suitable locations in the UK for the provision of an indoor snow centre to accommodate this identified need.

4.2.12 The facilities considered includes sites in London, Manchester and Edinburgh, all of which had insufficient site size, insufficient maximum slope length and an inability to provide additional resort facilities to provide an attractive year round destination.

4.2.13 Likewise, SCW and GB Snowsport have been seeking a UK base for their training operations due to the extent of their use of indoor facilities in continental Europe (principally at Langraaf in the Netherlands). Travel to Europe for training (especially for extended periods) gives rise to substantial associated costs and stress for able bodied and para sport athletes meaning they have difficulty hitting their 'snow time' targets. The existing facilities within the UK are not comparable to and substantially inferior to those at in Europe which means they are not capable of attractive FIS competitions. An added issue has been UK facilities' inability to provide freestyle jump features, which involve large ramps made of snow. These have proved too heavy to provide at non ground bearing UK facilities. No other sites of a size able to compete with flagship European snow centres have been passed to SCW and GB Snowsport for consideration.

Quantitative and Locational Scheme Parameters

4.2.14 The scheme parameters from a quantitative and locational perspective are set out below:

Essential

- A site of c. 25-30 ha which is available for development within a short timeframe (the need for the facility being now/overdue);
- To be within acceptable travel-time of target population by multiple modes;
- Good connectivity to a train station for onward transit;
- Good links to key major road networks;
- Compatible with neighbouring land uses (i.e. no sensitive neighbours);
- To be co-located or proximate to other 'adventure sports' facilities to allow for linked trips and to benefit from existing customer base profile;

- Favourable topography to support design requirements and configuration of a predominantly ground supported functional ski-slope (i.e. an area with a minimum gradient of approximately 1:5 to accommodate the ski slope);
- Sufficient space and technical specifications to provide an FIS compliant length slope and sufficient ancillary accommodation required to host international events;
- Existing or potential to provide suitable servicing infrastructure requirements (water, drainage, sewerage, electric, gas, telecoms and broadband);

Desirable

- Woodland environment to provide an appropriate natural environment for the snow centre, outdoor leisure and lodge elements;
- Regeneration / socio-economic benefits – a key aspiration is to ensure the proposals offer a range of new skilled and unskilled job opportunities in an area of high unemployment / deprivation;
- Ability to orientate the snow facility building north-south to limit solar gain;
- Sufficient space to provide a slope length of c.400m length.

4.2.15 The resort development necessitates a site physically able to accommodate the following key elements, across c. 25 ha of land:

- Indoor Snow Centre – c. 3.1 ha
- Indoor Tropical Water Park – c. 0.8 ha
- Hotel Accommodation including:
    - The Luxury Spa Wing – 0.8 ha
    - Sports hotel – 0.3 ha
- Indoor Adventure Centre – 0.4 ha
- Outdoor Adventure Centre – 0.6 ha
- Woodland Lodges – c. 8.8 ha
- Associated roads, parking and landscaping – 10.8 ha

4.2.16 In terms of potential site location and form, it is important to address the matter of disaggregation of the land uses proposed. With regard to applying the sequential test in respect of town centre uses[6], there is no requirement to disaggregate different aspects of the proposal, given the importance and complementary nature of such uses to the objectives of the proposed development as a whole. The position regarding disaggregation from a town centre use perspective has been established by various case law and Court decisions. To require disaggregation would fundamentally put into question the feasibility / viability of the proposals.

4.2.17 The correct approach to disaggregation was clarified in February 2012 by the Supreme Court in Tesco Stores v Dundee City Council (Tesco Stores Ltd v. Dundee City Council [2012] UKSC13). While this is a Scottish case, the Judgment has been recognised and applied by the High Court, Secretary of State and Inspectors as being applicable to other UK jurisdictions. The Dundee Judgment identifies that provided the applicant has demonstrated flexibility with regard to format and scale, the question is *"whether an alternative site is suitable for the proposed development, not whether the proposed development could be altered or reduced so that it can be made to fit an alternative site."* (Dundee, paragraph 29).

4.2.18 For a sequentially preferable site to be suitable, it must be *"suitable for the development proposed by the applicant."* The *"whole exercise is directed to what the developer is proposing, not some other proposal which the planning authority might seek to substitute for it which is for something less than that sought by the developer."* (Dundee, paras 24 and 38);

4.2.19 *"to refuse an out-of-centre planning consent on the ground that an admittedly smaller site is available within the town centre may be to take an entirely inappropriate business decision on behalf of the developer."* (Dundee, para 28). Accordingly, the application of the sequential test is *"for use in the real world in which developers wish to operate, not some artificial world in which they have no interest doing so."* (Dundee, para 38);

4.2.20 A subsequent decision, known as the Rushden Lakes decision related to proposals for a mixed use development comprising the erection of a home and garden centre, retail units, drive-thru restaurant, gatehouse, lakeside visitor centre, restaurants, boathouse (full) and hotel, creche and leisure centre (outline) in Northamptonshire. In his decision letter, the Secretary of State (in England) concurred with the Inspector's findings that: *"there is no requirement to disaggregate"* and that *"…it would be inappropriate for a significant part of the Rushden Lakes scheme to be located in Northampton* (paragraph 16). *"The policy concerning the sequential approach... must be applied in a manner which complies with the legally binding case law on the meaning of the sequential approach. Plainly the case in question (Dundee) is of seminal importance"* (paragraph 8.44).

[6] Policy 6 of Future Wales notes that significant (inter alia) commercial and leisure facilities must be located within town and city centres and that a sequential approach must be used to identify the best location. PPW indicates a sequential approach applies to retail and all other uses complementary to retail and commercial centres. Other complementary uses include, for example, hotels (C1) and leisure (D2).

4.2.21 Fundamentally, any main town centre uses such as on site restaurants or gift shop proposed will remain ancillary to the tourism / leisure offer and will not be a destination in their own right. In this regard, it is noted that when considering the Afan Valley Adventure Resort in Croeserw Cymmer for 600 lodges/apartments, 100-bed hotel with spa, central plaza comprising restaurants, leisure activities and shops, adventure activities (including X-sports, alpine/ski, forest activities) and other restaurants (P2018/0493) which was granted on 18 January 2022, a similar position was taken by Neath Port Talbot officers, stating:

"The proposed town centre uses – such as restaurants and cafes, some retail floorspace and a single screen cinema – would be ancillary to the leisure function of the Resort and will not be a destination in their own right".

Alternative Location Search

4.2.22 Investigations have confirmed that there is a clear deficit of indoor snow centre facilities in the South Wales market. Whilst hybrid planning permission was granted in June 2013 for mixed use development within Cardiff International Sports Village, which included the provision of a ski slope measuring c. 75 m high and c. 250 m in length (ref: 12/01861/DCI) (as renewed by virtue of the Section 73 application ref: 16/00006/MJR), the proposals have not yet been delivered to date due to viability concerns. Indeed, the most recent attempt to renew the permission, submitted in 2019 under reference 19/01343/MJR, has stalled and is yet to be determined while Cardiff Council is now consulting on developing the site without the ski facilities, focussing instead on cycling/velodrome provision. Note that this proposed indoor snow centre would not be capable of FIS certification so could not be comparable to the facility being propose at Rhydycar. In comparison, it is considered that the comprehensive nature of the Rhydycar proposals, i.e. including various leisure / tourism elements which underpin the viability will play a key role in securing the delivery of the proposals.

4.2.23 Development of a scheme of this nature has the potential to significant positive economic and reputational effects. Given Merthyr Tydfil's socio economic situation (see Chapter 5 of this ES), it is considered to be a location where the benefits of the scheme could have the biggest positive impact.

4.2.24 Planning policy (Future Wales Policy 6 and LDP Policy EcW3) requires a sequential approach to site selection for a number of the uses proposed by this development whereby locations within the town centre should be considered before out of centre sites are considered. For a town centre site to comply with the sequential approach, it would have to be suitable for the development proposed, allowing for a reasonable degree of flexibility. There is no requirement for disaggregation, as set out above. Even taking a very flexible approach there are no sites which could accommodate even the core elements of the proposed development (leaving aside necessary parking, servicing and landscaping etc) within a town centre location. The snow centre, water park, indoor activity centre and hotel accommodation alone have a footprint of over 4.5 hectares – an area approximately 10% of the area covered by Merthyr Town Centre. No such site exists within Merthyr Town Centre. Furthermore, the site would have to be suitable for the nature and form of the development which, even allowing for flexibility, would have to accommodate the slope required for the FIS standard snow centre and provide an appropriate natural environment for the outdoor leisure and lodges. Given that most town centres tend to

occupy valley floors, rather than the sides of the valley, makes a town centre location inappropriate and unsuitable. All this being the case, no suitable viable and available sequentially preferable site exists.

4.2.25 The Rhydycar West application site is the preferable location for the resort. In summary, the application site:

- Is served by two rail stations (albeit on the same line); Merthyr Tydfil and Pentre Bach (c.1km and c.1.2km distant respectively) and a bus station. A shuttle bus service to Merthyr Tydfil train station, bus station and town centre forms part of the scheme;
- Offers good connectivity to major road networks i.e. A470/A465/M4 corridor;
- Lies close to centres of population and would support the South Wales economy with Merthyr Tydfil lying equidistant to the three main South Wales cities of Swansea, Cardiff & Newport (all within 30-40 miles driving distance) and likewise the central Valleys communities;
- Is of an appropriate size to accommodate an FIS compliant indoor snow centre and all necessary ancillary accommodation and facilities to host competitions and provide a year round resort;
- Has appropriate topography to accommodate the approximately 1:5 slope required for the slopes , albeit with cut and fil being required;
- Is available for development immediately, subject to planning;
- Is compatible with the surrounding land uses and does not raise any concerns regarding impact on sensitive land uses;
- Is set within a green and wooded environment;
- Whilst there are known environmental constraints within and close to the application site (namely the SSSI, SINC and SAMs), the precise red line boundary has been chosen to minimise impact, such that it is considered the impact on such designations can be overcome by virtue of appropriate mitigation and management;
- Lies proximate to Bike Park Wales, South Wales Zip World Tower and Brecon Beacons National Park;
- Will allow for the beneficial remediation of a site with on-site coal mining and highways legacy;
- In view of the most recent findings of the Welsh Index of Multiple Deprivation (2019) which confirms that Merthyr Tydfil has proportionately the second highest proportion of ‘most deprived’ areas in Wales, behind Blaenau Gwent – there exists significant opportunity for the proposals to result in extensive regeneration and socio-economic benefits to the Merthyr Valleys communities, through various means including the creation of new jobs, spin-off investment and trade in existing facilities and services and through community initiatives at the Resort itself. As set out above, this socio-economic regeneration could not be delivered in Merthyr Tydfil town centre.

4.2.26 The proposed indoor now centre development on the Rhydycar West site would address this identified need within South Wales and take advantage of the connectivity to the wider outdoor activity market in the surrounding area.

Alternative Development Options

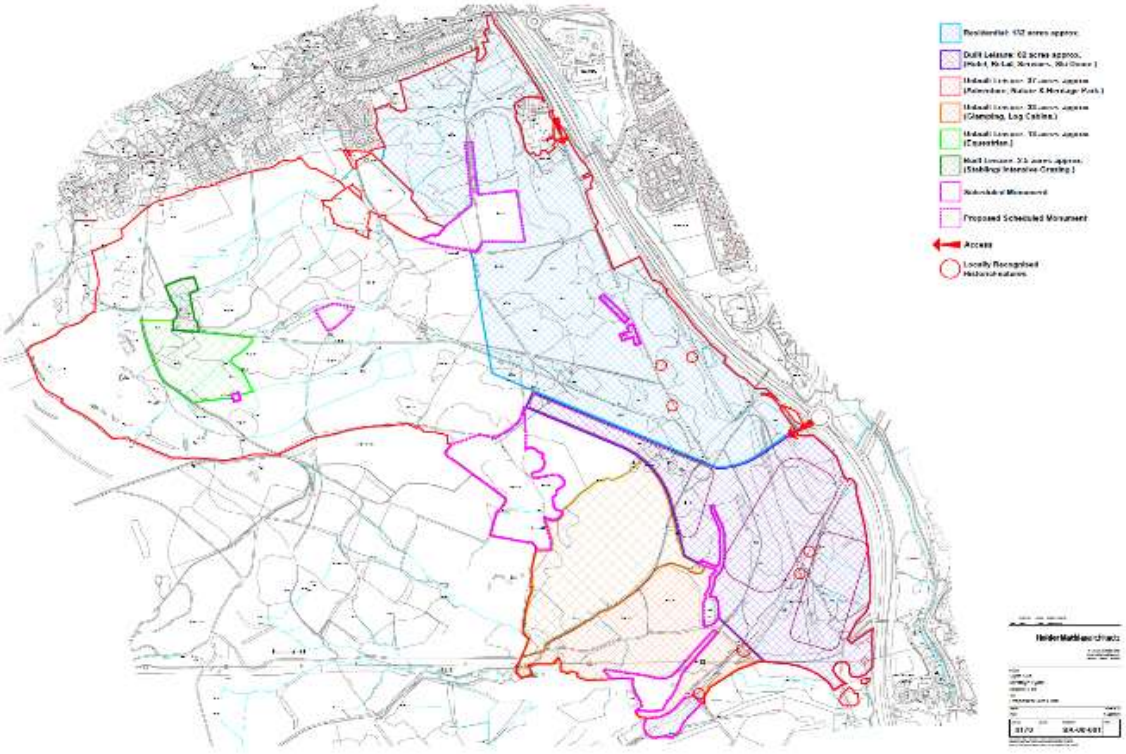
4.2.27 The proposed development scheme parameters have evolved in response to various factors over the years including the prospective operators' commercial requirements, environmental and physical constraints, associated technical studies and the prospective operators' commercial requirements. The following sections set out the alternative development options considered during the course of the design preparation.

Land Use Mix Options

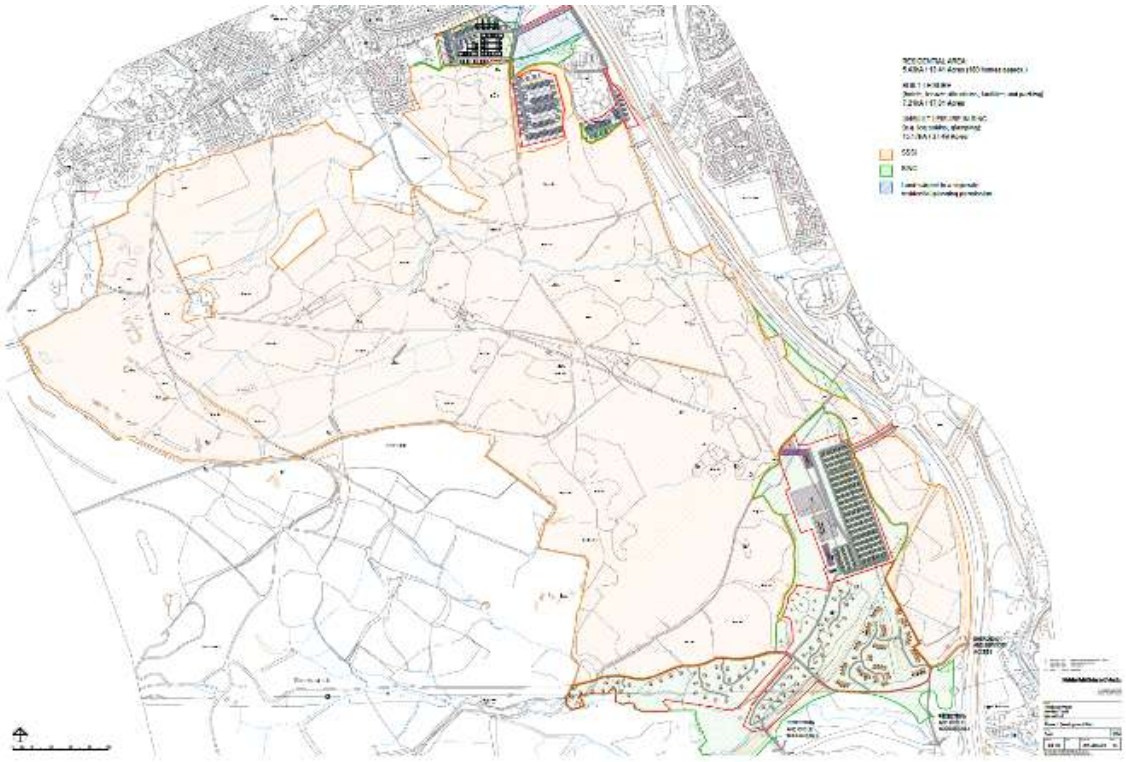
4.2.28 The key design scenarios investigated include:

- **Option A (c.121 ha mixed residential, leisure and retail)** - A pre-application enquiry was made to MTCBC in July 2016 relating to the potential for built leisure (indoor snow centre, hotel, service station, restaurant and other leisure offerings), unbuilt / low density leisure (log cabins, glamping, adventure, nature and heritage park and farm based / equestrian centre), designer retail outlet centre and residential (up to c. 1,335 homes) comprising c. 121 ha of land west of the A470 (ref: PA/16/0068).

  Given the extensive nature of the red line boundary and development area, these initial proposals included a significant extent of the Cwmglo Glyndyrus SSSI, SINC, TPOs and ancient / semi-ancient woodland and concern was raised by the LPA regarding the impact on these environmental elements, as well as Merthyr Tydfil Landscape of Outstanding Historic Interest and nearby Scheduled Ancient Monuments (SAMs);



- **Option B (c. 23 ha tourism / leisure / hotel)** - Based on the commentary received from officers in respect of Option A, the proposals were significantly reduced in terms of lake-take and development area by virtue of a revised design approach forming Option B. A pre-application enquiry was made relating to a reduced area of development comprising two areas including tourism / leisure / hotel uses on land west of the A470/A4120 roundabout and proposed residential development south of Brondeg and south/south west of Upper Colliers Row, Heolgerrig. The LPA sought to separate the two elements, in view of their position that the proposals represented two distinct applications (ref: PA/18/0010 and PA/18/0009).



In respect of the residential, the LPA continued to raise specific concern regarding the perceived impact on the nearby SAM, loss of SINC and protected trees, the perceived failure to provide an adequate buffer to the SSSI, and the unacceptable intrusion into the open countryside. While other residential options were considered, the landowners ultimately took the decision to remove the residential element from the proposals and pursue a leisure / tourism-led scheme only.

- **Option C (layout refinement)** – The composition of the leisure and tourism use forming the resort has expanded as consultation with the prospective operators, Snowsport Cymru Wales and the GB Snowsport developed. The proposals made more intensive use of the land within a smaller site area when compared with the original Option A and the proposed residential element was not pursued. However, scheme refinement continued in respect of:

    - Optimal orientation of a c.400m indoor snow centre and slopes (specifically to best use natural topography to achieve the required gradient, taking into account SSSI and the location of SAMs);

    - Inclusion of earth bund against southern elevation of the indoor snow centre slope to limit solar gain and visual impact;

    - Cut and fill balance and respective levels of development;

- Configuration of hotel offering (separate hotels or separate 'wings' offering differing service levels);
- Size and configuration of parking area and plaza;
- Inclusion of snow sport jump training area;
- Size and location of balancing ponds for SuDS drainage.

4.2.29 A key design challenge for the scheme was to balance the complex requirements for the location of an indoor snow centre of this type and the potential impact of the Cwmglo Glyndyrus SSSI. Both the siting of the development within the wider landholding and the positioning and extent of the Application Site have been configured through numerous design iterations in order that overlap with the designated Cwm Glo a Glyndyrys SSSI is restricted to the absolute minimum necessary. This has seen the quantum of SSSI land affected by the proposed development incrementally reduced over time in order to reduce impacts on the statutory site. Some SSSI land take remains unavoidable, however, in order to deliver the snow centre, as the central focus of the scheme. In total, a direct land take of 6ha of the SSSI is anticipated, which represents a little over 3% of the total land area of Cwm Glo a Glyndyrys SSSI.

4.2.30 The parts of the SSSI affected by the proposed development do not directly contain or support the primary features of special habitat or mycological interest underpinning the designation. Thus, the loss of SSSI land to the development will have little or no impact on the national and international mycological importance of the SSSI, and will not result in the loss from the SSSI designated area of any quantum of the cited marshy grassland, acid grassland or heathland habitats, including those supporting the site's current population of marsh fritillary. Consequently, it is only secondary interest features of the SSSI that will be directly affected, in particular woodland, scrub and 'ffridd' habitats of a type falling outside the scope of the primary interest features

4.2.31 In attempting to limiting the impact of the indoor snow centre on the designated site, the following options have been explored during the design process, these include:

- A bike and skate park, originally part of the scheme, were removed;
- The indoor snow centre was reduced from c.500m to c.400m in length;
- In order to avoid a clash with Black Pins Scheduled Ancient Monument, the indoor snow centre orientation needed to alter slightly to run east-west - 260 degrees in relation to due North - this resulted in an improved relationship with the monument's characteristic tips, whilst still avoiding the most ecologically sensitive parts of the site;
- Inclusion of an earth bund along the indoor snow centre's western elevation, to improve thermal efficiency and reduce visual impact. To conclude this point it was necessary to understand the cut and fill balance of the development. Development levels were adjusted to ensure a cut and fill balance to be achieved (allowing for an earth bund to the south of the ski slope);

4.2.32 Inclusion of a ski jump training facility was briefly considered, comprising a high jump ramp and very large landing 'pillow'. The visual impact of this facility and its impact on the wider area and the development itself has led to this facility not being pursued.

- **Option D (current design approach)** - The proposals continue to make more intensive use of the land within the red line boundary and encompass a less extensive area of the site when compared with the original Option A. Moreover, the site proposed to be developed is notably less environmentally sensitive with the majority of the development falling outside of the SSSI, with the exception of 6ha of the indoor snow centre. The Option D design feasibility concept plans demonstrate that the site was able to deliver all of the elements set out above across 30 ha of land. See further consideration of the Option D design approach below.

4.2.33 As set out above, the design evolution resulted in the decision to pursue Option D, which was deemed to be the preferable option that balanced the removal of the residential element, significantly reduced the original area of development within the SSSI, whilst providing the necessary quantum and mix of leisure / tourism uses to ensure a deliverable scheme.

Key Considerations – Design Options

4.2.34 Further studies and reports were prepared from 2020 onwards to inform the final stages of the design evolution, including:

Access Arrangements The internal roundabout junction previously proposed has been reduced in scale due to the removal of the residential element. The alignment of the access road from the A470 has been refined and non emergency use of the southern access was not pursued due to restricted width and its designation as a bridleway.

Surface Water Drainage has been tested for capacity, including climate change allowance. Drainage solution proposed to prevent scouring/erosion of Cwm Pit Scheduled Monument incorporated.

Sustainable Building Design and Energy Considerations –

4.2.35 Various options have been considered in terms of the energy generation at the site. An on-site heat sharing network was explored and adopted to make use of the waste heat generated cooling the indoor snow-centre to heat the hotel accommodation and site wide hot water (including heated swimming pools). This will significantly reduce the heat waste and operational energy emissions of the Proposed Development. The opportunity was also taken to make use of available rooftop areas for solar PV installation. Rooftop PV is anticipated to further reduce emissions. All measures taken together achieve a 92% reduction in CO2 emissions beyond the 'gas boiler baseline'.

Conclusions

4.2.36 As evidenced above, the final masterplan has been established through a comprehensive iterative design process, balancing the environmental constraints and engineering requirements. Each alternative option considered has been undertaken to ensure the elected design approach is cognisant of the resultant environmental effects and seeks to balance any impacts.

4.3 Summary & Conclusions

4.3.1 The proposed development has evolved over various design iterations, responding to the locational requirements for a development of this type, site constraints and the design objectives to ensure an optimum, viable and deliverable proposal.

4.3.2 For the various reasons presented within this Chapter, the proposals (particularly the specific nature of the proposed tourism / leisure offer) necessitate this site location and design approach. As demonstrated, there are no other reasonable alternatives to the application site and current proposals.,

5.0 Socio-Economics

5.1 Introduction

5.1.1 This Chapter assesses the socio-economic effects of the Proposed Development and the extent to which it conforms to planning policy relevant to socio-economics. The study area is the area over which potential direct and indirect effects of the Rhydycar West project may occur during construction and operation.

5.1.2 The proposed development will support high levels of employment both in the construction and the operational phase. In the construction phase, it is anticipated that 1,549 net (1,414 gross) additional jobs will be supported (1,219 within the Merthyr Tydfil TTWA and 330 outside of the area) per annum for a period of 3 years. In the operational phase, 755 net (842 gross) additional jobs will be supported, of which 594 (663 gross) will be within Merthyr Tydfil TTWA and 161 (179 gross) will be outside of it. This Development therefore contributes strongly to the local, regional and national objectives for employment and economic growth that are related to the scheme.

5.1.3 The above positive impacts of the scheme will be further targeted towards the local Merthyr economy by the developer's additional mitigation commitments, which will be secured through the Section 106 agreement. As outlined in this chapter these will target training and local employment by working alongside Partner Organisations. This is to be imbedded through legally binding obligations to secure recruitment and training opportunities for local residents. Though these impacts have not been quantified, the Section 106 obligations ensure that the positive socioeconomic impacts of the scheme are targeted towards the local economy.

5.1.4 The Proposed Development site falls within Lower Super Output Area (LSOA) W01001312 Merthyr Tydfil 006E (the 'Direct Impact Area'). LSOAs are small geographic areas defined by the ONS. There are 34,753 LSOAs across England and Wales with a minimum population of 1,000 and a maximum of 3,000.

5.1.5 The economic impact of the Proposed Development is considered relative to the Merthyr Tydfil Travel to Work Area (TTWA) – the 'Wider Impact Area' – as this represents the principal labour market catchment area (that is, the area which incorporates the population that may reasonably be expected to travel to and benefit economically from the Proposed Development)[1].

[1] A TTWA is defined by at least 75% of the area's resident workforce work within the area boundary and at least 75% of the people who work in the area also live in the area. It is a statistical tool used by UK Government agencies and local authorities to indicate an area where the population would generally commute to a larger town, city or conurbation for the purposes of employment.

5.2 Methodology and Scope

Policy Background

Future Wales: The National Plan 2040

5.2.1 Future Wales: The National Plan 2040 is part of the development plan and sets out the national development framework and spatial strategy for Wales over the next 20 years. It indicates that the Valleys area is a national growth area where development will be directed, with this area being a high priority for Welsh Government; this should also be a priority for the next tier down in the development plan hierarchy, i.e. South East Wales Strategic Development Plan. Future Wales also notes the need for the Strategic Development Plan to consider the need to spread prosperity across the region and strengthen the foundational economy, with the South East having "potential to build on its tourism offer". Rhydycar West is closely aligned with the priorities set out in Future Wales, having the potential to channel investment and job creation into an area which suffers from relatively high levels of deprivation while strengthening the tourism offer.

Merthyr Tydfil Local Development Plan (2016-2031)

5.2.2 The Local Development Plan (LDP) sets out planning policies and allocates sites for different types of development. It includes a number of strategic objectives which the Rhydycar West project is well-aligned with:

- LDP Objective 4: Regeneration: To promote the suitable reuse of previously developed land and the continued regeneration of local communities.
- LDP Objective 5: Infrastructure: To ensure that community infrastructure and open space supports the regeneration of local communities.
- LDP Objective 9 Heritage and Cultural Assets: To protect, enhance and promote all heritage, historic and cultural assets.
- LDP Objective 12 Economic Development: To provide and safeguard appropriate land for economic and skills development.
- LDP Objective 14 Town and Local Centres: To develop the town and local centres as accessible, attractive, viable and vibrant places.
- LDP Objective 15: Leisure, Recreation and Tourism: To support sustainable tourism, leisure and recreation developments and encourage an all year round tourism industry.

Planning Policy Wales

5.2.3 Planning Policy Wales outlines how the planning system should contribute towards the goals established in Future Wales and sets out the land use planning policies of the Welsh Government. Rhydycar West, as a large scale leisure oriented development, is closely aligned with the focus on Active and Social Places, with Planning Policy Wales noting that Planning Authorities "should indicate the ways in which previously developed or disused land and water bodies can be used for sport and recreation uses, particularly in relation to urban regeneration." Furthermore, Rhydycar West also links to the Productive and Enterprising Places theme which notes the role that tourism can have as a catalyst for regeneration, and that the planning system should encourage tourism where it contributes to economic development, urban regeneration and social inclusion.

Welsh Government Economic Resilience and Reconstruction Mission

5.2.4 The Economic Resilience and Reconstruction Mission sets out how Welsh Government is to address the socioeconomic impact of the coronavirus pandemic, to recover from the economic damage of the pandemic and reconstruct the economy to help its people, businesses and communities to prosper.

5.2.5 The Mission is underpinned by five beacons to help achieve its vision of a well-being economy which drives prosperity, is environmentally sound, and helps everyone realise their potential:

- Strengthening the Foundational Economy
- Protecting and enabling skills and employment
- Accelerating adaptation for recovery and future prosperity
- Magnetising investment in a green recovery
- Fortifying the pursuit of social value

5.2.6 "Strengthening the Foundational Economy" relates to the need to champion and support the sectors that provide the infrastructure of everyday life, such as care and health services, childcare, food, housing, energy, construction, waste and recycling. Tourism, including sporting and recreational activities, has been identified as one of Welsh Government's four priority foundational economy sectors alongside care, retail and food. The Rhydycar West development stands to strengthen the tourism sector through the generation of economic activity and employment. Furthermore, it will also support the retail sector through associated activities on site.

5.2.7 Through "Protecting and Enabling Skills and Employment", Welsh Government aims to support people across Wales into work and to prepare the workforce for the immediate and long-term challenges through access to support, training, higher and further education. The Rhydycar West development stands to create employment opportunities, many of which will be at the entry level, to support young people and adults into the labour market.

Well-being of Future Generations (Wales) Act 2015

5.2.8 The Wellbeing of Future Generations Act provides a broad framework to shape the decision-making process of public bodies, with the aim of improving the social, economic, environmental and cultural well-being of Wales, thereby providing current and future generations a good quality of life. The Wellbeing of Future Generations Act forms a key part of the policies previously outlined as is based around 7 wellbeing goals which provide a shared vision for the public bodies listed in the Act to work towards:

- A prosperous Wales
- A resilient Wales
- A healthier Wales
- A more equal Wales
- A Wales of cohesive communities
- A Wales of vibrant culture and thriving Welsh language
- A globally responsible Wales

5.2.9 The Rhydycar West development aligns with the goal of **A Prosperous Wales** by generating employment opportunities for local residents, thereby allowing people to take advantage of the wealth generated through securing decent work, in turn contributing to **A Resilient Wales**. Such opportunities will be spread across occupation levels, with opportunities for new entrants supporting progression and social mobility, contributing to **A More Equal Wales**. The project will not only generate benefits through tourism but also support participation in sports and recreation which are key focuses of **A Healthier Wales**. The development will include a heritage walking trail, affording access to two scheduled monuments (Cyfarthfa Balance Pond and Leat and Cwm Pit and Head of Railway) and a listed building (the Grade II listed building Base of Chimney at Cwm Pit) all of which are closely associated with Cyfarthfa ironworks and the wider industrial history of the town, aligning with **A Wales of vibrant culture and thriving Welsh language**. Rhydycar West will also develop more **Cohesive Communities** through providing a recreation asset which enables people to become more active, develop positive relationships and reduce isolation. Moreover, providing a world-leading facility within the UK reduces the need for UK residents to travel internationally to access world-class facilities – both at an elite and recreational level – supporting a more **Globally Responsible Wales**, having the potential to make a positive contribution to global environmental wellbeing.

Merthyr Tydfil Economic Growth Strategy

The vision of the Economic Growth Strategy

Merthyr Tydfil County Borough Economic Vision

5.2.10 A substantive economic Vision and deliverable plan was embarked upon by Merthyr Tydfil Borough Council and documented in a prospectus – Merthyr Tydfil County Borough Economic Vision 2020-2053. The Vision recognises the historical socio-economic challenges that resulted from the decline of the area's industrial legacy and most recent further unparalleled socioeconomic challenges as a result of the COVID-19 pandemic. The Vision focuses on seven Core Ambitions of action:

1. Economic Diversity
2. Destination Merthyr Tydfil
3. Education and Training
4. Modern Homes and Great Places
5. Transforming Connectivity
6. Public and Community Services
7. Natural Resources and Low Carbon Economy

5.2.11 Rhydycar West aligns with the "Economic Diversity" core ambition through its ability to generate employment opportunities accessible to local residents, thereby having the potential to increase economic activity rates and to sustain local businesses through the indirect expenditure the project could generate within the wider economy. It will support Destination Merthyr Tydfil by providing a unique, high quality leisure asset within the town which will drive higher domestic and international visitor numbers, generate value and tourism employment in the local economy and complement the wider outdoor adventure tourism businesses and attractions in the local area.

Merthyr Tydfil Destination Management Plan

5.2.12 The tourism sector has become a priority within the Merthyr Tydfil County Borough Council, which is focused on developing its products further and upgrading the existing tourism product. Through its Destination Management Plan, the Council identifies a number of themes that are a key focus in enhancing the profile of the area in relation to tourism one of which is Activity Tourism. The Destination Management Plan Action Plan identifies a number of actions to further develop the activity tourism sector, such as through broadening the development of activity tourism attractions and outdoor providers to enhance the region's offer and exploring new opportunities to develop new and emerging activity products. This links to the Rhydycar

West proposals which will support a year-round, activity-focused attraction and generate high-value tourism opportunities within the local market.

5.2.13 The Merthyr Tydfil Destination Management Plan includes a Heritage and Culture theme, highlighting the engaging and colourful history of the town and, that heritage is key to the tourism economy. Rhydycar West will add several key historic assets of the industrial era to the list of heritage attractions that can be experienced in and around Merthyr which are presently publicly inaccessible. Furthermore, the SWOT analysis within the Destination Management Plan identifies that the local area has weaknesses in relation to no major, high-quality hotel being located in the area and few large-scale indoor attractions, both which Rhydycar West will address.

Welcome to Wales Priorities for the Visitor Economy 2020-2025

5.2.14 The plan sets out the ambitions for the visitor economy in Wales. It aims to balance economic growth with environmental sustainability, social, cultural and health benefits while harnessing the potential for tourism to improve the wider economic wellbeing of Wales. The plan outlines its preferred core offer for tourism in Wales which includes 'innovative, world-leading adventures, events and activities – that bring our post-industrial and natural landscapes to life and promote healthy living for all'.

Key Legislation

5.2.15 The Socio-economic Duty came into force in Wales on the 31 March 2021 by virtue of the Equality Act 2010. It aims to improve the outcomes for those who suffer socio-economic disadvantage, by placing the need to tackle inequality at the heart of decision-making.

5.2.16 Furthermore, the Well-being of Future Generations (Wales) Act 2015 provides a broad framework to shape the decision-making process of public bodies, with the aim of improving the social, economic, environmental and cultural well-being of Wales, thereby providing current and future generations a good quality of life.

5.2.17 The socio-economic assessment presented in this chapter is based upon a range of relevant guidance. This includes:

- HM Treasury (2022) The Green Book – Appraisal and Evaluation in Central Government;
- HM Treasury (2011) The Magenta Book – Guidance for evaluation; and
- Homes & Communities Agency (HCA) (2014) Additionality Guide (4th Edition).
- Department for Business, Innovation and Skills (BIS)[2] (2009) Research to Improve the Assessment of Additionality;

[2] Now the Department for Business, Energy and Industrial Strategy

Assessment Methodology

5.2.18 Where possible, socio-economic impacts have been appraised against relevant standards, such as those provided by HM Treasury and the Homes and Communities Agency. These are UK-level documents that have been used where a Welsh equivalent is not available. Where relevant standards do not exist, professional experience and expert judgement have been applied.

5.2.19 The socio-economic assessment determines the:

- sensitivity of receptors;
- magnitude of impacts; and
- the consequent significance of effects.

Receptor Sensitivity

5.2.20 The sensitivity of socio-economic receptors is assessed as high, medium, low or very low. The socio-economic receptors include those who will potentially benefit from employment generation (either directly, indirectly or induced). The sensitivity of these receptors is considered to be high due to the availability of labour and skills in the local area required for the Proposed Development.

Effect Magnitude

5.2.21 The magnitude of the effects of the Proposed Development is assessed as being high, medium, low or very low. This is determined by:

- extent of change - the absolute number of people affected and the size of area in which effects will be experienced i.e. the level of change to baseline conditions including the proportion of the existing workforce;
- scale of the impact - the relative magnitude of each impact in its relevant market context (for example, the effects on local employment will be considered in the context of the overall size of the local labour market); and
- duration of impact - more weight is given to long-term, permanent changes than to short-term, temporary ones. Temporary to short-term impacts are considered to be those associated with the construction works. Medium to long-term impacts are those associated with the operation of the Proposed Development.

Effect Significance

5.2.22 The effects of the Proposed Development are defined as either:

- beneficial - an advantageous or beneficial effect on an impact area;

- negligible - an imperceptible effect on an impact area; or
- adverse - a disadvantageous or negative effect on an impact area.

5.2.23 Where an effect is assessed as being beneficial or adverse, the effect has been classified as minor, moderate, major or negligible. The assessment of significance is informed by the sensitivity of the receptor and the magnitude of impact as set out in Table 5.1. For the purposes of this assessment, only moderate and major impacts are considered 'significant'.

Table 5.1 Classification of effects

Magnitude of impact	Sensitivity/ importance of receptor			
	High	Medium	Low	Very low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very low	Minor	Negligible	Negligible	Negligible

Limitations of the Assessment

5.2.24 The assessment is based on the available data at the time of writing (and as detailed herein). The Socio-Economic baseline is partly informed by secondary data, which although the most recently available data have been used, it usually suffers a time lag.

5.3 Baseline Environment

Existing baseline

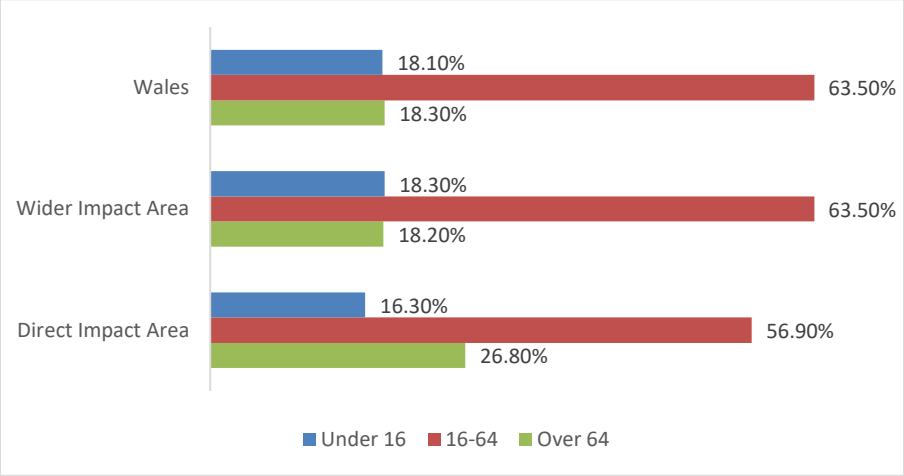
5.3.1 This section outlines the socio-economic baseline conditions in the Direct Impact Area[3], Wider Impact Area[4] and against Wales as a whole. The local population and labour market are the main receptors in the assessment for employment effects. The baseline conditions help to determine the impact of employment generated by the Proposed Development on the local population and labour market. The impact is mostly influenced by the size of the labour market and whether it has the relevant skills, occupations and sector strengths.

[3] As previously noted, the Direct Impact Area is the LSOA in which the proposed development is located

[4] The Merthyr Tydfil TTWA

5.3.2 Direct and Wider Impact Areas are used to provide socio-economic context for the development, and for assessing the socio-economic effects of the scheme. As is common practice for ES Socio-economic chapters, the Direct Impact Area is used to provide specific context for the scheme, specifically using the LSOA it is located in, and the Wider Impact Area is used to assess the area that predominately benefits from employment creation. The 2011 Census data shows that the Direct Impact Area had a population of 1,557 while the Wider Impact Area had a population of 229,136 (ONS, 2011). Chart 5.1 shows that the Direct Impact Area had a lower proportion of young people (aged 0 to 15) than both the Wider Impact Area and Wales. The Direct Impact Area contains fewer people of working age (aged 16 to 64) than the Wider Impact Area and Wales. There is also a higher proportion of residents aged over 64 in the Direct Impact Area than in both the Wider Impact Area and Wales as a whole.

Chart 5.1: Age Structure of Residents

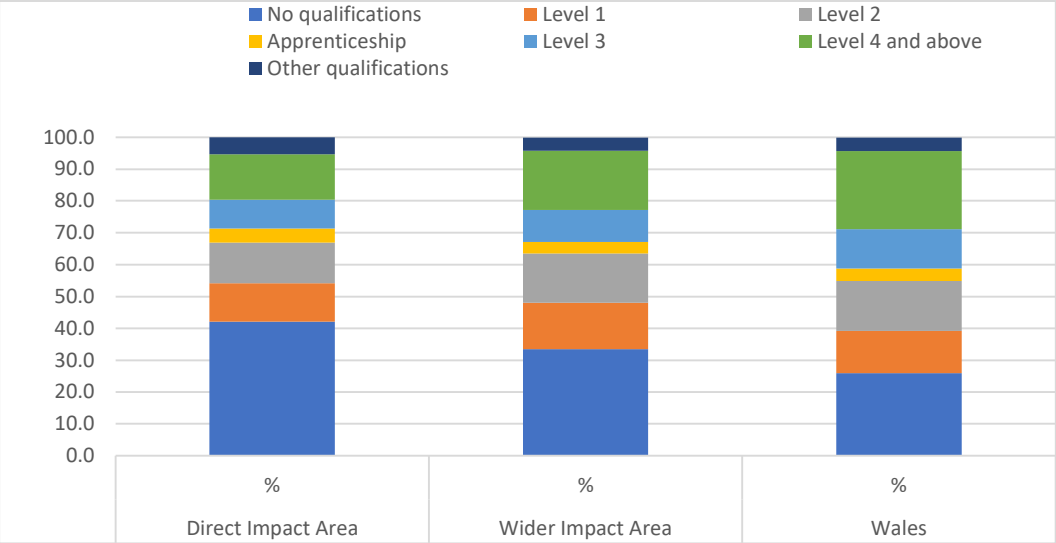


Source: Census (ONS, 2011)

5.3.3 Chart 5.2 shows that the Direct Impact Area has fewer residents qualified to Level 4 and above (14.2%) than the Wider Impact area (18.5%) and Wales as a whole (24.5%). However, there are more residents qualified to Apprenticeship level in the Direct Impact Area (4.4%) than both the Wider Impact Area (3.6%) and Wales (3.9%).

5.3.4 At the other end of the spectrum there are more residents in the Direct Impact Area with no qualifications (42.1%) when compared to the Wider Impact Area (33.5%) and Wales (25.9%). However, there are more residents with other qualifications in the Direct Impact Area (5.4%) than both the Wider Impact Area (4.2%) and Wales (4.3%). These figures are broken down in Chart 5.2 overleaf.

Chart 5.2: Highest level of qualification of residents



Source: Census (ONS, 2011)

5.3.5 Table 5.2 shows that the largest employment sector in the Direct Impact Area is wholesale and retail (including repair of motor vehicles) with 16% of residents employed in the sector, more than in the Wider Impact Area (15.1%) and Wales (15.6%). Other key employment sectors in the Direct Impact Area include human health and social work activities (14.2%), and manufacturing (13.1%).

5.3.6 Sectors that are underrepresented in the local area, compared to wider geographies include Construction and Accommodation and food services. There are likely to be opportunities across these sectors during the construction and operation of Rhydycar West, suggesting the potential to boost activity and employment and build capability across these sectors.

5.3.7 With Merthyr College offering a range of hospitality, sports, leisure and tourism courses, there is an opportunity for Rhydycar West to provide employment opportunities for graduates across these disciplines, as well as training and apprenticeship programmes to develop a talent pipeline through links to the project. Moreover, with the retail outlook uncertain owing to structural changes in the economy, accelerated by the Covid-19 pandemic, there should be opportunities to shift the relative overreliance on retail employment towards other areas of activity associated with the project.

Table 5.2 Employment by Industry

	Direct Impact Area (%)	Wider Impact Area (%)	Wales (%)
Agriculture, forestry & fishing	0	0.6	1.7
Mining, quarrying & utilities	0	0.4	0.2
Manufacturing	13.1	15.2	10.5
Construction	0.5	0.6	0.8
Motor trades	2.2	1.3	0.9
Wholesale	10.7	9.3	8.2
Retail	16	15.1	15.6
Transport & storage (inc postal)	4.2	3.6	3.9
Accommodation & food services	3.6	4.9	6.2
Information & communication	2	1.7	2.3
Financial & insurance	2.2	2.1	3.1
Property	0.5	1.3	1.2
Professional, scientific & technical	1.6	3	4.3
Business administration & support services	4.6	4.2	4
Public administration & defence	8.6	7.5	7.9
Education	10.9	8.8	10.1
Health	14.2	16.7	14.5

	Direct Impact Area (%)	Wider Impact Area (%)	Wales (%)
Arts, entertainment, recreation & other services	4.9	3.9	4.5

Source: Census (ONS, 2011)

5.3.8 Fewer residents aged between 16 and 74 are economically active in the Direct Impact Area (57.2%) than in the Wider Impact Area (62.5%) or Wales as a whole (65.8%). There are also less residents in employment (50.2%) compared to the Wider Impact Area (54.6%) and Wales (58.2%). The percentage of residents who are unemployed (4.8%) is less than in the wider impact area (5.7%) but more than nationally (4.3%). This is broken down in Table 5.3.

Table 5.3: Economic Activity

Economic Activity	Direct Impact Area		Wider Impact Area		Wales	
	No.	% Of Residents (Aged 16-74)	No.	% Of Residents (Aged 16-74)	No.	% Of Residents (Aged 16-74)
In employment	533	50.2	91,932	54.6	1,306,399	58.2
Employee: Part-time	137	12.9	22,411	13.3	313,022	13.9
Employee: Full-time	343	32.3	58,760	34.9	799,348	35.6
Self-employed	53	5	10,761	6.4	194,029	8.6
Un-employed	51	4.8	9,609	5.7	96,689	4.3
Full-time student	23	2.2	3,717	2.2	73,647	3.3

Source: Census (ONS, 2011)

5.3.9 There are more economically inactive residents aged between 16 and 74 in the Direct Impact Area (42.8%) than in the Wider Impact Area (37.5%) and Wales as a whole (34.2%). However, a higher proportion of residents in the Direct Impact Area are retired (19.7%) when compared to the Wider Impact Area (16.8%) and Wales as a whole (16.1%). This is broken down in Table 5.4.

Table 5.4: Economic Inactivity

Economic Inactivity	Direct Impact Area		Wider Impact Area		England	
	No.	% Of Residents (Aged 16-74)	No.	% Of Residents (Aged 16-74)	No.	% Of Residents (Aged 16-74)
Retired	209	19.7	28,223	16.8	361,501	16.1
Student (including full-time students)	60	5.7	7,787	4.6	133,880	6
Looking after home or family	44	4.1	7,215	4.3	86,396	3.8
Long-term sick or disabled	112	10.6	15,647	9.3	140,760	6.3
Other	29	2.7	4,203	2.5	45,894	2

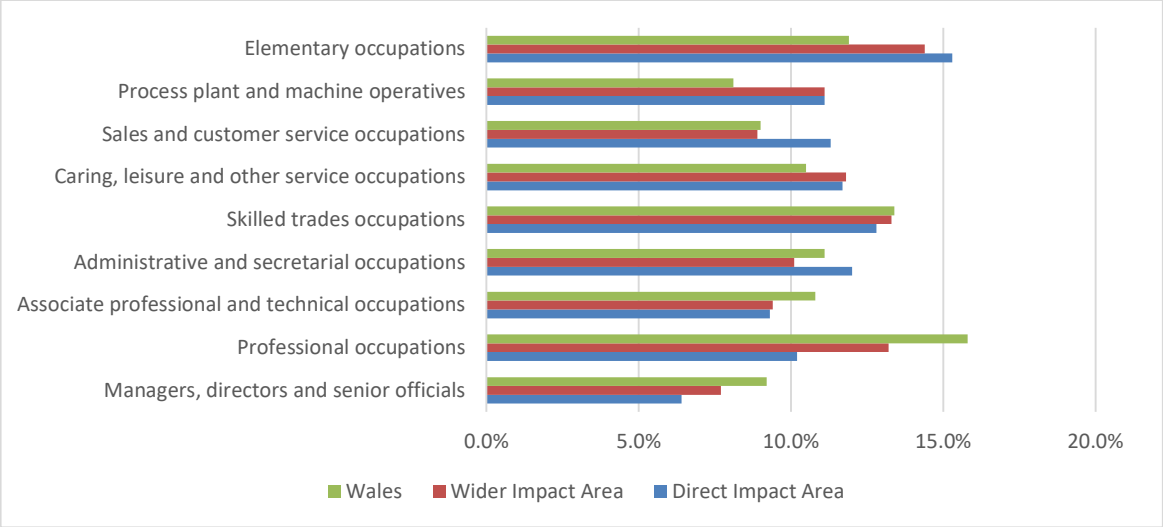
Source: Census (ONS,2011)

5.3.10 As shown in Chart 5.3, elementary occupations[5] dominate the workforce occupations in the Direct Impact Area, with 15.3% of employed residents in this occupation. This is compared to 14.4% in the Wider Impact Area and 11.9% in Wales as a whole. This is followed by skilled trades occupations, and administrative and secretarial occupations. There is a lower frequency of managers, directors and senior officials in the Direct Impact Area (6.0%), and the Wider Impact Area (7.7%) than in Wales as a whole (9.2%). Compared to Wales as whole, the Direct

[5] Occupations classified at this level will usually require a minimum general level of education (i.e. that which is acquired by the end of the period of compulsory education). Some occupations at this level will also have short periods of work-related training in areas such as health and safety, food hygiene, and customer service requirements.

Impact Area is also underrepresented in professional occupations, with 10.2% of residents compared to 15.8% across Wales.

Chart 5.3: Workforce Occupations



Source: Census (ONS,2011)

Deprivation

5.3.11 Deprivation in small areas in Wales is measured by the Index of Multiple Deprivation which ranks every LSOA in Wales from 1 (most deprived area) to 1909 (least deprived area). These are based on seven key measures: 'Income', 'Employment', 'Education, 'Access to Services', 'Community Safety', 'Physical Environment', and 'Housing'.

5.3.12 The Direct Impact Area falls within the 43% most deprived areas in the country based on the overall Index of Multiple Deprivation measure. On the 'Access to Services' domain, the Direct Impact Area is ranked just outside the top third of most deprived areas in Wales (based on this measure). The next most pressing domain is the 'Income' measure, with the area featuring just outside of the 50% most deprived areas in Wales. The best performing domain is the 'Housing' domain, where the area is amongst the 15% least deprived neighbourhoods in Wales.

Local Receptors

5.3.13 The closest residential properties lie within approximately 485m to the east of the Site (Plymouth Street). Other properties falling just outside the direct proximity of the site include properties on Cae'r Wern, approximately 520m to the south east of the site and Graig Road, around 540m to the north of the site.

5.3.14 Two schools are located within direct proximity of the Site (500m). These are Caedraw Primary School and St. Mary's Catholic Primary. Merthyr Tydfil Police Station is also in direct proximity of the Site.

5.3.15 A number of businesses are also located within 500m of the Site. These include Rhydycar Business Park which accommodates Welsh Government offices, the Orbit Business Centre and Enterprising Merthyr (business management consultants). Other businesses within direct proximity of the site include Draig Haulage (freight service), Kabin Hire Ltd., EE contact centre, Amnitec (manufacturing), 'Hire Me' Rental Vehicles, and a collection of car showrooms and associated businesses along Pentrebach Road (Vauxhall, Kwik Fit, Volkswagen, Evans Halshaw Ford, car wash, Topps Tiles).

5.3.16 Leisure and tourism facilities within 1km of the Site include Bike Park Wales, Merthyr Clay Pigeon Shooting Club, Merthyr Tydfil Leisure Village (Merthyr Tydfil Leisure Centre and playing fields, skate park, restaurants (Nando's, Subway, Frankie and Benny's, Harvester, McDonald's), Superbowl, Travelodge, Vue Cinema), The View Camping, Bunkhouse Ty Wern (rental lodge), and Merthyr Rugby Club.

Future baseline

5.3.17 While analysis of the most sought after occupations[6] by claimants of jobseeker's allowance in Direct Impact Area shows no sought after occupations (owing to the small sample size[7]), in the Wider Impact Area the most sought after occupations were Elementary Occupations (39%) and Sales and Customer Service Occupations (31%).

5.3.18 The top four sought after occupations by jobseekers in Wales are Elementary Occupations (46%), Sales and Customer Service Occupations (32%), and Managers and Senior Officials (7%). This shows the similarity of the most sought after occupations in Wales and the Wider Impact Area, with the largest categories being Elementary Occupations and Sales and Customer Service Occupations in both geographies. The rounding of data limits the use of sought occupation analysis for the Direct Impact Area.

5.4 Mitigation within the Submitted Design

Design

5.4.1 There is no mitigation within the submitted design that is relevant to the socio-economic impacts of the scheme.

Construction

5.4.2 There is no mitigation included in the construction of the scheme that is relevant to the socio-economic impacts of the scheme.

[6] ONS Jobseeker's Allowance by occupation – this denotes the occupation being sought by claimants

[7] This does not mean there were zero sought after occupations across all job types but that none of the categories were large enough to warrant appearing within the ONS dataset, given the small sample size. The dataset rounds to the nearest 5 for privacy purposes.

5.5 Likely Significant Environmental Effects of the Scheme

Construction Phase Effects

5.5.1 The Proposed Development will generate temporary jobs during the construction period. The following analysis estimates gross construction employment arising from the Proposed Development and then takes into account deadweight (existing employment on site), leakage, displacement and multiplier effects (to assess indirect and induced employment) in order to assess net impacts on the sub-regional and national economies.

5.5.2 Construction of the Proposed Development is expected to last approximately 2.5 - 3 years. During this time employment opportunities will be created as a result of the works. Although these jobs are temporary, they represent a positive economic impact that can be estimated as a function of the scale and type of construction. The direct expenditure involved in the construction phase will lead to increased output generated in the Merthyr Tydfil TTWA economy.

5.5.3 The estimated number of construction staff has been calculated on the basis of Capital Expenditure being and estimated £255.5m. This is estimated to generate approximately 1,414 construction jobs (gross) on an annual basis during the course of the construction period.

Deadweight

5.5.4 Deadweight refers to the reference case scenario whereby the intervention does not proceed, or is not implemented, otherwise known as a 'do nothing' scenario. In this case, deadweight has been assessed to be 0%, as the site of the proposed development does not support employment uses in its current state. Therefore, in a do nothing scenario, the site remains vacant and unused, and as such, deadweight does not apply to this assessment.

Leakage

5.5.5 Leakage effects refer to the proportion of jobs within an Impact Area that are filled by residents living outside the Impact Area (i.e. outside the Wider Impact Area, defined as the Merthyr Tydfil TTWA). Overall, it is assumed that a large amount of the employment generated will be taken by people living in the Merthyr Tydfil TTWA, but due to the large size of the scheme there is likely to be reliance placed on employment outside of the TTWA area too. In the latest Census data, from 2011, 21.3% of jobs in Merthyr Tydfil were filled by residents from areas outside of Merthyr Tydfil TTWA. A 21.3% discount is therefore applied to the 1,414 gross jobs created and as such it is estimated that 1,113 workers from within the Merthyr Tydfil TTWA and 301 workers from outside the Merthyr Tydfil TTWA will benefit from working at the Proposed Development during the construction period.

Displacement

5.5.6 Displacement measures the extent to which the benefits of a project are offset by reductions of output or employment elsewhere. Any additional demand for labour cannot simply be treated as a net benefit – it removes workers from other posts and the net benefit is reduced to the extent that this occurs.

5.5.7 Overall, it is assumed that due to the flexibility of a typical construction workforce (i.e. they quickly move from project to project) displacement effects are considered to be low. The HCA Additionality Guide suggests 25% as a 'ready reckoner' for low levels of displacement (i.e. there are expected to be some displacement effects, although only to a limited extent). Applying this level of displacement to total gross direct employment results in net direct employment of 1,061, including 835 net direct jobs in the Merthyr Tydfil TTWA.

Multiplier Effect

5.5.8 In addition to the direct construction employment generated by the project itself there will be an increase in local employment arising from indirect and induced effects of the construction activity. Employment growth will arise locally through manufacturing services and suppliers to the construction process (indirect or supply linkage multipliers). Additionally, part of the income of the construction workers and suppliers will be spent in the Merthyr Tydfil TTWA, generating further employment (induced or income multipliers).

5.5.9 The impact of the multiplier depends on the size of the geographical area that is being considered, the local supply linkages and income leakage from the area. Previous research from BEIS provides 'ready reckoners' of composite multipliers – the combined effect of indirect and induced multipliers. As the construction is for a capital project, a multiplier of 1.46 has been determined from the BEIS guidance. Applying this multiplier generates an additional 488 indirect and induced jobs, of which 384 are in the Merthyr Tydfil TTWA.

5.5.10 Based on the gross construction worker requirements in the construction schedule and the additionality factors outlined above 1,549 net construction jobs would be generated, of which 1,219 are expected to be from the Merthyr Tydfil TTWA. This represents a significant proportion of the existing employment in the direct impact area. Therefore, construction employment generated by the Proposed Development would have a significant effect on the local economy.

5.5.11 The following summarises the additionality figures that are used for estimating the operational employment as a result of the intervention.

Table 5.5: Additionality factors for construction employment

Additionality Factor	Merthyr Tydfil TTWA level	Rationale
Deadweight	0%	The site of the proposed development does not support employment uses and therefore deadweight is set at 0%.
Leakage	21.3%	Average leakage based on number of local jobs taken by residents within the TTWA (Census 2011).
Displacement	25%	In line with the latest census data from 2011. This shows that 78.7% of jobs in The Merthyr Tydfil TTWA are taken by Local residents.
Multiplier effects	1.46	In line with the mean benchmark composite multiplier for capital projects at the sub-regional level as set out by BEIS.

5.5.12 Table 5.6 presents the short-term employment created by the Proposed Development taking leakage, displacement and multiplier effects into account.

Table: 5.6 Net construction employment in Merthyr Tydfil TTWA (average no. of workers onsite per year)

Construction Employment	Merthyr Tydfil TTWA	Outside Of Merthyr Tydfil TTWA	Total
Gross Direct Employment	1,113	301	1,414
Displacement	278	75	353
Net Direct Employment	835	226	1,061
Net Indirect/ Induced Employment	384	104	488
Total Net Employment	**1,219**	**330**	**1,549**

5.5.13 The sensitivity of receptors is considered as high, given that employment is a key policy priority in Merthyr Tydfil, due to the recent closure of key companies[8] and higher levels of economic inactivity recorded locally. Taking into account the size of the labour pool of construction workers in the Merthyr Tydfil TTWA (5,000, according to the latest data from BRES in 2020), the magnitude of impacts is considered to be high. For example, the gross direct employment required during the construction phase of the Proposed Development would account for around 24.4% of the existing construction workforce in the Merthyr Tydfil TTWA. Therefore, the direct, indirect and induced employment created by the construction phase of the Proposed Development is likely to have a *major beneficial short-term* (significant) effect on the TTWA's economy.

Operational Phase Effects

5.5.14 The Proposed Development will also generate long-term jobs once operational. The following analysis estimates gross operational employment arising from the Proposed Development and then takes into account deadweight (existing employment on site), leakage, displacement and multiplier effects (to assess indirect and induced employment) in order to assess net impacts on the sub-regional and national economies.

5.5.15 The Rhydycar West development will generate employment across the various leisure-focused elements of the scheme. It is estimated there will be a total of 842 FTE gross operational jobs created by the Proposed Development. These jobs will be required for the leisure elements of the scheme, and for the accommodation, food and retail elements. The assumptions behind these gross operational jobs are as follows:

5.5.16 Leisure Elements – Operational employment has been estimated for the Indoor Snow Centre based on forecasts from existing leading indoor snow centre operators with many years of experience. The employment for the Tropical Water Park and Indoor and Outdoor Adventure Centre has been estimated using payroll forecasts from the Rhydycar West team and average gross annual salary data for the Merthyr Tydfil TTWA from ONS Annual Survey of Hours and Earnings.

5.5.17 Accommodation, food and retail elements – Operational employment has been estimated for the Hotels, Lodges, Retail and Food and Beverage elements by applying employment density benchmarks from the HCA Employment Density Guide 3rd Edition to the floorspace/number of bed spaces associated with these elements from the Rhydycar West Masterplan.

Deadweight

5.5.18 As in the scenario for construction employment, deadweight has been assessed to be 0%, as the site of the proposed development does not support employment uses in its current state. Therefore, in a Do Nothing scenario, the site remains vacant and unused, and as such, deadweight does not apply to this assessment.

[8] The town has seen a number of business closures, with companies including Debenhams, Kasai and Triumph Furniture, with Wilko set to follow suit

Leakage

5.5.19 Leakage assumptions for operational employment rely on the same Census data as for construction employment. In the latest Census data, from 2011, 21.3% of jobs in the Merthyr Tydfil TTWA were filled by residents from areas outside of the TTWA. Therefore, leakage is assessed to be 21.3%. It is then estimated that 179 people from outside the Merthyr Tydfil TTWA and 663 persons from within will benefit from working at the Proposed Development during the operational phase.

Displacement

5.5.20 For the intervention, the uses (A1, A3, C1 and D2) associated with the development are subject to displacement, as outlined in the MHCLG Appraisal Guide. However, Merthyr Tydfil has spare capacity in the labour market with unemployment higher than regional/national comparators. As such, a low to medium value of 35% is adopted, based on guidance within HCA Additionality Guide 4th Edition. Applying this level of displacement to total gross direct employment results in net direct employment of 547, including 431 net direct jobs in the Merthyr Tydfil TTWA.

Multiplier Effect

5.5.21 Employment growth will arise locally through recreational services (indirect or supply linkage multipliers), and part of the income from employment at the site will be spent locally in the Merthyr Tydfil TTWA, generating further employment (induced or income multipliers).

5.5.22 The impact of the multiplier depends on the size of the geographical area that is being considered, the local supply linkages and income leakage from the area. The HCA additionality guide provides estimates for multiplier effects in line with the mean benchmark composite multiplier for recreation as set out in HCA Additionality Guide 4th Edition. Applying this value of 1.38 generates an additional 208 indirect and induced jobs, of which 164 are in the Merthyr Tydfil TTWA.

5.5.23 The following summarises the additionality figures that are used for estimating the operational employment as a result of the intervention.

Table 5.7: Additionality factors for operational employment

Additionality Factor	Merthyr Tydfil TTWA level	Rationale
Deadweight	0%	The site of the proposed development does not support employment uses and therefore deadweight is set at 0%.
Leakage	21.3%	Average leakage based on number of local jobs taken by residents within the TTWA (Census 2011).
Displacement	35%	The uses (A1, A3, C1 and D2) associated with the development are subject to displacement, as outlined in the MHCLG Appraisal guide. However, Merthyr Tydfil has spare capacity in the labour market with unemployment higher than regional/national comparators. As such, a low to medium value of 35% is adopted, based on guidance within HCA Additionality Guide 4th Edition.
Multiplier effects	1.38	In line with the mean benchmark composite multiplier for recreation as set out in HCA Additionality Guide 4th edition.

5.5.24 It is anticipated there will be 842 gross operational jobs as a result of the Proposed Development. Once the additionality factors are applied to the gross figure, it is estimated that there will be 755 total net operational jobs created, with 594 of these jobs filled by Merthyr Tydfil TTWA residents and 161 being outside the Merthyr Tydfil TTWA.

Table 5.8: Net employment of the Proposed Development in operation

Operational Employment	Merthyr Tydfil TTWA	Outside Of Merthyr Tydfil TTWA	Total
Gross Direct Employment	663	179	842
Displacement	232	63	295
Net Direct Employment	431	117	547
Net Indirect/ Induced Employment	164	44	208
Total Net Employment	**594**	**161**	**755**

5.5.25 Overall, the direct, indirect and induced employment created by the permanent employment at the site is likely to have a *high, beneficial long-term impact* on the local and regional economy.

5.5.26 The sensitivity of receptors is considered as high[9], and the magnitude of impacts is also considered to be high. For reference, the 594 net additional employment opportunities created within the Merthyr Tydfil TTWA would represent 0.6% of total employment in 2020 (BRES, ONS). It is expected that the direct, indirect and induced employment created by the operational phase of the Proposed Development is likely to have a major beneficial (significant) effect on the TTWA's economy, across a wide-ranging number of sectors, including retail, hospitality and leisure sectors.

5.6 Additional Mitigation, Compensation and Enhancement Measures

5.6.1 No significant adverse effects are predicted during the construction, maintenance, operation and decommissioning of the Proposed Development, and as such no specific mitigation is required, over and above that stated in the other technical chapters of this Environmental Statement, to avoid or minimise the socio-economic effects identified in this chapter.

5.6.2 However in order to ensure the proposal has the maximum positive effect in terms of social value, the applicant will enter into the following legally binding obligations to secure local recruitment and training opportunities:

- Prior to the commencement of development, the Developer will submit a schedule of likely employment and training opportunities at the Site and a list of appropriate Partner Organisations to be consulted on each opportunity (such as Tydfil Training, Merthyr College, the Council, the local Job Centre Plus, Local Schools, Colleges and Training providers, Careers Wales).

- The Developer will work in partnership with the appropriate approved Partner Organisations in the recruitment of Local Candidates to employment and training opportunities arising at the Site by using reasonable endeavours to take the following steps:

    - supplying to the appropriate approved Partner Organisations a job description and person specification in relation to any employment opportunity and a training description in relation to any training opportunity advertised generally at the Site;

    - not advertising generally any employment opportunity or training opportunity in relation to the Site unless the appropriate approved Partnership Organisations have been given the chance to nominate Local Candidates for the opportunity;

[9] Given that employment is a key policy priority in Merthyr Tydfil, due to the recent closure of key companies[9] and higher levels of economic inactivity recorded locally, as previously set out

- Interviewing those Local Candidates identified by the appropriate approved Partnership Organisations that the Developer considers to be job or training ready and who meet the requirements of the person specification and the job description;

- Providing feedback to the appropriate approved Partnership Organisations in relation to Local Candidates who were interviewed and were unsuccessful or who were trained and were not successful in obtaining employment with the Developer.

5.6.3 These additional mitigation measures, secured through the Section 106 agreement, are intended to ensure that the positive economic impacts of the development are targeted towards the local economy of Merthyr. These include keeping jobs local by ensuring a route to train and recruit local residents. The impact of these additional measures is not able to be quantified but there is clear evidence that such mitigation does work to maximise economic benefits to the local area.

5.7 Assessment Summary and Likely Significant Residual Environmental Effects

5.7.1 It is considered that the Proposed Development will have a highly significant positive impact on the Merthyr Tydfil TTWA economy, through the provision of employment during construction and operation and through associated multiplier effects.

5.7.2 The creation of employment opportunities during both the construction and operation phases of the Proposed Development supports the objectives set out in national plans, such as “Future Wales: The National Plan 2040” and “Welcome to Wales: Priorities for the Visitor economy 2020-2025”. It does so by supporting the national tourism sector through providing a key new source of employment, thereby supporting regional economic growth in Merthyr Tydfil. The creation of employment through the Proposed Development also supports local objectives, such as through the Merthyr Tydfil Economic Growth Strategy. The Development contributes to the joint aims of creating a skilled, flexible, well-paid workforce, and supporting a labour market with employment opportunities, with the Section 106 obligations on offer ensuring that the economic benefits are targeted towards the local economy of Merthyr.

5.7.3 Nevertheless, in addition, the Proposed Development would have further positive effects on surrounding neighbourhoods and the wider area. The scale of the Proposed Development implies the likely generation of ‘catalytic’ effects - intangible benefits, such as the creation of a better local physical and economic environment, which could lead to a step-change in the level of investment. The developer will also work with the operator in order to encourage adoption of preferential rates and tariffs for local residents at appropriate periods during the week in order to further promote the benefits of the development in the local area.

5.7.4 The residual effects associated with the Proposed Development are assumed to be non-applicable in this case. As employment is generated from the Development, no mitigation is required for other negative effects, and as such, the scheme is unaffected by any residual effects.

5.8 Cumulative impacts

5.8.1 From a review of likely forthcoming developments, there have been no schemes identified as potentially resulting in cumulative impacts, when taken into consideration with the Proposed Development.

5.9 Summary

5.9.1 The proposed development will support high levels of employment both in the construction and the operational phase. In the construction phase, it is anticipated that 1,549 net (1,414 gross) additional jobs will be supported (1,219 within the Merthyr Tydfil TTWA and 330 outside of the area) per annum for a period of 3 years. In the operational phase, 755 net (842 gross) additional jobs will be supported, of which 594 (663 gross) will be within Merthyr Tydfil TTWA and 161 (179 gross) will be outside of it. This Development therefore contributes strongly to the local, regional and national objectives for employment and economic growth that are related to the scheme.

5.9.2 The above positive impacts of the scheme will be further targeted towards the local Merthyr economy by the developer's additional mitigation commitments, which will be secured through the Section 106 agreement. As outlined in this chapter these will target training and local employment by working alongside Partner Organisations. This is to be imbedded through legally binding obligations to secure recruitment and training opportunities for local residents. Though these impacts have not been quantified, the Section 106 obligations ensure that the positive socioeconomic impacts of the scheme are targeted towards the local economy.

Table 5.9 Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
1,549 net (1,414 gross) additional jobs will be supported (1,219 within the Merthyr Tydfil TTWA and 330 outside of the area) per annum for a period of 3 years.	High	High	Highly significant, positive temporary construction employment	None	Not applicable	Not applicable	High – Employment numbers are based on robust estimates from the Strategic Benefits report
Operation							
755 net additional jobs (842 gross) will be supported, of which 594 will be within Merthyr Tydfil TTWA and 161 will be outside of it	High	High	Highly significant, positive permanent operational employment	None	Not applicable	Not applicable	High – Employment numbers are based on robust estimates from the Strategic Benefits report

5.10 References

Ref 1 MHCLG, (2021); National Planning Policy Framework

Ref 2 Welsh Government, (2021); Future Wales: The National Plan 2040

Ref 3 Welsh Government, (2021); Planning Policy Wales

Ref 4 Welsh Government, (2021); Welcome to Wales Priorities for the Visitor Economy 2020-2025

Ref 5 Merthyr Tydfil County Borough Council, (2016); Merthyr Tydfil Local Development Plan

Ref 6 Merthyr Tydfil County Borough Council, (2016); Merthyr Tydfil Economic Growth Strategy

Ref 7 Department for Business, Innovation and Skills (BIS), (2009); Research to Improve the Assessment of Additionality

Ref 8 HM Treasury, (2011); The Green Book – Appraisal and Evaluation in Central Government

Ref 9 HM Treasury, (2011); The Magenta Book – Guidance for evaluation

Ref 10 Homes & Communities Agency (HCA) (2014); Additionality Guide (4th Edition)

Ref 11 ONS, (2011); 2011 Census

Ref 12 MHCLG, (2019); Index of Multiple Deprivation

Ref 13 ONS, (2020); Business Register and Employment Survey

6.0 Greenhouse Gas Emissions and Climate Change

6.1 Executive Summary

6.1.1 This Environmental Statement chapter reports the outcome of the assessment of likely significant environmental effects arising from the Proposed Development in relation to greenhouse gas emissions (GHG) and climate change. This specifically includes embodied carbon of construction, tree felling, traffic-related emissions and carbon dioxide emissions from the operation of the project. In addition, the assessment outlines the mitigation measures required to avoid, prevent, reduce or offset any potentially significant adverse effects.

6.1.2 All calculations were carried out in accordance with Regulation 17(3) of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. An estimate, by type and quantity, of expected GHG emissions, generated during the construction and operational phases, were produced based on the available environmental information and scientific knowledge for the following:

- Impacts of the Proposed Development on the nature and magnitude of GHG emissions;
- Impacts of the Proposed Development relevant to adaptation in a changing climate; and
- Impacts of the Proposed Development associated with its vulnerability to climate change.

6.1.3 Where the effects resulting from any potential changes caused by the Proposed Development have been deemed to be significant, a description of the measures envisaged to mitigate any identified significant adverse effects on the environment are set out, in the context of the following:

- Climate change mitigation (i.e. measures implemented in the design of the Proposed Development to avoid, prevent, reduce or offset GHG emissions);
- Climate change resilience & adaptation (i.e. measures implemented to future-proof the Proposed Development and adapt to the anticipated impacts of a changing climate).

6.1.4 To determine the anticipated impacts of the Proposed Development, they were measured against an existing baseline, following the IEMA (Institute of Environmental Management and Assessment) methodology for GHG emission assessments [1].

Summary of key findings, strategies and outcomes

6.1.5 The Applicant, in response to the climate emergency, is seeking to achieve net zero carbon for the Proposed Development for embodied construction, operational emissions and transport emissions.



6.1.6 Suitable methodologies will be reviewed and adopted, where appropriate, to achieve this. An example, for the building emissions (i.e. not including transport emissions) is the UK Green Building Council (UKGBC) Net Zero Carbon (NZC) Framework that is an industry recognised approach to achieve NZC for the built environment. The framework aims to reduce, mitigate and offset emissions for construction and operational energy separately.

6.1.7 Below provides a summary of the embedded and additional measures that have been considered as part of the assessment, demonstrating that the Proposed Development will be designed, constructed and used to be a sustainable addition to the local area. Strategies and considerations that will be employed as well as projected outcomes are summarised below:

Embodied carbon during construction:

- The Proposed Development will adopt Circular Economy Principles during detailed design to ensure that the specification of low carbon technologies are prioritised.
- Preference for local suppliers (within Merthyr Tydfil or Wales, also see ES Chapter 5 Community & Socio-Economic) to shorten the supply chain and reduce its associated environmental footprint coupled with prioritisation of responsibly sourced goods and services where feasible whilst maximising the proportion of recycled content within materials used in construction.
- Detailed consideration on the placement of the Proposed Development within the site to minimise its impact on the site's ecology.
- Position of the buildings and structures so to minimise the number of trees that need to be felled.
- Key materials extracted as part of the enabling works to be re-used and/or recycled in accordance with the waste hierarchy giving priority to on-site uses where practical.
- Manage all waste materials during the construction phase in accordance with the construction waste management practices outlined in the Site Waste Management Plan. Facilitate this objective by providing training for site personnel regarding the correct disposal of materials.
- Procure energy efficient construction plant reflecting the latest technology advances.
- Monitor energy, water and waste data during the construction stage to encourage transparency and accountability.
- All waste generated during construction to be diverted from landfill (where technically feasible).
- Explore the potential for low carbon construction materials and techniques, such as timber frame and offsite manufacture, which can help reduce the embodied impact of construction.
- To be considered a zero-carbon development, in line with the UKGBC approach previously mentioned, residual emissions from the construction stages can be offset via recognised initiatives.

Transport emissions during construction:

- Identifying materials that can be procured and sourced locally.
- Coordinating movement of products to reduce number of trips to site.
- Employment of local workforce, where possible.

- Producing and implementing a site waste management plan that follows circular economy principles to reduce the need for movement of waste from the site wherever possible.

Emissions from operational energy demand:

- The Applicant will adopt a verified green tariff so that zero emissions are achieved from day-1 of operation.
- An "all-electric" approach to the Energy Strategy will be adopted to enable the development's operational emissions to continue to decarbonise over its lifetime through decarbonisation of the National Grid.
- Optimisation of photovoltaic (PV) panels throughout the site, in combination with biodiverse roof and plant space will provide green energy to supply the "all electric" approach. It is estimated that the indicative PV area identified (approx. 18,000m^2 panel area) could provide 2,700 MWh/yr. of green energy alone which is approximately 10% of the annual regulated energy demand for the site.
- Waste heat will be captured from cooling systems so it can be used to offset heating demand throughout the site via an ambient heat-sharing loop network, utilising Air Source Heat Pumps to supply the buildings' demands. In particular, this heat exchange system will enable excess heat from cooling the Indoor Snow Centre to be used to heat the Indoor Water Park.
- For all energy that is required for the operations of the development, the Energy Strategy is projected to achieve a ~92% reduction in energy demand and therefore a ~92% reduction in regulated emissions compared to the Part L 2022 Wales notional building.
- The approach to Energy Strategy for the Proposed Development has been to provide an appraisal of the anticipated energy requirements and CO_2 emissions that could arise as a result of the Proposed Development through the use of energy data benchmarks of similar buildings. These building energy data benchmarks have been produced using Part L calculation methodology. The energy requirements for the Indoor Snow Centre component of the site have been estimated based on energy usage totals from similar existing facilities.
- The proposed Energy Strategy that has been developed for the site follows the Energy Hierarchy approach (i.e. Be Lean, Be Clean, Be Green).
- Following a fabric first approach, energy demand will be reduced from high specification of building fabric, high efficiency mechanical ventilation with heat recovery, and reduce the need for artificial lighting through appropriate glazing sizing and location.
- Waste heat will be captured from cooling systems so it can be used to offset heating demand throughout the site via an ambient heat-sharing loop network, utilising Air Source Heat Pumps to supply the buildings' demands. In particular, this heat exchange system will enable excess heat from cooling the Indoor Snow Centre to be used to heat the Indoor Water Park.
- Full details on the proposed Energy Strategy can be seen in the Submitted Energy Strategy.

Transport emissions in operation:

- The transport emissions in operation contribute to the majority of the overall emissions of the Proposed Development due to the anticipated travel patterns and distances travelled of visitors of the site.

- Estimated emissions have been based on current and predicated travel patterns which also consider modes of transport.
- As the Proposed Development consists of a world-class leisure resort attraction, it is expected that visitors will be travelling from national locations in addition to local movement that would be expected for developments such as residential or offices.
- Considering this, the level of direct mitigation measures that can be applied as a result of the proposed design as the resultant emissions will depend on behaviour patterns of the visitors for how they choose to travel.
    - It is expected that should all measures, including secondary (e.g. the forecasted increase of uptake of EV cars by ~43% by 2030) are implemented, the expected impact from transport during operations could be reduced to low over the development lifetime.

6.1.8 To support positive behaviours in relation to sustainable travel, the following measures will be implemented:

- Extensive provision of electric vehicle (EV) charging bays, which can be partially offset by the onsite PV array, to support visitors using EV private vehicles. The proposed offerings have also considered the expected increased uptake of EV use by the general public over the building's lifetime by including passive charging bays (i.e. infrastructure available from day-1 with the exception to the physical chargers) to enable 100% of parking to be EV charging should demand increase.
- Ensure public realm strategy incorporates existing and proposed cycling and pedestrian routes to the site.
- Provide safe and secure cycle storage provision for site users.
- Provide appropriate signage and information on local public transport, cycle and pedestrian routes to encourage the use of sustainable modes of transport.
- Implement dedicated sustainable transport modes, specifically by running a shuttle bus from the Proposed Development to key destinations in Merthyr including the rail station, bus station and town centre.

6.1.9 Additional measures are measures that have not been included within the assessment as they are planned outside of the Proposed Development design. However, if implemented they will also have a positive impact on transport emissions and will reduce such emissions. The Additional measures considered are as follows:

- The proposed South Wales Metro will provide an integrated network of bus, rail and active travel to make sustainable travel easier across South Wales. The works will include electrification of railway infrastructure, replacement of trains and improving facilities at existing station.
- Increased uptake in use of EV vehicles for private travel (forecast to be 43% increase by 2030).
- Increased uptake in use of public transport modes to travel to and from the site.

Considerations for emissions reduction and methodology

Approach to net zero carbon

6.1.10 The Applicant, in response to the climate emergency, seeks an approach to achieve net zero carbon for the Proposed Development for both embodied construction and operational emissions. Suitable methodologies will be reviewed and adopted, where appropriate, to achieve this. An example of this is the UK Green Building Council (UKGBC) Net Zero Carbon (NZC) Framework that is an industry recognised approach to achieve NZC for the built environment. The framework looks to reduce, mitigate and offset emissions for construction and operational energy separately, as shown in

6.1.11

6.1.12

6.1.13 Figure 6.1 below.

6.1.14 The illustrative graph in provides an overview of whole life emissions associated with a building. Embodied carbon occurs during the construction period, i.e. before day 1 of operation, and then proceeds to have additional emissions where maintenance and/or replacement works are required, whereas operational emissions occur from day 1 of occupancy to end of life. In the case of an all-electric building services strategy, as is proposed for this site, the resultant emissions benefit from ongoing decarbonisation of the National Grid. Furthermore, the Applicant will procure an approved, green utility tariff, so that all these emissions will be carbon neutral from day 1.

6.1.15 Therefore, there is a methodology and approach that could be adopted to allow the Proposed Development to achieve Net Zero Carbon Emissions in relation to the associated construction (i.e. building materials) and building operation phases which will be reviewed and refined further during the detailed design.

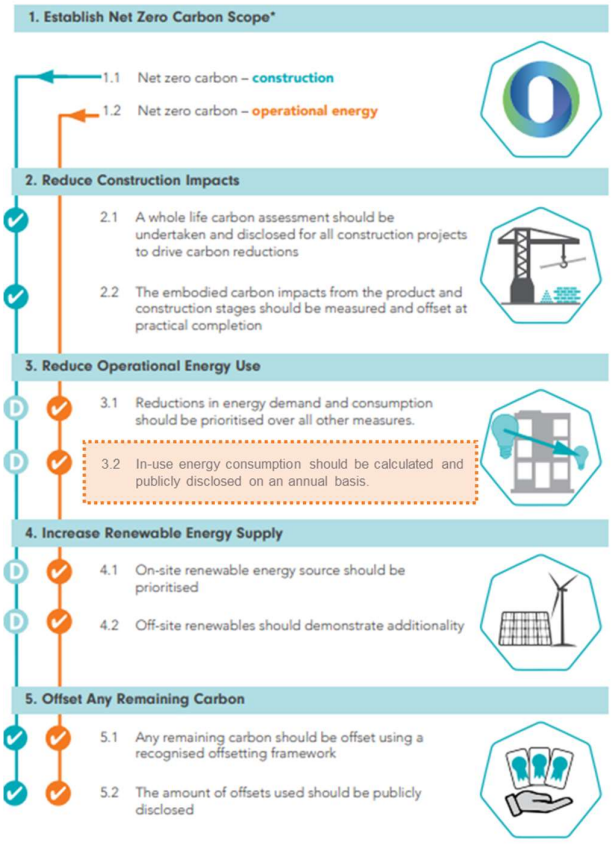


Figure 6.1: Approach to net zero carbon (source: UKGBC Net Zero Carbon: A Framework Definition)

Construction emissions

6.1.16 Embodied carbon is the total carbon emissions generated to produce a built asset. It is often defined as the 'carbon emissions associated with energy consumption (embodied energy) and chemical processes during the extraction, manufacture, transportation, assembly, replacement and deconstruction of construction materials or products.'

6.1.17 An appraisal of the anticipated carbon emissions associated with the product and construction stages of the development lifecycle has been completed, following the requirements of EN 15978. This assesses carbon emissions associated with raw material extraction, manufacturing of the building materials, transporting these to site and erecting the buildings.

6.1.18 This has been carried out based on outline design information including area schedules, building types and building heights using OneClick DesignBuilder: Integrated Life Cycle Assessment which uses RICS benchmark data to give indicative values at this outline stage. Typical materials used for these building types have been mapped to suit these attributes to generate materials quantities. The associated carbon intensities of these materials have then been computed to generate carbon footprints for each building, following a business-as-usual

approach. The same model was used to estimate the emissions generated in the construction process stages, A4 transport and A5 site operations.

6.1.19 An assessment of the impact of removing the trees for the construction site has been done and considered within this analysis. This assessment includes the impact of removing the existing trees and the associated carbon emissions, but it also includes an estimation of the additional carbon emission associated with the reduced carbon sequestration of the Site due to the removal of the trees, although, to some degree, this will be offset by new planting.

6.1.20 To be considered a zero-carbon development, in line with the UKGBC approach previously mentioned, residual emissions from the construction stages can be offset via recognised initiatives.

Operation emissions

6.1.21 The operational emissions associated with this Proposed Development have been evaluated using regulated and unregulated carbon emissions projected.

6.1.22 The assessment has reviewed the estimated total operational energy of the Proposed Development. This is made up of regulated components – including heating, cooling, hot water, fans, pumps and lighting – and unregulated ones, such as IT equipment, plug-in devices and catering facilities.

6.1.23 Regulated energy uses are inherent in the design of a building. Estimated carbon emissions from regulated operational energy uses of buildings have been calculated from benchmarks based on modelling undertaken in line with Part L 2014 of the Building Regulations (Conservation of fuel and power) where available. Where closely matching buildings were not available, modified cases of as-similar-as-possible buildings were used, these were modified based on a combination of reported total energy usage for similar buildings and professional judgement. For operational energy modelling purposes, the gross internal areas of all buildings were split based on use case. The total footprint of all buildings was used to give an estimate of roof area, which has been allocated as available for the deployment of a solar photovoltaics (PV) systems, enabling the energy usage estimate to include a feasible contribution from PV.

6.1.24 The unregulated operational emissions are typically mainly attributable to energy consumption associated with IT equipment, domestic appliances, plug-in devices and catering facilities. Unregulated carbon emissions have been calculated based on the benchmarks described above for regulated energy. Although unregulated carbon emissions are not included within Part L targets, an estimate of unregulated energy consumption is still an output produced as part of this methodology.

6.1.25 Through the combination of an all-electric strategy, fabric first approach and extensive site wide PV allocation, it is projected that the Proposed Development will be able to demonstrate no emissions from operational activities during its lifespan due to decarbonisation of the National Grid.

6.1.26 Furthermore, through the Applicant's commitment to use verified green tariffs, the Proposed Development will achieve carbon neutral emissions from operation from day-1.

Transport in operation

6.1.27 As noted above and detailed within the main body of this ES Chapter, the most significant sources of emissions are associated with transport from building users visiting the site. This is primarily due to the proposed use of the site and anticipated journeys on a national scale. However, as required by the IEMA methodology for GHG emission assessments [1], the likely worst-case scenario must be assessed. In the case of the Proposed Development, an assumption has been made in relation to the percentage of vehicles that are electric being used to travel to the site.

6.1.28 This assumption is based on current commercial patterns and predicted uptake of electric vehicles at day-1 of operation (i.e. 2026). This said, it is anticipated that the proportion of electric vehicle users is to increase to 43% by the year 2030. Therefore, although it is not currently accounted for within the GHG emissions sections, it can be assumed that emissions associated with transport will significantly reduce further during the lifetime of the Proposed Development.

6.1.29 It is also considered, but not quantified, that there is societal pressure to decarbonise transport on a national scale, in line with the UK carbon budget guidance. Greener nationwide transport infrastructure would have a positive impact on the traffic emissions generated by visitors to the Proposed Development. In line with this societal change, Merthyr Tydfil has an award winning state-of-the-art fully electric transport hub which opened in 2021 [1] and consulted on plans for transport interchange improvements in early 2022 [2].

6.1.30 Furthermore, it can be estimated (if not quantified) that a proportion of building users will use this site as an alternative to travelling abroad, which requires aviation travel. The emissions associated with this mode of transport are significantly higher per person in comparison to private vehicle use. In addition, on a socio-economic level, the Proposed Development offers the opportunity for a more affordable opportunity for local, regional and national residents compared to travelling abroad for the same activity.

6.1.31 In summary, although transport is expected to be the dominant source of carbon emissions associated with the site, it is anticipated that due to the increased uptake in electric vehicle purchase for private use (anticipated to be ~43% by 2030) and improvements to the local railway infrastructure (i.e. South West Metro), these emissions will reduce over the lifetime of the development and will provide qualitative benefits to individuals that can be considered to offset this impact.

Summary of assessment.

6.1.32 IEMA's overarching principles on Climate Change Mitigation & EIA acknowledge that the carbon emissions from all projects will contribute to climate change. Therefore, additional mitigation and adaptation measures are discussed for all effects in order to identify further opportunities for reducing any potential adverse impacts of the Proposed Development.

6.1.33 This analysis has concluded that apart from operational traffic, all reviewed sources of carbon emissions are likely to result in minor adverse effects, in the context of the Welsh emissions and UK national carbon budgets (apportioned to reflect the contribution of the built environment's estimated share).

6.1.34 Operational traffic is considered a significant effect of moderate adverse nature. However, if the various mitigation and other measures detailed were taken into account, this effect would be reduced. However, as the impact of these measures cannot be quantified at this outline stage, as they are still under development/unknown, we are not in a position to quantify the magnitude of the impact in relation to carbon emission reduction. Although transport is expected to be the dominant source of carbon emissions associated with the site, it is anticipated that these emissions will reduce over the lifetime of the development and will provide qualitative benefits to individuals that can be considered to offset this impact.

6.1.35 The proposed mitigation measures can be actioned during the detailed design stages. Implementing secondary mitigation measures to improve access to the site with sustainable transport modes will reduce the residual effect to minor, not significant.

6.1.36 The ongoing electrification of the transport sector and continuous decarbonisation of the national electricity grid are expected to further reduce the annual emissions of the Proposed Development during its operational stages.

6.2 Introduction

6.2.1 This chapter reports the outcome of the assessment of likely significant environmental effects arising from the proposed Rhydycar West development (from now on identified as the Proposed Development) in relation to greenhouse gas emissions (GHG) and climate change. This specifically includes embodied carbon, tree loss, traffic-related emissions and carbon dioxide emissions from the operation of the project. In addition, the assessment outlines the mitigation measures required to prevent, reduce or offset any potentially significant adverse effects. The assessment also summarises the recommended approach to climate resilience and adaptation. The conclusions are provided both in terms of the residual effects and whether these are considered significant.

6.2.2 The GHG Protocol which was originally published in 2001, defines carbon dioxide equivalent (CO2e) as the standard unit for measuring and reporting emissions [3]. The terms 'carbon dioxide (CO2)' and 'greenhouse gas (GHG)' are used interchangeably in this chapter in accordance with the terminology of referenced documents. CO2, methane (CH4) and nitrous oxide (N2O) are the main greenhouse gases of concern due to their high global warming potential (GWP) and/or concentration levels in the atmosphere.

6.2.3 In accordance with Regulation 17(3) of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (hereinafter referred to as the 'EIA Regulations') [4], this ES chapter sets out the information relating to climate change outlined in Schedule 4 as follows:

6.2.4 An estimate, by type and quantity, of expected GHG emissions, generated during the construction and operational phases, produced on the basis of the available environmental information and scientific knowledge.

6.2.5 A description of the likely significant effects of the Proposed Development on the environment resulting from:

- Impacts of the Proposed Development on the nature and magnitude of GHG emissions;
- Impacts of the Proposed Development relevant to adaptation in a changing climate; and
- Impacts of the Proposed Development associated with its vulnerability to climate change.

6.2.6 Where the effects resulting from any potential changes caused by the Proposed Development are expected to be significant, a description of the measures to mitigate any identified significant adverse effects on the environment in the context of the following:

- Climate change mitigation (i.e. measures implemented in the design of the Proposed Development to avoid, prevent, reduce or offset GHG emissions); and
- Climate change resilience & adaptation (i.e. measures implemented to future-proof the Proposed Development and adapt to the anticipated impacts of a changing climate).

The Proposed Development

6.2.7 A full description of the Proposed Development is provided in ES Chapter 3. In short, regarding the change in environment, the Proposed Development will comprise of establishing new leisure facilities on previously undeveloped land at Rhydycar West, near Merthyr Tydfil, South Wales. The new facilities include an Indoor Snow Centre facility, Indoor Tropical Waterpark, Resort Hotel (with 3 wings), Woodland Lodges and Indoor and Outdoor Adventure Centre. The proposed Energy Strategy seeks to reduce emissions on the basis of an efficient design and thermal performance in conjunction with an all-electric strategy based on the using use of heat pump technology combined with an on-site heat sharing network and other renewable technologies such as photovoltaic panels. The all-electric approach will enable the Proposed Development to continue to reduce its operational emission following decarbonisation of the National Grid. Furthermore, the Applicant will use a verified green tariff for electricity supply to enable operational emissions to be considered as zero from day 1. However, this is not currently captured within the figures presented within this report as it is not yet guaranteed.

6.2.8 The proposed strategy is based on an advanced heat recovery system which connects the heating and cooling network. This system is capable of moving the rejected heat from the cooling system back into the heating system so, at the same time, reducing the cooling and heating demand of the Site. This approach is based on the assumption that a high cooling demand is expected from the Indoor Snow Centre and rejected heat can be repurposed within the site instead of being rejected in the environment.

6.3 Policy background

Planning Policy Wales (PPW) & Future Wales – The National Plan 2040

6.3.1 Together, the Planning Policy Wales (PPW) and Future Wales – The National Plan 2040 documents set out how the Welsh planning system at a national, regional and local level can assist in delivering their set requirements through the Strategic and Local Development Plans.

6.3.2 The purpose of the PPW is to set out land use policies to "ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation and resultant duties such as the Socio-economic Duty."

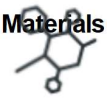
6.3.3 Future Wales – The National Plan 2040 sets the direction for development in Wales and contains a strategy for "addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of our communities." For the Proposed Development, a notable energy policy is Policy 16 'Heat Networks'. This states that large scale mixed-use development should, where feasible, have a heat network with a renewable / low carbon or waste heat energy source. Therefore, this policy is a main driver to evaluate the implementation of a district heat network on site.

Merthyr Tydfil Local Development Plan 2016 - 2031

6.3.4 Merthyr Tydfil policy relating to GHG emissions and climate change are summarised in Table 6.1.

Table 6.1: A summary of Merthyr Tydfil policy relating to GHG emissions and climate change.

Sustainability Theme	Merthyr Tydfil Policy
Building Performance	**Policy BW7: Sustainable design and placemaking** The Council requires all new development to: – minimise the demand for energy and, where appropriate, utilise renewable energy resource – adopt energy conservation/ efficiency measures **Policy TB7: Renewable Energy** Development proposals that meet national and local renewable energy targets will be viewed favourably if: – They do not have an acceptable impact on biodiversity and landscape including the setting of the Brecon Beacons National Park

Sustainability Theme	Merthyr Tydfil Policy
	– For wind turbines, their capacity does not exceed 25 MW on urban and industrial brownfield, and 5MW elsewhere – They do not have an unacceptable impact on the amenity of residential areas
Water & Drainage 	**Policy BW7: Sustainable design and placemaking** The Council requires all new development to: – adopt water conservation/efficiency measures **Policy BW8: Development and the water environment** Proposals for development will only be permitted where: – They do not have adverse effects on the quality and/or quantity of water surfaces or groundwater resources – Adequate water and sewerage systems exist or are reasonably accessible or capable of being provided prior to the development becoming operational – Sustainable drainage systems (SuDS) are used for the disposal of surface water. Alternative methods only considered if SuDS proven inappropriate for practical or environmental reasons
Flood Risk 	**Policy BW8: Development and the water environment** Proposal for development will only be permitted where: – Identified river floodplains are avoided
Waste 	**Policy BW7: Sustainable design and placemaking** The Council requires all new development to: – Incorporate facilities for the segregation, recovery and recycling of waste
Materials 	**Policy BW7: Sustainable design and placemaking** The council requires all new developments to: – Incorporate resource efficient/ adaptable buildings and layouts using sustainable design and construction techniques

Sustainability Theme	Merthyr Tydfil Policy
Biodiversity 	**Policy BW5: Natural Heritage** In order to protect and support the enhancement of the County Borough's natural heritage, development proposals will only be permitted where they maintain, enhance and do not harm: – Landscape character of the countryside – National and local nature conservation designations – Trees, woodlands and hedgerows that have natural heritage value **Other biodiversity interests such protected and priority species and ecological networks**
Transport 	**Policy BW12: Development proposals and transport** Where appropriate the Council will expect all development proposals to demonstrate how they will: – Help reduce the need to travel – Encourage use of transport other than the private car – Avoid increasing traffic to unacceptable levels – Avoid causing or exacerbating highway safety problems

6.4 Key Legislation

Well-being of Future Generations (Wales) Act 2015

6.4.1 This Act gives a legally binding common purpose – seven well-being goals – for national and local government as well as local health boards and other public bodies. One of these goals is 'A resilient Wales'. It also sets out five ways of working (long-term thinking, prevention, collaboration, integration and involvement). It is through this act that Wales is set to make its contribution to the achievement of the 17 United Nations Sustainable Development Goals.

Climate Change Act (2008)

6.4.2 The Climate Change Act [5] established the context for government action to enable the UK to achieve its long-term carbon reduction goals. Through the Climate Change Act, the UK government has set a target to reduce UK GHG emissions by at least 80% by the year 2050, relative to 1990 levels, and outlined a path to get there.

6.4.3 The Act incorporates a requirement for the government to produce a UK Climate Change Risk Assessment (CCRA) every five years and to develop a National Adaptation Programme (NAP) to address the opportunities and risks arising from climate change.

6.4.4 The Act also further introduced a key institutional innovation in the form of legally-binding five-year 'carbon budgets' with distinct five-year targets to act as stepping stones towards the 2050 target. A carbon budget is essentially a cap on the amount of GHGs that are allowed to be emitted in the UK over a five-year period. The Act also established the Committee on Climate Change (CCC) to ensure that emissions targets are evidence-based and independently assessed.

The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

6.4.5 The EIA Regulations [4] require a detailed examination of the potential impacts of development projects on climate. They require a description of 'the impact of the Proposed Development on climate', and 'the vulnerability of the Proposed Development to climate change' (Schedule 4, paragraph 5(f)).

The Climate Change Act 2008 (2050 Target Amendment) Order 2019

6.4.6 On 26th June 2019, the UK parliament passed the Climate Change Act 2008 (2050 Target Amendment) ("Order") [6] implementing the recommendations of the Committee on Climate Change committing the country to a new legally binding "net-zero" carbon target for 2050. This replaced the previous legally binding net GHG emissions reduction target of 80% relative to 1990 levels, introduced by the Climate Change Act, with the updated target of a 100% reduction when compared to the 1990 baseline. With this Act the UK became the first G7 economy to introduce a legal obligation on its Government to achieve net zero emissions.

6.4.7 The Order was enacted following a recommendation made by the UK Committee on Climate Change that the UK should adopt a target of "net-zero" emissions by 2050 contained in a report which was published shortly after the UK Parliament had declared a climate change emergency.

6.4.8 In March 2021 Senedd Cymru approved a net zero target for 2050. Wales also has interim targets for 2030 and 2040, and a series of 5-year carbon budgets.

The UK Climate Change Risk Assessment (2017)

6.4.9 The UK Government and the Adaptation Sub-Committee (part of the CCC) published the second five-year Climate Change Risk Assessment (CCRA) in January 2017 [7]. The CCRA draws upon the findings contained in the Adaptation Sub-Committee's (ASC) independent evidence report for a range of potential impacts of climate change in a UK context.

6.4.10 The UK Government commissioned the ASC to produce an Evidence Report to inform the second CCRA (CCRA2). The full CCRA2 Evidence Report [8] comprises eight chapters written by leading academics, consultants and other experts in the public and private sectors and civil society representing organisations across Great Britain and Northern Ireland. It highlights priority risks across different sectors where additional action is recommended over the next five years to tackle current and future risks, and realise opportunities, arising for the UK from climate change.

6.4.11 The Welsh Government endorses the conclusions of the UK Climate Change Risk Assessment 2017 Evidence Report national summary for Wales. Some 49 risks and opportunities have been identified, with the most important risks to Wales summarised in Table 6.2 as follows:

Table 6.2: Summary of the most important risks to Wales from the 2017 CCRA [7].

Risks to infrastructure (from all sources of flooding)	More action needed
Risk to public water supplies from drought and low flows	
Risks from some land management practices exacerbating flood risk	
Risks to ecosystems and agriculture businesses from changes in climatic conditions	
Risks to communities from all sources of flooding and sea-level rise	Research priority
Risks to infrastructure, business and buildings from high river flows, erosion and extreme weather	
Risks and opportunities from changes to agriculture and forestry productivity	
Risks to people's health and well-being and associated service delivery from high temperatures, flooding and extreme weather	

6.4.12 The Welsh Government's actions on climate change adaptation are described in the Climate Change Strategy for Wales: Adaptation Delivery Plan (2010). The actions in this plan were reviewed in light of the new evidence, and a new version, Prosperity for all: A Climate conscious Wales was published in 2019.

Prosperity for all: A Climate conscious Wales

6.4.13 The 'Prosperity for All: A climate Conscience Wales' (2019) document focuses on how Wales will adapt to the impacts of climate change from 2020 - 2050. It communicates what actions have been taken to date as well as seeking to influence important actors to take action, raising awareness of climate adaptation and sharing knowledge and best practice. It aims to do this in a way which strengthens the economy and create a more equal society.

6.4.14 The policy determines that all new developments are to contribute towards climate change adaptation. These include the location of new developments, the design of buildings, the strategic importance of green spaces and an approach to managing development in areas of flood risk. Collectively, these enable current and future generations to adapt more effectively to the threats and impacts of climate change. Furthermore, all new developments, homes and communities are required to be protected from flood risk, take climate risks into account, and encourage climate change adaptation.

6.5 Assessment Methodology: Greenhouse gas emissions

Impact Assessment Methodology

6.5.1 The Greenhouse Gas Emissions and Climate Change ES chapter aims to:

- Determine the existing sources of carbon emissions currently present at the site, and consider how these could change in the future (future baseline);
- Identify the likely sources of carbon emissions arising from the construction and operation of the Proposed Development, and measure them as far as practical; and
- Review measures in which different alternatives (such as development type, construction methodology and operating mechanisms) can demonstrably reduce carbon emissions.

6.5.2 The carbon emissions assessment study area considers all carbon emissions arising over the lifecycle of the Proposed Development (subject to the limitations and assumptions listed below). The assessment of the Proposed Development's carbon footprint for the purpose of EIA provides an opportunity to identify the potential for effects to be designed out or reduced/offset through iterative design, and thereby maximise the Proposed Development 's contribution towards a net zero carbon society.

6.5.3 Climate change is a pressing environmental issue. It is recognised that all new development produces carbon emissions that contribute towards global climatic change. The IEMA (Institute of Environmental Management and Assessment) methodology stipulates that all carbon emissions may be considered significant because "the GHG emissions from projects will contribute to climate change" and "GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit". However, we also recognise that new developments need to work within the constraints of a changing climate and have the potential to contribute positively towards a thriving, net zero carbon society.

6.5.4 The key anticipated carbon emission sources reviewed in this assessment are summarised in Table 6.3 below.

Table 6.3: Anticipated key sources of carbon dioxide emissions.

Lifecycle Stage	Activity	Emissions Sources
Enabling Works and Construction	Raw material extraction and manufacturing of building materials	Embodied carbon in building materials as per lifecycle stages A1-A3 (EN 15978)
	Transportation of building materials	GHG emissions from construction traffic as per lifecycle stage A4 (EN 15978) and associated activities
	On-site construction activity	Fuel use in construction plant & associated facilities as per lifecycle stage A5 (EN 15978) Impact of removed trees for the enabling work and construction site.
Operation	Building operation	Regulated energy uses from buildings (Regulated energy is building energy consumption resulting from the specification of controlled, fixed building services and fittings, including space heating and cooling, hot water, ventilation, fans, pumps and lighting. Such energy uses are inherent in the design of a building.')
		Unregulated energy uses from buildings (Unregulated energy is building energy consumption resulting from a system or process that is not 'controlled', i.e. energy consumption from systems in the building on which the Building Regulations do not impose a requirement such as IT equipment, refrigeration systems etc.)
	User transportation	GHG emissions from operational traffic

Lifecycle Stage	Activity	Emissions Sources
	Repair and Maintenance	Fabric and component materials as per lifecycle stages B1-B5 (EN 15978)
End of life	Decommissioning	End of life lifecycle stages C1-C4 (EN 15978).
The Proposed Development would be a highly utilised national attraction, therefore maintenance and refurbishment to extend the operational lifetime or reuse of the buildings would be considered before deconstruction. In light of these circumstances, it is considered unlikely that the Proposed Development would be decommissioned at the end of the 60-year timeframe considered throughout this assessment (standard assumed life of building, RICS best practice guidance). Furthermore, in line with industry and government expectations regarding future development, should the development be decommissioned after the 60-year period used within the supportive calculations, the expectation would be that the replacement development would be built to be net zero carbon. Therefore, end of life emissions sources will not be considered in this assessment		

6.5.5 To identify and assess the significance of GHG emissions within the EIA process, this assessment has followed the recommendations and best practice contained within the IEMA Principles Series: Climate Change Mitigation & EIA (2010) [9], the IEMA Environmental Impact Assessment Guide to: Delivering Quality Development (2016) [10] and Institute of Environmental Management & Assessment (IEMA) Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance, 2nd Edition (2022) [11]. Key legislative instruments and national and local planning policy and related guidance have been reviewed to inform the approach.

Construction Phase

Embodied Carbon in Buildings

6.5.6 Embodied carbon is the total carbon emissions generated to produce a built asset. It is often defined as the 'carbon emissions associated with energy consumption (embodied energy) and chemical processes during the extraction, manufacture, transportation, assembly, replacement and deconstruction of construction materials or products.'

6.5.7 Embodied carbon assessment is an area which has undergone significant development in recent years. Traditionally the greatest impact on an asset's whole life carbon has been associated with its operational phase. With the ongoing decarbonisation of the UK electricity grid, this trend is expected to shift, and embodied carbon is expected to assume an ever-increasing significance in the overall carbon footprint of developments (made up of embodied and operational carbon emissions).

6.5.8 An appraisal of the anticipated carbon emissions associated with the product and construction stages of the development lifecycle has been completed, following the requirements of EN 15978. This assesses carbon emissions associated with raw material extraction, manufacturing of the building materials, transporting these to site and erecting the buildings. The lifecycle stages are shown as part of the project timeline in Figures 6.2.

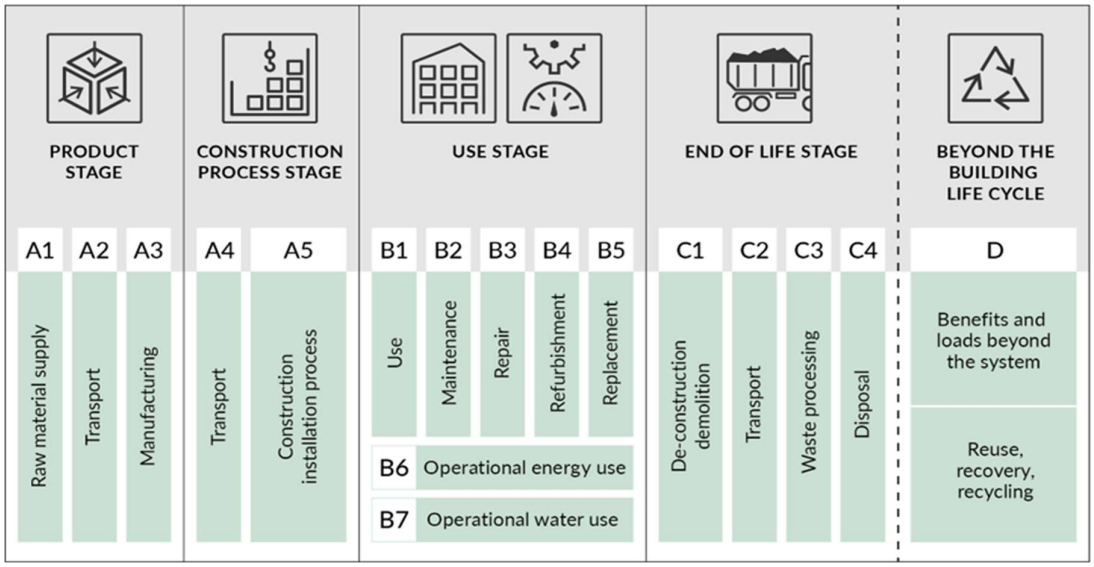


Figure 6.2: Lifecycle modules as determined in EN 15978. Source: Hoare Lea infographic

6.5.9 This has been carried out based on outline design information including area schedules, building types and building heights using OneClick DesignBuilder: Integrated Life Cycle Assessment which uses RICS benchmark data to give indicative values at this outline stage. Typical materials used for these building types have been mapped to suit these attributes to generate materials quantities. The associated carbon intensities of these materials have then been computed to generate carbon footprints for each building, following a business-as-usual approach. The same model was used to estimate the emissions generated in the construction process stages, A4 transport and A5 site operations.

6.5.10 An assessment of the impact of removing the trees for the construction site has been done and considered within this analysis. This assessment includes the impact of removing the existing trees and the associated carbon emissions, but it also includes an estimation of the additional carbon emission associated with the reduced carbon sequestration of the Site due to the removal of the trees, although, to some degree, this will be offset by new planting.

Fuel use in construction plant & associated facilities

6.5.11 An estimate for lifecycle stage A5 was also made using the model inputs described for embodied carbon above.

GHG emissions from construction traffic

6.5.12 Construction traffic was calculated alongside the materials and construction processes modelled with the embodied carbon approach described above.

Operational Phase

Regulated / Unregulated CO_2 Emissions from Buildings

6.5.13 The operational emissions associated with this Proposed Development have been evaluated using regulated and unregulated carbon emissions projected.

6.5.14 The assessment has reviewed the estimated total operational energy of the Proposed Development. This is made up of regulated components – including heating, cooling, hot water, fans, pumps and lighting – and unregulated ones, such as IT equipment, plug-in devices and catering facilities.

6.5.15 Regulated energy uses are inherent in the design of a building. Estimated carbon emissions from regulated operational energy uses of buildings have been calculated from benchmarks based on modelling undertaken in line with Part L 2014 of the Building Regulations (Conservation of fuel and power) where available. Where closely matching building were not available, modified cases of as-similar-as-possible buildings were used, these were modified based on a combination of reported total energy usage for similar buildings and professional judgement. For operational energy modelling purposes, the gross internal areas of all buildings were split based on use case. The total footprint of all buildings was used to give an estimate of roof area, which has been allocated as available for the deployment of a solar photovoltaics (PV) systems, enabling the energy usage estimate to include a feasible contribution from PV.

6.5.16 The unregulated operational emissions are typically mainly attributable to energy consumption associated with IT equipment, domestic appliances, plug-in devices and catering facilities. Unregulated carbon emissions have been calculated based on the benchmarks described above for regulated energy. Although unregulated carbon emissions are not included within Part L targets, an estimate of unregulated energy consumption is still an output produced as part of this methodology.

GHG Emissions from Operational Traffic

6.5.17 The anticipated GHG emissions from operational traffic associated with the Proposed Development have been estimated on the basis of traffic flow data provided by the transport consultant and an average distance of travel based on a projected visitor breakdown.

Carbon Emissions from Repair and Maintenance (Materials)

6.5.18 The carbon impacts of repair and maintenance of the fabric of the buildings have been calculated as part of the life cycle analysis process, following the requirements of EN 15978.

Assumptions and Limitations

6.5.19 To ensure transparency within the EIA process, the following limitations and assumptions have been identified.

6.5.20 It is currently assumed that the site baseline carbon emissions are zero.

6.5.21 The anticipated carbon emissions associated with the product and construction stages of the development lifecycle have been determined based on the design information available to date which consists of area schedules, building types and building heights. Typical materials used for these building types have been mapped to suit these attributes to generate materials quantities. The associated carbon intensities of these materials have then been computed to generate carbon footprints for each building. This approach to modelling the site was also used to generate estimates of construction energy usage and traffic, as well as embodied carbon estimates for the repair and maintenance of the building lifetime. Since the design of the Proposed Development is currently early stage and the application is in outline, the calculated values may not be wholly representative of the project at detailed design. Additional assumptions used in these calculations were as follows:

- Construction is assumed to last for c.3 years.
- Calculated for 60-year operational time frame (assumed life of building, RICS best practice guidance).
- All buildings assumed steel frame construction.
- Used max scenarios for building width/depth.

6.5.22 The estimated carbon emissions associated with the operational energy consumption are indicative values based on benchmark Part L data, previous experience for similar buildings and available Display Energy Certificates (DECs). Where closely matching buildings were not available, modified cases of as-similar-as-possible buildings were used, these were modified based on a combination of reported total energy usage for similar buildings and professional judgement. Calculations were made for different building types and indicative areas for different uses included in the Proposed Development. The Part L methodology uses standardised parameters, including operational profiles, ventilation rates, and heating and cooling setpoints, based on the building use, which may be different from how the buildings will operate in practice.

6.5.23 The anticipated GHG emissions from operational traffic associated with the Proposed Development have been estimated on the basis of estimated traffic flow changes and projected visitor breakdown data provided by the transport consultant (see ES Chapter 9 Transport & Movement).

6.5.24 In line with IEMA 2022 guidance [11], activities which account for under 5% of the energy usage and, therefore, do not have a significant contribution to the overall energy consumption, will be excluded from the assessment. These include:

- Temporary construction site accommodation;
- Refuse collection from public bins; and
- Street lighting, traffic signals and security cameras.

Receptor Sensitivity

6.5.25 The following sensitive receptors have been identified and assessed within this chapter:

Global Atmosphere

6.5.26 The global climate has been identified as the 'sensitive receptor' for the purposes of the carbon impact assessment, which is highlighted in the IEMA GHG assessment guideline. In light of the extreme importance of limiting global warming to well below 2°C (aiming for 1.5°C in line with the Paris Agreement) and the IEMA 2022 Guidance which states that "The receptor for GHG emissions is the global atmosphere. The receptor has a high sensitivity, given the severe consequences of global climate change and the cumulative contributions of all GHG emission sources", this assessment asserts that the sensitivity of global climate to increases in carbon emissions is always considered to be 'high'.

Impact Magnitude

6.5.27 The magnitude of impact has been considered as the change experienced from the baseline conditions at the sensitive receptor. The assessment of magnitude is carried out taking account of any primary and tertiary mitigation that forms part of the Proposed Development. In the absence of clearly defined criteria for assessing magnitude in the context of GHG emissions, a robust, market-leading blended quantitative-qualitative assessment utilising professional judgement relying on standard GHG accounting and reporting principles has been conducted.

6.5.28 To provide context and to assist with determining the magnitude, the carbon emissions generated by the Proposed Development have been assessed in the context of emissions at a local scale (Merthyr Tydfil), regional scale (Wales), and national scale (the UK as a whole) reflecting the various levels where emissions may occur. Carbon emissions data at local and regional level have been sourced from UK national statistics collated by the Department for Business, Energy and Industrial Strategy [12]. The national-scale data is based on the five-year National Carbon Budgets produced by the Committee on Climate Change (CCC), which reflect the requirement to remain within agreed global emission limits.

6.5.29 This has been supplemented with the relevant local (Merthyr Tydfil) and regional (Wales) carbon budgets, to contextualise potential impacts of the Proposed Development on the globally sensitive climate receptor. These local and regional budgets have been produced for BEIS by the University of Manchester Tyndall Centre as part of the City Area Targets and Trajectories for Emissions Reduction (SCATTER) project, to set carbon emissions targets that are consistent with the United Nations Paris Climate Agreement. Carbon budgets have been apportioned to reflect the contribution of the built environment towards the UK total carbon footprint, estimated to be nearly 40% [13]. This approach is consistent with Section 6.4 of the

IEMA Guide on Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) [11], which provides advice on contextualising a project's carbon footprint.

6.5.30 The Opening Year of the initial phase of the Proposed Development is expected to be 2026. Consequently, the 4th national carbon budget is deemed to be most applicable to both the construction and operational phase of the Proposed Development (refer toTable 6.4). No data is currently available post-2037 so it is not possible to assess the anticipated operational emissions against UK carbon emissions beyond this date. However, in light of the progressive national sustainability targets that the Welsh Government is currently in the process of defining and legislating i.e. the accepted CCC target of a 95% reduction in emissions compared to 1990 levels for 2050 and the ambition to go further and set a Net Zero target if possible, it can be expected that the magnitude of operational emissions will only increase in significance as a proportion of the total national carbon budget as the size of those carbon budgets continues to decrease.

Table 6.4: UK National Carbon Budgets.

Budget	Carbon Budget Level	Reduction Below 1990 Levels
1st carbon budget (2008 - 2012)	3,018 $MtCO_2e$	25%
2nd carbon budget (2013 - 2017)	2,782 $MtCO_2e$	31%
3rd carbon budget (2018 - 2022)	2,544 $MtCO_2e$	37% by 2020
4th carbon budget (2023 - 2027)	1,950 $MtCO_2e$	51% by 2025
5th carbon budget (2028 - 2032)	1,725 $MtCO_2e$	57% by 2030
6th carbon budget (2033 – 2037)	965 $MtCO_2e$	78% by 2035

6.5.31 The proposed energy approach for the Site is based on a full electric strategy coupled with high efficient thermal envelope design and MEP system. The addition of Photovoltaic system and heat recovery (able to recover rejected heat from the cooling system) further improve the site energy performance and present a state-of-the-art approach to the energy. Furthermore, the all-electric energy strategy for the Proposed Development will benefit from the incremental reductions in grid electricity carbon intensity between now and commencement of the operational development, and subsequently throughout its operational life. As discussed in the future energy subsection of the future baseline section below, the UK electricity grid has seen significant reductions in carbon intensity over the past 15 years as the contribution of renewables has increased and that of coal-fired power stations has decreased. Carbon intensity of electricity is projected to continue to decrease over coming years meaning current estimates of operational emissions are likely to represent a worst-case scenario, and the Proposed Development will benefit from an energy strategy which makes the most pragmatic use of national drivers towards a zero-carbon economy. Furthermore, a commitment to use a verified green tariff for electricity supply by the Applicant will enable operational emissions to be considered as zero from day 1. However, this is not currently captured within the figures presented within this report as it is not yet guaranteed.

6.5.32 In GHG accounting, it is a widely accepted practice to exclude emission sources that do not have a material contribution to the overall carbon footprint on the basis of the De Minimis rule. ISO guidance on GHG reporting (ISO 14064-1) [14] states that 'the organisation may exclude from quantification direct or indirect GHG sources or sinks whose contribution to GHG emissions or removals is not material or whose quantification would not be technically feasible or cost effective'. In this context, multiple sources have introduced a 'materiality threshold'. PAS 2050 [15] for example, stipulates that in order to be considered 'material', the contribution from any one source of GHG emissions should be more than 1% of the anticipated total GHG emissions associated with the product being assessed.

6.5.33 The UK Emissions Trading System (UK ETS) replaced the EU Emissions Trading System (EU ETS) from 1st January 2021. It retains the provision for small installations [16], which states that small installations whose emissions do not exceed a threshold of 25,000 t CO2e per annum and, where they carry out combustion activities, have a rated thermal input below 35 MW, excluding emissions from biomass, can opt out from the scheme.

6.5.34 Additionally, as part of its public reporting under the Task Force on Climate-related Financial Disclosures framework (IFC Performance Standard 3: Resource Efficiency and Pollution Prevention [17]), the International Finance Corporation (IFC) discloses emissions of projects with estimated annual emissions over 25,000 metric tons of carbon dioxide equivalent through the Environmental and Social Review Summary for each project.

6.5.35 In line with the above, a 1% materiality threshold has been implemented in this assessment when determining magnitude of the relevant change in carbon emissions. To ensure a robust approach, a second reference point has been included, i.e. 25,000 tCO2e annual emission maximum level. It is, therefore, assumed that any annual carbon emissions quantum <1% of the (proportional value) of the relevant carbon budget(s) and < 25,000 tCO2e would not be considered to have a 'material' contribution to the relevant UK GHG inventory. More details are provided in Table 6.5 and Table 6.6 below.

Table 6.5: Criteria for determining magnitude of impact – national baseline.

Magnitude of Impact	Criteria for Determining Impact
High	Annual difference in carbon emissions represents a contribution equal to or higher than 1% of the national baseline emissions and/ or annual proportion of the relevant UK national carbon budget's share attributable to the built environment sector; AND Annual difference in carbon emissions is higher than 25,000 t CO2e in any year.
Medium	Annual difference in carbon emissions represents a contribution lower than 1% of the national baseline emissions and/ or annual proportion of the relevant UK national carbon budget's share attributable to the built environment sector; AND Annual difference in carbon emissions is higher than 25,000 t CO2e in any year.
Low	Annual difference in carbon emissions represents a contribution lower than 1% of the national baseline emissions and/ or annual proportion of the relevant UK national carbon budget's share attributable to the built environment sector; AND Annual difference in carbon emissions is lower than 25,000 t CO2e in any year.

6.5.36 The above approach has been followed when analysing the Proposed Development. Due to the small scale of the local area (Merthyr Tydfil) and to the level and importance of the Proposed Development, the 1% threshold can provide a restrictive view on the overall impact in the local area. The results of the quantitative approach are reported within this document for information.



Table 6.6: Criteria for determining magnitude of impact – against local/regional baseline.

Receptor Sensitivity to Change	Impact Magnitude	Magnitude Criteria
High	High	Annual difference in carbon emissions represents a contribution higher than 1% of the local/regional baseline emissions share attributable to the built environment sector; AND Annual difference in carbon emissions represents a contribution higher than 1% of the relevant local/regional carbon budget's share attributable to the built environment sector.
	Medium	Annual difference in carbon emissions represents a contribution lower than 1% of the local/regional baseline emissions share attributable to the built environment sector; OR Annual difference in carbon emissions represents a contribution higher than 1% of the relevant local/regional carbon Budget's share attributable to the built environment sector.
	Low	Additional annual carbon emissions represent a contribution lower than 1% of the local/regional baseline emissions share attributable to the built environment sector; AND Additional annual carbon emissions represent a contribution lower than 1% of the relevant local/regional carbon Budget's share attributable to the built environment sector.

Table 6.7: Impact Magnitude Criteria (1% Carbon Emissions Threshold) – Merthyr Tydfil carbon budget [18].

Merthyr Tydfil budget period	Merthyr Tydfil Carbon Budget (Mt CO2e)	Years	Built environment share – 40% (Mt CO2e)	Annual built environment share (Mt CO2e)	Magnitude criteria (1%) (Mt CO2e)
2018 - 2022	1.1	5	0.44	0.088	0.00088
2023 - 2027	0.5	5	0.20	0.040	0.00040
2028 - 2032	0.3	5	0.12	0.024	0.00024
2033 - 2037	0.1	5	0.04	0.008	0.00008
2038 - 2042	0.1	5	0.04	0.008	0.00008
2043 - 2047	0.0	5	0.00	0.000	0.00000
2048 - 2100	0.0	53	0.00	0.000	0.00000

Table 6.8: Impact Magnitude Criteria (1% Carbon Emissions Threshold) – Wales carbon budget [18].

Wales budget period	Wales Carbon Budget (Mt CO2e)	Years	Built environment share – 40% (Mt CO2e)	Annual built environment share (Mt CO2e)	Magnitude criteria (1%) (Mt CO2e)
2018 - 2022	99.7	5	39.88	7.976	0.07976
2023 - 2027	49.6	5	19.84	3.968	0.03968
2028 - 2032	24.0	5	9.600	1.920	0.01920
2033 - 2037	11.6	5	4.640	0.928	0.00928
2038 - 2042	5.60	5	2.240	0.448	0.00448
2043 - 2047	2.70	5	1.080	0.216	0.00216
2048 - 2100	2.50	53	1.000	0.019	0.00019

6.5.37 While the emission thresholds outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by IEMA guidance [11] which may result in a different overall conclusion than the one suggested by quantitative criteria alone based on a percentage increase/decrease relative to the baseline.

6.5.38 For the majority of development projects, the individual contribution to total GHG emissions (from local through to global scale) will be very small; however, the IEMA guidance recognises that the contribution of GHG emissions to climate change is a cumulative global issue, and as such it is important for developments of all scales to acknowledge the significance of any increases in GHG emissions, and that the EIA should ensure the project addresses their occurrence by taking mitigating action.

6.5.39 IEMA recommends that mitigation should in the first instance seek to avoid GHG emissions. Where GHG emissions cannot be avoided, the development should aim to reduce a project's residual emissions at all stages. Where additional GHG emissions remain but cannot be further reduced at source, approaches should be considered that compensate the project's remaining emissions, for example offsetting.

Effect Significance

6.5.40 The significance level attributed to each effect has been assessed based on the sensitivity/value of the affected receptor(s) and the magnitude of change arising from the Proposed Development, as well as a number of other factors that are outlined in more detail in other chapters of the provided EIA document. The sensitivity of the affected receptor is assessed on a scale of very high, high, medium or low and the magnitude of impact is assessed on a scale of high, medium or low.

6.5.41 The approach to defining likely significant effects has been carried out in three steps:

- The first step is to compare the Proposed Development's GHG emissions in the opening year to the baseline GHG emissions to determine whether there is a net increase or decrease in GHG emissions as a result of the development;
- The second step is to compare the calculated change in emissions to local GHG emissions for context; and
- The third step applies expert judgment on the significance of those emissions taking into account the changes in emissions, their contribution to local and regional GHG emissions, their consistency with relevant policy, and an evaluation of the mitigation measures proposed to avoid, reduce and compensate for GHG emissions.

6.5.42 In categorising whether an effect is significant or not, due consideration has also been given to the nature, duration and geographical scale of the effect in question (e.g. direct/indirect, temporary / permanent, short / medium-term, etc).

6.5.43 For the purposes of this assessment, the geographical scope of the identified likely significant effects has been assumed to be 'international' in all cases due to the global nature of climate change and its transnational ramifications. Furthermore, in view of the findings of the Intergovernmental Panel on Climate Change (IPCC) [19] Special Report on the effects of global warming of 1.5 °C that some effects from climate change may be long-lasting, the duration of all effects assessed in this chapter is assumed to be long-term and permanent.

6.5.44 The effects are categorised as either adverse or beneficial in order to allow easy comparison between impacts. These terms are defined as follows:

- **Adverse** – Detrimental or negative effects to an environmental resource or receptor. The quality of the environment is diminished or harmed; or
- **Beneficial** – Advantageous or positive effect to an environmental resource or receptor. The quality of the environment is enhanced.

Table 6.9: Effect Significance descriptions (from IEMA, 2022 [11]).

Typical description	
Major	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
Moderate	The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
Minor	The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
Negligible	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Beneficial	The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

Categorising Likely Significant Effects

6.5.45 Typically, effects that are identified as moderate or major adverse / beneficial effects would be classified as significant effects. Minor or negligible effects would be classified as not significant. As noted above a blended quantitative-qualitative approach relying on standard GHG accounting and reporting principles has been applied so the effect categorisation will be subject to professional judgment.

6.6 Assessment methodology: Climate adaptation and resilience

6.6.1 The climate adaptation and resilience assessment methodology follows guidance provided in IEMA Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation [20]. This provides guidance for practitioners undertaking climate change impact assessment in setting a framework for considering climate change resilience and adaptation in EIA. The guidance advocates a risk assessment methodology whereby climate change and resilience is assessed based on the potential for climate impacts (likelihood) against their magnitude (severity). The guidance sets out key principles including setting out the future scenarios of climate change, coordinating assessment of climate change risks between EIA topics, and reporting on the in-combination climate change impacts. This information is supplemented with additional baseline information from the UK Climate Change Risk Assessment.

6.6.2 The terminology and methodology outlined in Table 6.10, Table 6.11 and Table 6.12 follows a climate change risk assessment set out by IEMA in the latest guidance. The climate change risk assessment allows the likelihood and impact of various climate risks to be assessed against a significance matrix to conclude the overall significance of each climate risk.

6.6.3 The main steps identified within the guidance are to:

0. Pre-EIA Stage: Building Climate Resilience into the Project;
1. Scoping Climate Change Adaptation into the EIA;
2. Defining the Future Baseline;
3. Identifying Climate Change Vulnerability and sensitivity of receptors;
4. Identifying and Determining Magnitude of Effects;
5. Significance Assessment;
6. Develop Mitigation Measures; and
7. Post-EIA Stage: monitoring and Adaptive Management.

6.6.4 To build climate resilience into the Proposed Development (i.e. the project), climate change risks must be identified. This has been undertaken through a climate change risk assessment. From this the main risks to the Proposed Development have been weighed against their likelihood and their impact resulting in an overall significance. In categorising significance professional judgement should be applied [20]. Due consideration of inherent mitigation measures aimed at reducing the identified risks have informed overall judgement of significance.

6.6.5 At the simplest level it can be summarised into the following steps:

- identifying potential climate change risks to a scheme or project;
- assessing these risks (potentially prioritising to identify the most severe); and
- formulating mitigation actions to reduce the impacts of the identified risks.

6.6.6 The assessment of risk will assess the likelihood and magnitude of the impacts identified. Definitions of these will be specific to the Proposed Development.

Likelihood categories

6.6.7 Table 6.10 outlines the likelihood categories for the identification of climate change related risk to the Proposed Development. These are considered to include construction and operational spaces.

Table 6.10: Climate change risk likelihood categories

Likelihood Category	Description (probability and frequency of occurrence)
Very high	The event occurs multiple times during the lifetime of the project (60 years), e.g. approximately annually, typically 60 events
High	The event occurs several times during the lifetime of the project (60 years), e.g. approximately once every five years, typically 12 events.
Medium	The event occurs limited times during the lifetime of the project (60 years), e.g. approximately once every 15 years, typically 4 events.
Low	The event is only likely to occur once during the lifetime of the project (60 years), e.g. once in 60 years.
Very Low	The event is unlikely to occur during the lifetime of the project (60 years).

Impact Magnitude

6.6.8 Table 6.11 details the impact magnitude of the risks to the Proposed Development as a result of climate change. This is how the magnitude of impact will be assessed.

Table 6.11: Impact magnitude.

Impact magnitude	Description
Very large adverse	Site-level (or greater) disruption/loss of function and usability that is permanent or irreversible
Large adverse	Site-level (or greater) disruption/loss of function and usability lasting more than 1 week
Moderate adverse	Partial site-level disruption/loss of function and usability lasting more than 1 day and less than 1 week
Minor adverse	Partial site-level disruption/loss of function and usability lasting less than 1 day
Negligible	Disruption to site negligible causing no disruption in function and usability.

Significance Matrix

Table 6.12: Significance Matrix.

		Measure of likelihood				
		Very low	**Low**	**Medium**	**High**	**Very high**
Measure of Impact	**Negligible**	NS	NS	NS	NS	S
	Minor	NS	NS	NS	S	S
	Moderate	NS	NS	S	S	S
	Large	NS	S	S	S	S
	Very large	NS	S	S	S	S

NS= Not significant
S= Significant

6.6.9 Table 6.22 outlines the risks identified to the Proposed Development as a result of climate change, the significance (Table 6.12) of each of these risks will be assessed based on their likelihood (Table 6.10) and their magnitude (Table 6.11). Where effects are assessed as significant, mitigation measures are considered to reduce the risk and/or magnitude of impacts occurring.

Climate Adaptation and Resilience Assumptions and limitations

6.6.10 Risks associated with climate change have been based on national climate change projections. While data from the UKCP18 provide national climate projections for the United Kingdom based on the latest scientific evidence on projected climate changes the accuracy of projections must be highlighted[1]. Adopting a conservative approach, a future scenario of global mean warming of 2°C has been utilised to inform this assessment and help articulate suitable additional mitigation and enhancement measures. However, it is acknowledged that in reality climate change may differ from projections.

6.7 Baseline Environment.

Existing baseline

Site

6.7.1 The Proposed Development consists of new buildings and infrastructure on undeveloped land. A significant portion of the Rhydycar West site is considered ecologically rich, with parts being designated as SSSI (Site of Special Scientific Interest) and the whole site designated as SINC (Site of Importance for Nature Conservation).

6.7.2 With this local context, designing sympathetically to the surroundings is particularly important and has been considered in the project masterplan. Key activities to support this consideration include:

- Extensive surveying of the site to understand the environment has been undertaken over many years on habitats and plant species, birds (winter and spring/summer), amphibians and reptiles, dormice, bats, badgers and invertebrates including butterflies. The known importance of various parts of the site for grassland fungi (such as waxcaps) has also been assessed by these specialist surveys (see Ecology Chapter for details);
- Seeking to retain important and protected environmental elements by sensitively locating development components and leaving over 85% of the owned land undeveloped; and
- Mitigating or compensating for unavoidable damage.

[1] Met Office. (n.d.). *UK Climate Projections (UKCP)*.

6.7.3 The ecologist's report and surveys have been taken into account for the baseline performance of the Site. The current carbon emission associated with the trees proposed to be felled and the impact of removing the trees over the course of 60 years has been considered.

6.7.4 Baseline transport emissions associated with the Proposed Development's adjacent roads, is based on AADT data provided by the transport consultant.

Local, Regional and National Baseline

Local - Merthyr Tydfil

6.7.5 The latest available BEIS annual CO2 emissions data for Merthyr Tydfil from 2019 were 255.6 kt CO2 [20].

6.7.6 The data show emissions allocated on an 'end-user' basis where emissions are distributed according to the point of energy consumption (or point of emission if not energy related). Except for the energy industry, emissions from the production of goods are assigned to where the production takes place. Therefore, emissions from the production of goods which are exported are included, and emissions from the production of goods which are imported are excluded.

6.7.7 In order to help understand the trends in carbon emissions at a local level, a breakdown of total carbon emissions from three main sources (industry & commercial, domestic and transport) has been provided for Merthyr Tydfil. The BEIS national statistics data from the UK government are available for the period 2005-2019, an extract of the full dataset for Merthyr Tydfil is shown in Table 6.13 [20]. The 'Grand Total' values also include a contribution from Land use, land-use change and forestry which is not shown here, this contribution can be negative if it represents a CO2 sink which is removing CO2 from the atmosphere.

Table 6.13: Carbon emissions within Merthyr Tydfil 2005-2019 (source: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019 [20])

Year	Industry & Commercial Total (kt CO_2)	Domestic Total (kt CO_2)	Transport Total (kt CO_2)	Grand Total (kt CO_2)	Population ('000s, mid-year estimate)	Per Capita Emissions (t)
2005	122.7	147.5	96.6	389.2	56.3	6.9
2006	126.7	149	96.9	395.6	56.6	7
2007	116	141.7	100.8	377.6	57.2	6.6
2008	115.4	144.7	97.2	377.1	57.7	6.5
2009	93.9	130.5	95.9	335.1	58.2	5.8
2010	96.2	138	95.6	345.6	58.5	5.9
2011	88	120	92.9	314.5	58.9	5.3
2012	94.3	128.4	92.5	333.9	58.9	5.7
2013	86.3	126.6	91.4	321	59	5.4
2014	75.6	105.9	89.9	284.3	59.1	4.8
2015	73.7	103.2	94.4	284.2	59.2	4.8
2016	82.9	98.1	96	291.6	59.7	4.9
2017	73.8	92.9	89	266.9	60	4.5
2018	75.4	93.4	88.5	269.1	60.2	4.5
2019	68.1	92.8	85.3	255.6	60.3	4.2

Regional – Wales

6.7.8 The latest available BEIS annual CO2 emissions data for Wales from 2019 were 23,807 kt CO2 [20].

6.7.9 A breakdown of total carbon emissions has also been provided for Wales in Table 6.14 [20]. Technical details are as described for Table 6.13 above.

Table 6.14: Carbon emissions within Wales 2005-2019 (source: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019 [20])

Year	Industry & Commercial Total (kt CO_2)	Domestic Total (kt CO_2)	Transport Total (kt CO_2)	Grand Total (kt CO_2)	Population ('000s, mid-year estimate)	Per Capita Emissions (t)
2005	17,715.33	7,840.60	6,648.00	33,353.30	2,969.30	11.2
2006	18,092.60	7,919.30	6,688.40	33,736.10	2,985.70	11.3
2007	18,149.20	7,505.00	6,799.50	33,347.80	3,006.30	11.1
2008	17,177.86	7,663.70	6,556.90	32,268.50	3,025.90	10.7
2009	13,987.08	6,983.40	6,331.80	27,981.40	3,038.90	9.2
2010	16,502.35	7,465.90	6,236.80	30,963.10	3,050.00	10.2
2011	14,870.33	6,462.80	6,112.50	28,081.20	3,063.80	9.2
2012	13,563.91	6,884.30	6,042.60	27,462.80	3,074.10	8.9
2013	16,282.76	6,725.00	6,017.50	29,929.40	3,082.40	9.7
2014	15,968.53	5,721.50	6,098.70	28,509.40	3,092.00	9.2
2015	14,605.76	5,489.30	6,254.50	27,004.80	3,099.10	8.7
2016	13,122.07	5,229.50	6,426.60	25,337.20	3,113.20	8.1
2017	13,182.24	4,942.70	6,403.00	24,942.00	3,125.20	8
2018	12,311.04	4,946.70	6,396.30	24,064.50	3,138.60	7.7
2019	12,424.69	4,839.50	6,256.30	23,807.80	3,152.90	7.6

National - United Kingdom

6.7.10 The latest BEIS data available for the UK was published in 2021 and relates to the year 2019 [20]. The total CO2 emissions generated in the UK in 2019 amount to 344,512 kt CO2. According to a report by the World Resources Institute, the UK demonstrates one of the largest declines in CO2 emissions, with a 20% reduction in the period 2000-2014 [21]. This is one of the biggest percentage reductions in CO2 emissions of all large economies.

6.7.11 In line with this trend, the statistics for Wales demonstrate a continuing downward trend over the 2005-2019 period, whereby the per capita CO2 emissions have decreased by approximately 32%. Total emissions have also gone down by nearly 29% over the studied period despite the observed population growth.

6.7.12 The main reductions are observed in industry and commercial emissions followed by domestic emissions in line with an overall downward trend for the whole of the UK. In comparison, the reduction observed in the transport sector for the region is considerably smaller, at approximately 5%.

6.7.13 A study conducted by analysts Carbon Brief [22] reveals that the decline in industry, commercial and domestic emissions is driven by a combination of the introduction of a low- and zero-carbon electricity mix based on gas and renewables instead of coal and reduced non-electric energy consumption in the industrial and residential sectors. The latter is explained mainly by improvements in energy efficiency and switching to lower-carbon fuels. A structural movement towards a less carbon-intensive mix of industrial output, with some energy-intensive industry moving to other countries and UK industry increasingly focusing on higher-value manufacturing with lower energy intensity is also considered to have been a significant factor in the case of industry-related emissions.

Climate Change.

6.7.14 The UKCP18 [23] national climate projections for the United Kingdom provide the latest scientific evidence on projected climate changes. Over land the projected general trends of climate change in the 21st century are similar to UKCP09, with a move towards warmer, wetter winters and hotter, drier summers. However, natural variations mean that some cold winters, some dry winters, some cool summers and some wet summers will still occur.

6.7.15 The UKCP18 projections show that there are likely to be changes to the average weather conditions in the future. Not all years will fit a clear trend of change, leading to a variable and unpredictable climate. The projections do, however, enable the identification of the likely effects of climate change, and inform appropriate recommendations for changes to design, construction and maintenance policies, standards and practices.

6.7.16 UKCP18 uses scenarios for future greenhouse gases called the representative concentration pathways (RCPs) which were designed to cover a more up to date range of assumptions around future population, economic development and to explicitly include the possibility of mitigation of greenhouse gas emissions towards international targets (Moss et al, 2010).

6.7.17 The RCPs are expressed for future radiative forcing targets in 2100 of 2.6, 4.5, 6.0 and 8.5 watts per square metre (W m-2), and these targets are incorporated into the names of the RCPs; RCP2.6, RCP4.5, RCP6.0 and RCP8.5 pathways. Each pathway drives a different range of projected global mean temperature increases over the 21st century, taking account of uncertainty in aspects such as the transient climate response and rate of ocean heat uptake. The RCP pathways lead to a broad range of climate outcomes but are neither forecasts nor policy recommendations.

6.7.18 RCP2.6 represents a future in which the world aims for and is able to implement sizeable reductions in emissions of greenhouse gases. Many studies show that following this scenario gives a sizeable chance of limiting global average warming to near 2°C above pre-industrial levels. Some simulations in the published literature also suggest the RCP2.6 scenario could produce a response as low as the more ambitious target in the Paris climate agreement, which includes provision to aim for limiting warming to below 1.5°C.

6.7.19 RCP8.5 represents a world in which global greenhouse gas emissions continue to rise. It is a potential future where the nations of the world choose not to switch to a low-carbon future. The temperature increases associated with this are much higher than RCP2.6. A comparison of predicted annual temperature changes in the UK with RCP2.6 and RCP8.5 is shown in Figure 6.3.

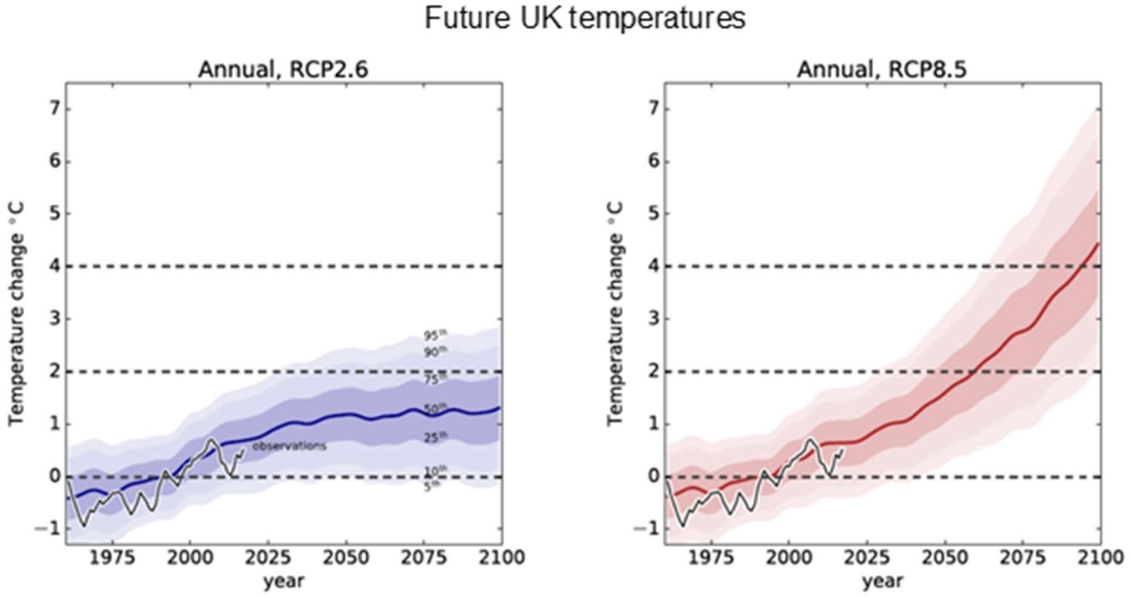


Figure 6.3: Comparison of the predicted future annual temperature change in the UK according to RCP2.6 and RCP8.5 of the UKCP18 National Climate Projections [23].

6.7.20 At 2°C of global mean warming [24]:

- For temperature:
    - The largest warming in the UK will be in the Southeast where summer temperatures may increase another 3 to 4°C relative to present day (1981-2000);
    - Median warming will be at least 1 to 2°C throughout the year across the whole of the UK;
    - Winter cool days will warm by 1 to 1.5°C across the country, whilst temperatures on warmer winter days increase by less than 1°C;
    - In summer both hot and cool days warm by 1 to 1.5°C across Scotland and 1.5 to 2°C across England.
- For precipitation:
    - Changes are uncertain, but suggest slightly wetter winters and drier summers, with summer drying more in the South;
    - Dry days in summer have 30% less precipitation in parts of the South West.

6.7.21 The example predictions above come from the Met Office reporting referenced within the figures overleaf which considers the UK as a whole, rather than regional. Therefore, there are no specific prediction examples for Wales that can be reported at this time.

6.7.22 Visualisations of the UKCP18 projected changes in temperature are included in

6.7.23

6.7.24



6.7.25 Figure 6.4 and precipitation in Please note these maps are taken from a Met Office report and are included as examples.

6.7.26 It is projected that average sea levels will continue to rise in the future, increasing the risk of coastal flooding and erosion, but the pattern of sea level rise is not uniform across the UK. Extreme coastal water levels driven mainly by increases in mean sea level rise are expected. For example, for Cardiff, sea level rise by the end of the century (when compared to 1981-2000), for the low emission scenario is very likely to be in the range 0.27 m to 0.69 m. For a high emission scenario, the range is very likely to be 0.51 m to 1.13 m [25]. This, combined with a predicted increase in storm surges, will lead to a significantly increased risk of flooding.

6.7.27 There are several primary mitigation measures recommended to be incorporated into the design to ensure the Proposed Development avoids, prevents or reduces carbon emissions to the extent possible. These have been set out in the Section 6.8 with further detail available in the Energy Strategy.

6.7.28 This analysis has concluded that with the only of exception of the operational traffic, all the other reviewed sources of carbon emissions are likely to result in minor adverse effects, relative to the defined effect significance criteria.

6.7.29 It is also known that the Welsh Government has developed plans to improve the connections within the Wales region, including the Merthyr Tydfil local area. Furthermore, Merthyr Tydfil and other local authorities are developing plans to support a more sustainable way of travelling. The current known plans include the opening of additional cycle routes nearby the Site and the enhancement and upgrade of the current train connection to Merthyr Tydfil. These measures will have a significant impact in reducing the car traffic generated by the Proposed Development and is estimated to be a significant factor in reducing the operational traffic emissions. However, as the impact of these measures cannot be quantified at this stage, as they are still under development, we are not in a position to comment on the magnitude of the impact in relation to carbon emission reduction. Hence these measures being proposed as “additional” or “secondary” mitigation measures. In summary, although transport is expected to be the dominant source of carbon emissions associated with the site, it is anticipated that these emissions will reduce over the lifetime of the building and will provide qualitative benefits to individuals that can be considered to offset this impact.

6.7.30 Additional mitigation and adaptation measures are discussed for all effects in order to identify further opportunities for reducing any potential adverse impacts of the Proposed Development. For operational traffic in particular, which is considered a significant effect, these measures could be implemented to reduce the magnitude of impact. The proposed mitigation measures will be considered further during the detailed design stages.

6.7.31 ‘Additional’ or ‘secondary’ mitigation refers to measures that require additional action beyond the core function of the development, which can be proposed at any point within the EIA process, including during the decision-making process. Such interventions tend to operate in the middle of the mitigation hierarchy, focusing on reducing the significance or likelihood of adverse effects.

6.7.32 The following section sets out the key additional mitigation measures proposed to further strengthen the Proposed Development and minimise any potential impacts on the environment.



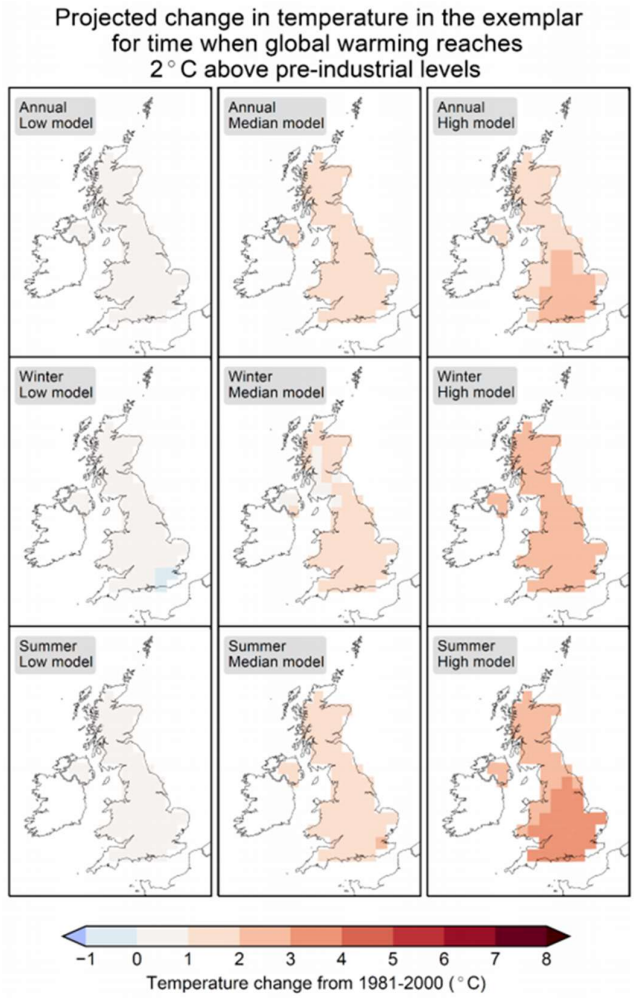


Figure 6.4: Projected changes in UK temperatures at a global mean warming of 4°C (GWL4) above pre-industrial (1850-1900). Changes are shown relative to present day (1981-2000). Rows show annual (top), winter (December-February; middle) and summer (June-August; bottom) changes. Columns shows maps for the model projection with a UK mean temperature changes which are relatively low (left), high (right) or median (centre) [24].

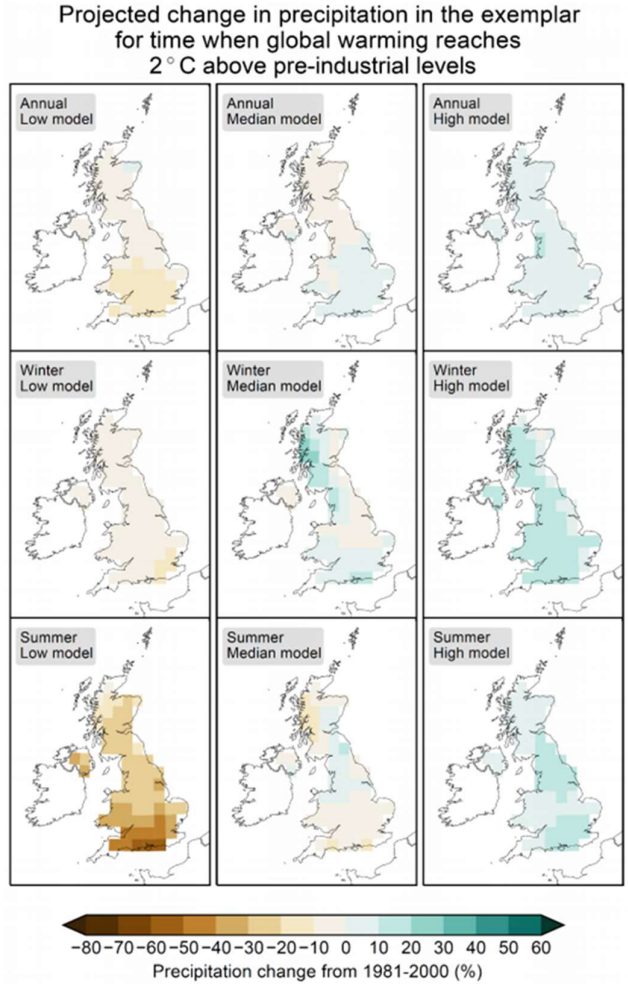


Figure 6.5: Projected changes in UK precipitation at a global mean warming of 2°C (GWL2) above pre-industrial (1850-1900). Changes are shown relative to present day (1981-2000). Rows show annual (top), winter (December-February; middle) and summer (June-August; bottom) changes. Columns shows maps for the model projection with a UK mean precipitation changes which are relatively low (left), high (right) or median (centre) [24].

Future baseline

6.7.33 In the absence of the Proposed Development, the potential use of the land is assumed to remain as it is. If the land use remains unchanged, in this case undeveloped, it should be assumed that there are no GHG emissions associated with embodied carbon or operation. The impact of the removal of trees from the construction site has been also considered.

Future Energy

Decarbonisation of the electricity grid.

6.7.34 The carbon factor of the National Grid – the amount of carbon dioxide released per kilowatt hour of electricity generated and distributed – is recognised in current Building Regulations as being 0.519 kgCO2/kWh [26]. However, the national mix of electricity generation methods is progressing towards greener solutions with renewable sources accounting for 39.3% of the electricity generated in the UK in 2021; up from 24.5% in 2016 [27].

6.7.35 Consequently, the Building Regulations Part L 2014 value of the National Grid carbon factor has been shown to be substantially higher than how the grid is performing in reality. This severely impacts the calculated emissions produced by all heat raising plant which either use electricity directly or generate it to offset other emissions.

6.7.36

6.7.37 Figure 6.6shows how the grid carbon factor (affected by the mix of generation techniques serving the National Grid), has varied over the past fifteen years. The carbon intensity of the grid has reduced to below a third of its original value between 2012 and 2020 – to 0.159 kgCO2/kWh [28]. The carbon emissions associated with electricity consumption are therefore much lower than reported in Building Regulations. This means that, under the Part L 2014 methodology the CO2 emissions associated with electrically driven plant are being overestimated by over 200%. Based on the above, a full electric strategy has been developed for the Site to take full advantage of the current decarbonisation process. This also entails that the operational energy usage for the Site will steadily decrease in the future years following the same improvement the national grid will deliver.

Future Projections

6.7.38 The Future Energy Scenarios (FES) document, produced by the National Grid, discusses how the UK's energy landscape is changing. The latest version, FES 2021 [29], discusses these projections in four scenarios and

6.7.39

6.7.40 Figure 6.6 combines these future trajectories with the actual carbon intensity of the National Grid over the past 15 years. The reported emissions associated with electricity generation have fallen steeply since 2012 and in all four cases, the grid decarbonises further by 2050. The rate of decarbonisation differs between scenarios depending on the modelled consumer behaviour, technology developments and generation mix. The trajectories presented here do not include the negative emissions benefit of Bio Energy Carbon Capture and Storage (BECCS) because these will be needed to offset hard-to-abate sectors such as aviation, shipping and agriculture in future. In order for the UK as a nation to meet net zero carbon by 2050. It is important to note that carbon capture and storage technology is not currently commercially demonstrated at a large scale, but the FES 2020 studies are useful as future scenarios.

6.7.41 This projected decarbonisation of the grid has been considered and has informed the proposed all-electric Energy Strategy.

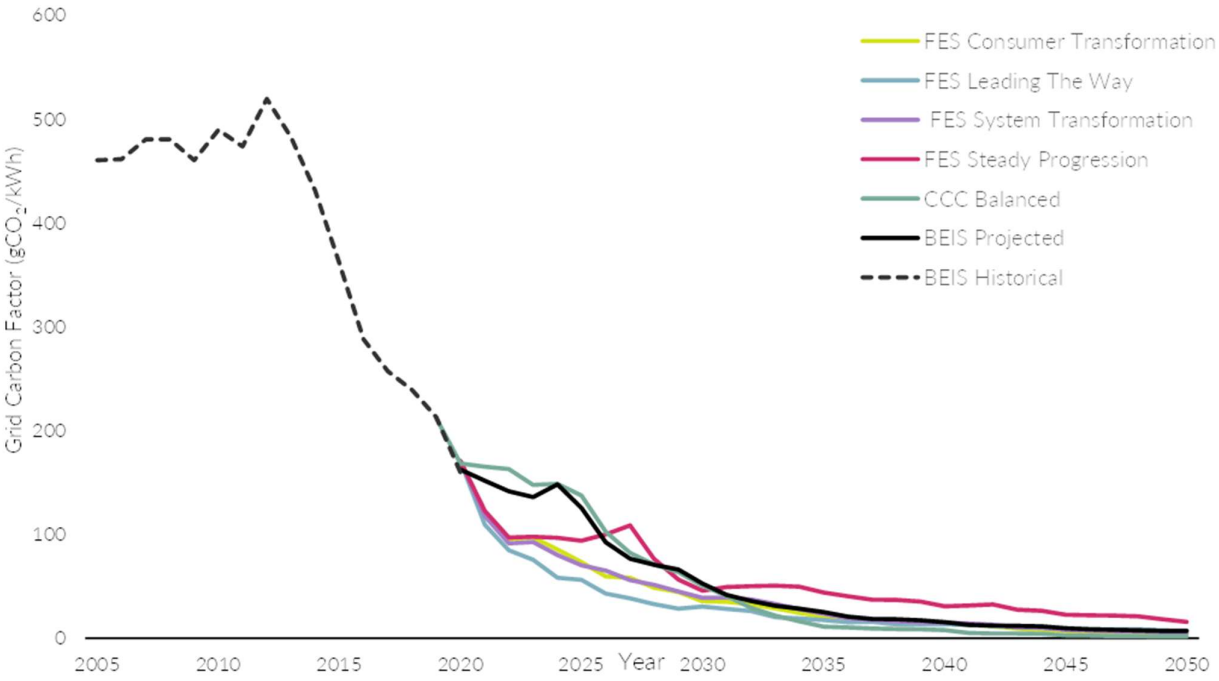


Figure 6.6: Historic and future projected carbon factor for the National Grid. Sources: BEIS Green Book (historic carbon factors); National Grid Future Energy Scenarios (FES) 2021 (future projected carbon factors). Source: Hoare Lea infographic.

6.8 Mitigation within the Submitted Design

6.8.1 A number of design principles and solutions have been 'built in' to or 'embedded' in the Proposed Development design to minimise GHG emissions. This is known as 'embedded' mitigation. Such measures are defined as 'modifications to the location or design of the development made during the pre-application phase that are an inherent part of the Proposed Development, and do not require additional action to be taken'. In arriving at the scale identified for the likely environmental effects, 'embedded' mitigation measures have been taken into consideration as inherent components of the Proposed Development.

6.8.2 Embedded mitigation sits at the top of mitigation hierarchy, with greater ability to avoid detrimental environmental impacts. A full description of the Proposed Development can be found in ES Chapter 3.

6.8.3 Embedded mitigation strategies that have been evaluated and will be implemented as part of the construction phase assessment, include the below.

- Preference for local suppliers (within Merthyr Tydfil or Wales, also see ES Chapter 5 Community & Socio-Economic) to shorten the supply chain and reduce its associated environmental footprint coupled with prioritisation of responsibly sourced goods and services where feasible whilst maximising the proportion of recycled content within materials used in construction;
- Prioritising, wherever possible and feasible, the use of low embodied carbon materials;
- Adoption of the circular economy principles within the design;
- Detailed consideration on the placement of the Proposed Development in the Site to minimise its impact in the Site's ecology;
- Position of the building and structure so to minimise the number of trees that need to be felled;
- Key materials extracted as part of the enabling works to be re-used and/or recycled in accordance with the waste hierarchy giving priority to on-site uses where practical; and
- Manage all waste materials during the construction phase in accordance with the construction waste management practices outlined in the Site Waste Management Plan. Facilitate this objective by providing training for site personnel regarding the correct disposal of materials.

6.8.4 Embedded mitigation strategies that have been evaluated and will be implemented as part of the operational phase assessment, are listed below.

- Operational Energy:
    - Undertake operational energy modelling in compliance with the Part L requirements to determine key contributors to anticipated operational energy;
    - Implement highly energy efficient building fabric and building services to maximise the reduction in energy demand and associated carbon emissions through passive design measures (including mechanical ventilation with heat recovery to further reduce energy consumption and carbon emissions);
    - Specify suitable glazing ratios to reduce heating demand and overheating risk whilst maintaining light levels. A lower g-value assists with minimising the risk of overheating, but balanced with the need to capture beneficial solar gains in winter and a better visible light transmittance;
    - Design in an earth bund adjacent to the South elevation of the indoor ski-slope building to reduce solar gain;
    - Procure 100% renewable energy;

- An “all-electric” approach to the Energy Strategy will be adopted to enable the development’s operational emissions to continue to decarbonise over its lifetime through decarbonisation of the National Grid.

- Optimisation of photovoltaic (PV) panels throughout the site, in combination with biodiverse roof and plant space will provide green energy to supply the “all electric” approach. It is estimated that the indicative PV area identified (approx. 18,000m^2 panel area) could provide 2,700 MWh/yr. of green energy alone which is approximately 10% of the annual regulated energy demand for the site.

- Waste heat will be captured from cooling systems so it can be used to offset heating demand throughout the site via an ambient heat-sharing loop network, utilising Air Source Heat Pumps to supply the buildings’ demands. In particular, this heat exchange system will enable excess heat from cooling the Indoor Snow Centre to be used to heat the Indoor Water Park.

- For all energy that is required for the operations of the development, the Energy Strategy is projected to achieve a ~92% reduction in energy demand and therefore a ~92% reduction in regulated emissions compared to the Part L 2022 Wales notional building.

- Full details on the proposed Energy Strategy can be seen in the Submitted Energy Strategy.

- Transport in operation:

  - Production of a Framework Travel Plan to set out all relevant targets/measures in relation to encouraging more sustainable travel patterns and identify future monitoring and management arrangements;

  - Proposed Section 106 measures to provide additional training and education on transport initiatives, with further incentives for local residents through financial discounts where private vehicle use is avoided;

  - Create and enhance pedestrian and cycle accessibility by increasing the permeability and safety of the site;

  - Increase engagement with sustainable transport modes by carefully considering walking and cycling infrastructure;

  - Provision of a shuttle bus linking the site with key destinations in Merthyr including the bus, station, train station and town centre.

6.8.5 NB for a full discussion of traffic mitigation see ES Chapter 9 Transport & Movement.

6.9 Climate adaptation and resilience

6.9.1 Table 6.15 below outlines relevant inherent mitigation relating to climate adaptation and resilience.

Table 6.15: Climate adaptation and resilience inherent mitigation.

Potential effect of climate change	Embedded mitigation measures	Further Information
Overheating for visitors and staff while indoors.	Optimised passive design of buildings, to reduce risk of overheating. Considering orientation, natural ventilation including cross ventilation opportunities, glazing areas and specifications, thermal mass. Openable windows for occupant control and thermal comfort.	More details on principles to address overheating can be found in the Greenhouse gas emissions sections and the Sustainability Strategy.
Water scarcity causing changes to water availability.	Measures to reduce water demand in all buildings, the use of water efficient fixtures and fittings.	Greenhouse gas emissions sections of this chapter and the Energy Strategy.
Higher external temperatures could challenge the cooling systems, especially for the indoor ski-slope, affecting the operation of the facility.	The ambient loop energy sharing system that facilitates the efficient re-distribution of heating and cooling energy on the site will be designed to incorporate future climate changes in terms of the primary heating and cooling equipment selections, as well as the associated heat network distribution. The energy and thermal modelling work associated with the development of the design will incorporate appropriate uplifts on external temperatures to assess the impact of elevated temperatures on the operation of the system, as well as the longer-term suitability of naturally ventilated spaces. Whilst the external environment will have some effect on the system, the energy eco-system proposed where energy is shared across building functions will go a long way to mitigating the impact, relative to buildings and systems that rely on the external climate for their heating and cooling requirements. Also design in an earth bund to reduce solar gain for the ski-slope building.	More details on systems and design measures can be found in the Greenhouse gas emissions sections of this chapter and the Energy Strategy.
Changes in climate (hotter/wetter) could make utilisation of external public spaces such as sports	Landscaping proposals for the central piazza to include substantial tree planting to provide shelter and shade. The cooling effect of the tree canopies will be supported by a variety of sustainable drainage proposals which aim to keep runoff at the surface where wider benefits	Chapter 13 Townscape and Landscape and landscaping strategy.

Potential effect of climate change	Embedded mitigation measures	Further Information
facilities, parks and play spaces difficult.	such as cooling, biodiversity and amenity benefits would occur. Green and blue infrastructure – The proposals aim to protect and enhance existing Green Infrastructure (GI) on site where practicable. Proposed planting will supplement existing GI and all areas would be managed in a way that increases resilience to the changing climate.	
The masterplan proposes increased walking and cycling, although pedestrians and cyclists will be sensitive to extreme weather.	The existing and proposed Green Infrastructure (GI) would provide solar shading and shelter from wind along routes for pedestrians, equestrians and cyclists. This will create routes and spaces that are well used through the seasons. Many of the proposed routes would utilise existing GI to provide a mature setting for the routes, which would be complemented by planting proposals. Proposed SuDS along walking and cycling routes would aim to keep runoff at or near the surface where wider benefits such as cooling, biodiversity and amenity benefits would occur.	Chapter 13 Townscape and Landscape, Travel Plan and landscaping strategy.
More overheating and less comfort, potentially less reliable public transport.	Provision of pleasant onsite bus stops which provide appropriate shading and shelter. The new Merthyr Bus Station and proposed upgrades to the railway network as part of METRO proposals. Upgrades will include electrification of infrastructure and air conditioned carriages to provide comfortable thermal environment for passengers.	Travel Plan.
Increased run off causing downstream flooding.	The development is outside of flood plains for fluvial, marine and reservoir flooding. While NRW online flood maps indicate the application site is at risk from pluvial flooding, any potential pluvial flood risk to or from the proposed development will be mitigated using the measures detailed in the Flood Consequence Assessment; watercourses will be rerouted subject to appropriate consents and approvals, and a SuDS compliant drainage scheme will be implemented. SuDS are incorporated in the form of Swales and Attenuation Basins. Detention basin volumes	A full list of mitigation measures associated with water, drainage and flooding which are to be employed during the Construction Phase are discussed in the Tetra Tech Drainage Strategy report. The Tetra Tech Flood Consequence Assessment Report

Potential effect of climate change	Embedded mitigation measures	Further Information
	have been determined using MicroDrainage's quick-storage estimator facility for up to and including a 100-year return period event plus an allowance for climate change (40%).	outlines the proposed mitigation measures associated with the flood risk and drainage designs.
Blockage of groundwater migration, resulting in groundwater flooding.	The risk of groundwater flooding is deemed negligible.	As above
Local sewage and water supplies threatened (including drought/inundation). Contamination of the surrounding water environment.	Demand reduced on site through water efficiency measures. Appropriate guidance & policy to be followed on robust pipework design and supply installation.	As above
Planting may not be resistant to extremes of temperatures and moisture causing it to die or become stunted. Potentially insufficient adaptation potential in habitats.	Proposed planting will supplement existing Green Infrastructure (GI) I using native species to create well connected and diverse ecosystems. All GI would be managed to increase resilience to the changing climate. Proposed SuDS are integrated into the Green Infrastructure Strategy for the side which would aim to keep runoff at or near the surface where wider benefits such as cooling, biodiversity and amenity benefits would occur. Introduced habitats will be in keeping with existing habitats and biodiversity as a minimum. This could expose the created habitats to risks faced site-wide from future climate trends, e.g. change in the vegetation of substrate composed of free-draining materials. Due consideration for appropriateness of habitats for adaption to future climate will be given and detailed within the landscape management strategy during operation.	ES Chapter 13 Townscape and Landscape (including trees), ES Chapter 8 Ecology, Ecosystems Report and Landscape Strategy
Increase in duration of noise from cooling/ventilation plant, as may be required to run for longer. Potentially increased impact due	Provision of acoustic attenuation measures to be provided. Any cooling/ventilation plant will be required to meet the noise emission limits that are set out within ES Chapter 14 Noise, Acoustics & Vibration to avoid significant adverse effects.	ES Chapter 14 Noise, Acoustics & Vibration and associated appendices.

Potential effect of climate change	Embedded mitigation measures	Further Information
to windows being open more due to hotter weather.	Consequently, even if plant is required to run longer/harder due to increased temperatures, noise from these units will still be controlled.	

6.10 Greenhouse gasses and climate assessment.

Considerations for emissions reduction.

Operation and construction emissions

6.10.1 The Applicant, in response to the climate emergency, seeks an approach to achieve net zero carbon the Proposed Development for both embodied and operational emissions. Suitable methodologies will be reviewed and adopted, where appropriate, to achieve this. An example of this is the UK Green Building Council (UKGBC) Net Zero Carbon (NZC) Framework that is an industry recognised approach to achieve NZC for the built environment. The framework looks to reduce, mitigate and offset emissions for construction and operational energy separately, as shown in

6.10.2

6.10.3

6.10.4 Figure 6.7 below.

6.10.5 The illustrative graph in

6.10.6

6.10.7

6.10.8 Figure 6.7 provides an overview of whole life emissions associated with a building. Embodied carbon occurs during the construction period, i.e. before day 1 of operation, and then proceeds to have additional emissions where maintenance and/or replacement works are required whereas operational emissions occur from day 1 of occupancy to end of life. In the case of an all-electric building services strategy, as is proposed for this site, the resultant emissions benefit from ongoing decarbonisation of the National Grid. Furthermore, the Applicant will procure an approved, green utility tariff, so that all these emissions will be carbon neutral from day 1 of operation.

6.10.9 Therefore, there is a methodology and approach that could be adopted to allow the Proposed Development to achieve Net Zero Carbon Emissions in relation to the associated construction (i.e. building materials) and building operation phases which will be reviewed and refined further during the detailed design.

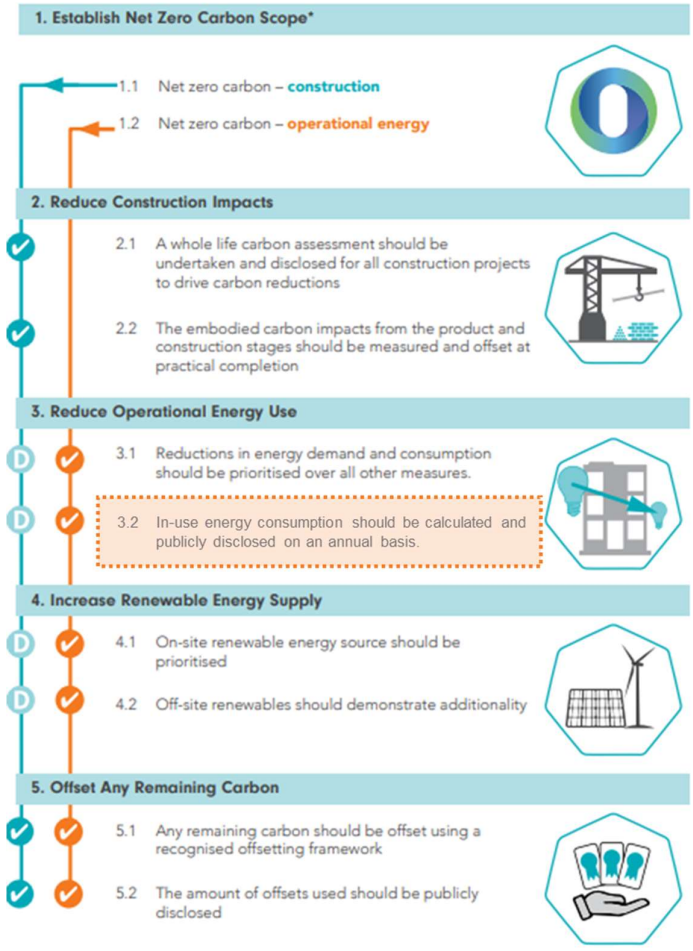


Figure 6.7: Approach to net zero carbon (source: UKGBC Net Zero Carbon: A Framework Definition)

BREEAM 2018 Summary

6.10.10 Gleeds has been appointed separately by the client as the BRREAM project Advisor. The project team understand that the Rhydycar West project is unique and that careful guidance is needed to enable the project to achieve its potential BREEAM aspiration.

6.10.11 The Rhydycar West project has undergone a BREEAM 2018 pre-assessment to highlight the likely score and tangible credits available for the project. The outcome of this consultative exercise with the appointed professional project team has concluded that a possible score of circa 76% is likely, with a further 9% of potential credits highlighted. Based on the current status of the design proposals and information prepared to date, a BREEAM Excellent score is therefore a viable target.

6.10.12 To begin to facilitate the BREEAM process, Gleeds undertook the BREEAM pre-assessment and produced focused BREEAM Early Action lists, which clearly highlight key credits to be addressed prior to completion of RIBA Stage 2. The BREEAM Early Action lists have been distributed to each applicable member of the project team, to enable each party to satisfactorily address the pre-identified key credits, via an evidence based approach.

6.10.13 Subject to a successful planning approval, the Rhydycar West Project BREEAM plan will be further developed and secured during the remaining design development phase through RIBA Stages 3 and 4 respectively, prior to commencement on site and subsequent operation in use.

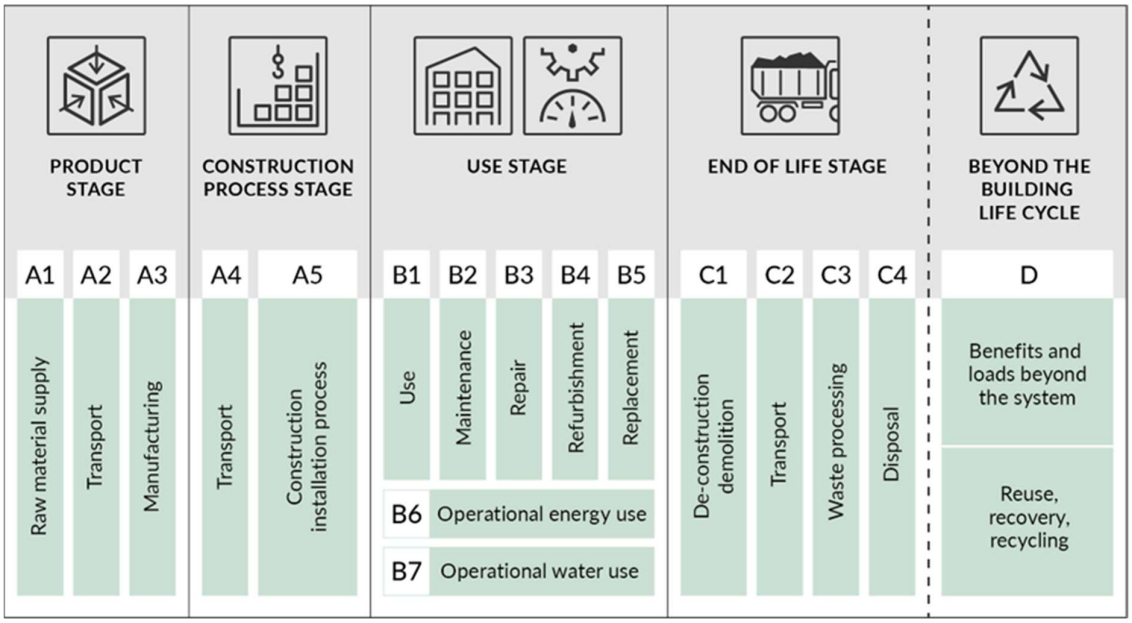
Construction

Embodied Carbon & construction traffic

6.10.14 An appraisal of the anticipated carbon emissions associated with the product and construction stages of the development lifecycle has been completed, following the requirements of EN 15978. This study assesses carbon emissions associated with raw material extraction, manufacturing of the building materials, transporting these to site and erecting the buildings. The lifecycle stages are shown as part of the project timeline in Figure 6.8.

Figure 6.8: Lifecycle modules as determined in EN 15978. Source: Hoare Lea infographic.

6.10.15 This has been carried out based on outline design information including area schedules,



building types and building heights using OneClick DesignBuilder: Integrated Life Cycle Assessment which uses RICS benchmark data to give indicative values at this outline stage. Typical materials used for these building types have been mapped to suit these attributes to generate materials quantities. The associated carbon intensities of these materials have then been computed to generate carbon footprints for each building, following a business-as-usual approach. The same model was used to estimate the emissions generated in the construction process stages, A4 transport and A5 site operations. The estimates generated with this approach are presented in Table 6.16.

6.10.16 The key assumptions used in these calculations were as follows:

- Construction is assumed to last for c.3 years.
- Calculated for 60-year time frame (assumed life of building, RICS best practice guidance).
- All buildings assumed steel frame construction.
- Used max scenarios for building width/depth.

Table 6.16: Embodied carbon breakdown across the construction lifecycle stages, for each building in the Proposed Development, total for an assumed 3-year construction period.

Building	Total Gross Floor Area (m²)	A1-A3 (kg CO2e)	A4 Transport (kg CO2e)	A5 Site operations (kg CO2e)
A Snow Centre	25,900	8,060,883	114,386	1,105,528
B Water Park	7,500	3,604,680	58,555	387,738
C Indoor Activity Centre	22,000	7,970,214	148,520	1,021,604
D Hotel Accommodation	15,500	4,898,910	59,307	689,608
E Hotel Accommodation	7,000	2,365,781	26,831	304,424
F Hotel Accommodation	4,900	1,722,928	21,103	215,799
G Lodge Accommodation	2,300	974,540	17,769	114,568
P2 Multi-Storey Parking and Ancillary	8,500	2,116,453	34,497	316,475
TOTAL	**93,600**	**31,714,390**	**480,968**	**4,155,745**

Operational Phase

Carbon Emissions from Regulated & Unregulated Operational Energy Use

6.10.17 An estimate of operational energy usage was made using the submitted outline masterplan, schedule of accommodation and gross external area schedule supplied by Holder Mathias architects.

6.10.18 Estimated carbon emissions from regulated operational energy uses of buildings have been calculated from benchmarks based on modelling undertaken in line with Part L 2014 of the Building Regulations (Conservation of fuel and power), previous experience for similar buildings and available Display Energy Certificates (DECs). Where closely matching buildings were not available, for example the Indoor Snow Centre, modified cases of as-similar-as-possible buildings were used, these were modified based on a combination of reported total energy usage for similar buildings and professional judgement. For operational energy modelling purposes, the gross internal areas of all buildings were split based on use case. Unregulated energy estimates were made using the same model.

6.10.19 With this approach it was estimated that, for the gas boiler baseline approach used to assess Part L compliance, the Proposed Development would have a regulated energy requirement of approximately 55,500,000 kWh/year and an unregulated requirement of 5,400,000 kWh/year.

6.10.20 A provision for solar photovoltaic (PV) panels was made for the Site, enabling the energy usage estimate to include a feasible contribution from PV. The estimates presented below account for this contribution as well as the implementation of connected air source heat pumps and water to water heat pumps on site for heating, cooling and hot water.

6.10.21 The proposed energy strategy is based on a heat network that can benefit from the waste heat to reduce the Site heat demand. With this system, the excess heat generated by cooling the Indoor Snow Centre could be used to heat hotel rooms and the Indoor Waterpark, thereby minimising wasted heat and energy and improving the coefficient of performance for all linked facilities. As described in the Energy Strategy, the proposed strategy involves implementing an on-site heat sharing network to make use of the waste heat from cooling the Indoor Snow Centre to heat other parts of the facility. This has been modelled as an uplift in the coefficient in performance of the connected heat pumps. Please refer to the appended Energy Strategy for full detail.

Future Building Regulations Part L

6.10.22 Updates to the Building Regulations Part L are due to be implemented in Wales in 2022. Specific details of the proposed amendments are unconfirmed at this stage but could include the following for non-residential buildings, i.e. Building Regulations Part L2A include:

- Update to carbon factors (refer to Table 6.17).
- Introduction of a Primary Energy metric alongside CO_2 emissions calculations.

6.10.23 In October 2019, the BRE released an update to the Standard Assessment Procedure (SAP) – used to assess domestic buildings' compliance with Building Regulations Part L1A – for consultation. The proposed update is called SAP10.1. The important proposed change to the SAP methodology is the carbon factors to be used to calculate CO2 emissions.

6.10.24 Whilst SAP is related to dwellings, it is expected that proposed changes to carbon factors within this methodology will also be applied to non-residential buildings and Part L2A.

6.10.25 As shown in Table 6.17, there is significant reduction in emissions factor for electricity expected, recognising recent decarbonisation of the UK electricity grid.

Table 6.17: Current (SAP 2012) and proposed (SAP10) carbon factors for grid-supplied electricity.

Fuel	SAP 2012 Carbon Factor ($kgCO_2/kWh$)	SAP 10.1 Carbon Factor ($kgCO_2/kWh$)
Electricity	0.519	0.136

6.10.26 To demonstrate the effect of the likely changes to Part L carbon factors, the emissions estimate was made using both the current Part L 2014 and SAP 10.1 values as proposed updated carbon factors. A comparison of the emissions estimate with Part L 2014 and SAP 10.1 carbon factors is presented in Table 6.18.

Table 6.18: Operational energy estimates.

INITIAL ESTIMATES	Regulated	Unregulated	Total
System side energy demand [kWh/year]	20,800,000	5,000,000	25,800,000
Part L 2014 carbon factors (old carbon factors)			
CO_2 emissions [$kgCO_2$/year]	10,800,000	2,600,000	13,400,000
SAP 10.1 carbon factors (proposed future carbon factors)			
CO_2 emissions [$kgCO_2$/year]	2,500,000	690,000	3,200,000

6.10.27 All estimates in Table 6.18 account for a provision for PV systems and the implementation of the on-site heat network described above and in the Energy Strategy.

6.10.28 The estimates with the new updated carbon factors (SAP10.1) are used in all comparisons with baseline emissions in the effects sections which follow.

GHG Emissions from Operational Traffic

6.10.29 The anticipated GHG emissions from operational traffic associated with the Proposed Development have been estimated on the basis of traffic flow data provided by the transport consultant and an average distance of travel based on a projected visitor breakdown. The total distance travelled by all vehicles estimated in this way was converted to greenhouse gas emissions in kg CO2e using the Department for Business, Energy & Industrial Strategy greenhouse gas reporting 2021 conversion factors [30]. The annual carbon emissions resulting from operational traffic are compared to baseline emissions and budgets below.

Table 6.19: Operational traffic estimation.

	AADT			Average distance (km)	Carbon Factor (kg CO2e/km)			Annual emissions (t CO2e)			TOTAL annual emissions (t CO2e)
	HGV	LGV electric	LGV other	All vehicles (from visitor breakdown)	HGV all diesel, average laden	Battery Electric Vehicle, Average car	Average petrol car	HGV	LGV electric	LGV other	
2026 traffic (~15% EVs)											
Just site access: National (UK)	285	612	3470	148.6	0.86407	0.05031	0.17431	5,109*	1,671	32,812	**39,591**
Just site access: Regional (Wales)	285	612	3470	56.8	0.86407	0.05031	0.17431	5,109	639	12,549	**18,297**
Just site access: Local (Merthyr Tydfil)	285	612	3470	11.1	0.86407	0.05031	0.17431	995	124	2,443	**3,562**
2031 traffic (~43% EV)											
Just site access: National (UK)	285	1755	2327	148.6	0.86407	0.05031	0.17431	5,109*	4,791	22,003	**31,903**

Just site access: Regional (Wales)	285	1755	2327	56.8	0.86407	0.05031	0.17431	5,109	1,832	8,415	**15,356**
Just site access: Local (Merthyr Tydfil)	285	1755	2327	11.1	0.86407	0.05031	0.17431	995	357	1,638	**2,990**

* HGVs considered on the national scale are assumed to travel the average distance specified for Wales, to account for local supply preference.

Table 6.20: Operational traffic comparison.

Operational traffic emissions	% of baseline or budget	emissions (kt CO2)
2026 (15% EV)		
National (UK) operational traffic emissions estimate kt CO2	**39.59**	
% of annual proportion of the 4th national carbon budget (2023 - 2027)*	0.0254%	156000
Regional (Wales) operational traffic emissions estimate kt CO2	**18.30**	
% of regional (Wales) baseline emissions (2019)	0.0769%	23,807.80
% of annual proportion of Wales budget (2023 - 2027)*	0.461%	3968
Local (Merthyr Tydfil) operational traffic emissions estimate kt CO2	**3.56**	
% of local (Merthyr Tydfil) baseline emissions (2019)	1.394%	255.6
% of annual proportion of Merthyr Tydfil budget (2023 - 2027)*	8.91%	40
2030 (43% EV)		
National (UK) operational traffic emissions estimate kt CO2	**31.90**	
% of annual proportion of the 5th national carbon budget (2028 - 2032)*	0.0231%	138000
Regional (Wales) operational traffic emissions estimate kt CO2	**15.36**	
% of regional (Wales) baseline emissions (2019)	0.064%	23807.8
% of annual proportion of Wales budget (2028 - 2032)*	0.800%	1920
Local (Merthyr Tydfil) operational traffic emissions estimate kt CO2	**2.99**	
% of local (Merthyr Tydfil) baseline emissions (2019)	1.170%	255.6
% of annual proportion of Merthyr Tydfil budget (2028 - 2032)*	12.5%	24

* all budgets are presented as the 40% share attributable to the built environment sector.



6.10.30 While the emission benchmarks outlined above have been used to provide context, it is important to recognise that the application of professional judgement is a critical additional component, as recognised by IEMA guidance. In the context that traffic vehicles are required to decarbonise in the coming years and that there are nationwide efforts to reduce car usage, the professional judgement has therefore taken into account that a significant proportion of emissions will be further reduced in future.

Transport in operation

6.10.31 As can be seen in the calculations above, the most significant sources of emissions are associated with transport from building users visiting the site. This is primarily due to the proposed use of the site and anticipated journeys on a national scale. However, as required by the EIA methodology for GHG emission assessments, the worst-case scenario must be used in all cases. In the case of the Proposed Development, an assumption has been made in relation to the percentage of vehicles that are electric being used to travel to the site.

6.10.32 This assumption is based on current commercial patterns and predicted uptake of electric vehicles at day-1 of operation (i.e. 2026). This said, it is anticipated that the proportion of electric vehicle users is to increase to 43% by the year 2030. Therefore, although it is not currently accounted for within the GHG emissions sections of this chapter, it can be assumed that emissions associated with transport will reduce further during the lifetime of the Proposed Development.

6.10.33 It is also considered, but not quantified, that there is societal pressure to decarbonise transport on a national scale, in line with the UK carbon budget guidance. Greener nationwide transport infrastructure would have a positive impact on the traffic emissions generated by visitors to the Proposed Development. In line with this societal change, Merthyr Tydfil has an award winning state-of-the-art fully electric transport hub which opened in 2021 [1] and consulted on plans for transport interchange improvements in early 2022 [2].

6.10.34 Furthermore, it can be estimated (if not quantified) that a proportion of building users will use this site as an alternative to travelling abroad, which requires aviation travel. The emissions associated with this mode of transport is significantly higher per person in comparison to private vehicle use. In addition, on a socio-economic level, the Proposed Development offers the opportunity for a more affordable opportunity for local, regional and national residents compared to travelling abroad for the same activity.

6.10.35 In summary, although transport is expected to be the dominant source of carbon emissions associated with the site, it is anticipated that due to the increased uptake in electric vehicle purchase for private use (anticipated to be ~43% by 2030) and improvements to the local railway infrastructure (i.e. South West Metro), these emissions will reduce over the lifetime of the development and will provide qualitative benefits to individuals that can be considered to offset this impact.

Carbon Emissions from Repair and Maintenance B1-B5 (Materials)

6.10.36 The carbon impacts of repair and maintenance of the fabric of the buildings have been calculated as part of the life cycle analysis process, following the requirements of EN 15978.

6.10.37 These impacts relate to the replacement of materials/components during a projected 60-year lifespan of the buildings. For example, external windows may be expected to require replacement after 30 years, internal finishes as soon as 10 years. The service lives used are determined from Environmental Product Declaration (EPD) certificate data. The carbon impacts of these replacements are presented in Table 6.21 below.

Table 6.21: Carbon impacts for the In-Use stage (total for an assumed 60-year lifetime) of the development lifecycle for each building.

Building	B1-B5 Replacement (kg CO_2e)
A Snow Centre	6,155,753
B Water Park	2,040,329
C Indoor Activity Centre	3,668,940
D Hotel Accommodation	2,649,364
E Hotel Accommodation	1,261,277
F Hotel Accommodation	922,370
G Lodge Accommodation	393,641
P2 Multi-Storey Parking and Ancillary	1,161,511
TOTAL	**18,253,186**

6.11 Climate adaptation and resilience assessment

6.11.1 Table 6.22 identifies climate change risks to the Proposed Development. The inherent mitigation measures responding to each risk are shown in Table 6.15. The climate risk assessment outlined in the methodology section has been used in conjunction with professional judgement to reach an overall significance. For significant risks, residual mitigation measures will be suggested to further reduce the impact.

Table 6.22:Climate change risks, significance and mitigation.

ES Chapter / relevant documents	Sensitive Receptor	Potential effect of climate change	Significance	Additional Mitigation measures
ES Chapter 6 Sustainability & Climate Change, Sustainability Strategy, Energy Strategy and Design and Access Statement	Visitors and site staff	Overheating for visitors and staff while indoors.	**Not Significant** Likelihood can be identified as very high and impact magnitude as moderate adverse. However, due to the various inherent mitigation measures aimed to reducing the risk of overheating, using professional judgement the overall risk has been identified as not significant.	None proposed
		Water scarcity causing changes to water availability.	**Not Significant** Likelihood can be identified as high and impact magnitude as moderate adverse. The effect of the development on water availability is considered and minimised.	None proposed
		Higher external temperatures could challenge the cooling systems, especially for the Indoor Snow Centre, affecting the operation of the facility.	**Not Significant** Likelihood can be identified as very high and impact magnitude as moderate adverse. However, due to the various inherent mitigation measures aimed to reducing the risk of overheating for systems, using professional judgement the overall risk has been identified as not significant.	None proposed

ES Chapter 13 Townscape and Landscape (including trees) and Landscape Strategy	Users of outdoor spaces	Changes in climate (hotter/wetter) could make utilisation of external public spaces such as sports facilities, parks and play spaces difficult.	**Not Significant** Likelihood can be identified as very high and impact magnitude as minor adverse. The landscaping strategy considers future climate change and is designed to mitigate outdoor heating overheating risk.	None proposed
Chapter 13 Townscape and Landscape, Travel Plan and landscaping strategy	Pedestrians and cyclists	The masterplan proposes increased walking and cycling, although pedestrians and cyclists will be sensitive to extreme weather.	**Not Significant** Likelihood can be identified as very high and impact magnitude as moderate adverse. The landscaping strategy considers future climate change and is designed to facilitate usage of sustainable transport modes.	None proposed
Travel Plan	Users of public transport	More overheating and less comfort, potentially less reliable public transport.	**Not Significant** Likelihood can be identified as very high and impact magnitude as minor adverse. Thoughtful design of waiting areas will reduce the impact of unreliable public transport.	Refer to the submitted Travel Plan for detail on proposed dissemination of public transport information for visitors and building users.
ES Chapter 11 Hydrology & Hydrogeology, Drainage Strategy report and Flood Consequence Assessment Report.	Visitors and site staff	Increased run off causing downstream flooding.	**Not Significant** Likelihood can be identified as medium and impact magnitude as moderate adverse. Flood risk has been mitigated through landscape and SUDs design.	None proposed
		Blockage of groundwater migration, resulting in groundwater flooding.	**Not Significant** Likelihood can be identified as very low and impact magnitude as moderate adverse. Flood risk	None proposed

			has been mitigated through landscape and SUDs design.	
		Local sewage and water supplies threatened (including drought/inundation). Contamination of the surrounding water environment.	**Not Significant** Likelihood can be identified as medium and impact magnitude as minor adverse.	None proposed
ES Chapter 13 Townscape and Landscape (including trees), ES Chapter 8 Ecology, Ecosystems Report and Landscape Strategy	Introduced biodiversity and habitats	Planting may not be resistant to extremes of temperatures and moisture causing it to die or become stunted. Potentially insufficient adaptation potential in habitats.	**Not Significant** Likelihood can be identified as medium and impact magnitude as moderate adverse. Landscape and ecology strategies have been developed to ensure planting and habitats respond to future climate trends.	None proposed
ES Chapter 14 Noise, Acoustics & Vibration and associated appendices	Visitors and site staff	Increase in duration of noise from cooling/ ventilation plant, as may be required to run for longer. Potentially increased impact due to windows being open more due to hotter weather.	**Not Significant** Likelihood can be identified as medium and impact magnitude as minor adverse.	None proposed

6.11.2 The use of professional judgement has been applied to the significance of each of the climate risks. This considers application of inherent mitigation shown in Table 6.15 when making a final judgement of significance.

6.12 Likely Significant Effects of the Proposed Development.

Construction Phase Effects

6.12.1 The annual carbon emissions resulting from the combined construction lifecycle stages A1 – A3 (product stages), A4 (transport) and A5 (site operations) is currently estimated to be approximately 12,300 t CO2e per year. This is less than 25,000 tCO2e and accounts proportionally for:

- 4.7% of local (Merthyr Tydfil 2019) baseline emissions;
- 30.29% of the annual Merthyr Tydfil budget (2023 – 2027);
- 0.051% of regional (Wales 2019) baseline emissions;
- 0.31% of the annual Wales budget (2023 – 2027);
- 0.0078% annual proportion of the 4th national carbon budget (2023 - 2027) (40% share attributable to the built environment sector);
- 0.0088% of annual proportion of the 5th national carbon budget (2028 - 2032) (40% share attributable to the built environment sector); and
- 0.0157% annual proportion of the 6th national carbon budget (2033 – 2037) (40% share attributable to the built environment sector).

6.12.2 This assessment has concluded that impact of the construction phase is low at a national and regional level. Due to the small size of Merthyr Tydfil and the nature and scale of the Proposed Development, at local level, the impact of the construction phase is considered medium.

6.12.3 Considering the nature of the Site and the national and regional relevance it can have, the overall effect is considered to be minor, with no significant effects. Furthermore, when considering the emission sources in isolation, embodied carbon during construction and transport during construction are likely to have a minor adverse, not significant effect.

Operational Phase Effects

6.12.4 The annual carbon emissions resulting from the combined operational phase effects of operational energy, operational traffic and repair and maintenance emissions (lifecycle stages B1 – B5) is currently estimated to be approximately 43,200 t CO2e at a national level, 21,900 t CO2e at regional level and 7.1 t CO2e at local level. When looking at the reported carbon emissions at national level, the reported figure is more than 25,000 tCO2e. The following breakdown shows the impact on the various baseline emissions and carbon budgets:

- 2.8% of local (Merthyr Tydfil 2019) baseline emissions;
- 17.64% of the annual Merthyr Tydfil budget (2023 – 2027);

- 0.092% of regional (Wales 2019) baseline emissions;
- 0.55% of the annual Wales budget (2023 – 2027);
- 0.028% annual proportion of the 4th national carbon budget (2023 - 2027) (40% share attributable to the built environment sector);
- 0.031% of annual proportion of the 5th national carbon budget (2028 - 2032) (40% share attributable to the built environment sector); and
- 0.056% annual proportion of the 6th national carbon budget (2033 – 2037) (40% share attributable to the built environment sector).

6.12.5 Furthermore, when considering the emission sources in isolation operational energy is considered to have a negligible, not significant effect. Operational phase transport effects are detailed below.

Operational Phase Transport

6.12.6 Looking at the breakdown of these emissions, it is noted that annual operational transport emissions are currently estimated to be approximately 40,000 tCO2e at national level, which accounts for > 90% of annual emissions during the operational phase. The operational traffic is calculated based on the estimated vehicle mix for the date of opening the Site (2026) and for the forecasted electric vehicle mix for the 2030. For the 2026 scenario, 15% of vehicles are estimated to be electric vehicles (EV). For the 2030 scenario, 43% of vehicles have been estimated to be EV based on the latest UK Carbon Budget "The Sixth Carbon Budget: The UK's Path to Net Zero, December 2020". For this study, EV have been intended as battery electric car, plug-in hybrid and hybrid electric vehicles.

6.12.7 When calculating the impact on the local and regional scale, the traffic generated within those areas has been considered. For the above assessment, it has been estimated an average distance of 149km at national level. This reflects the nature of the development attracting visitors from all over the UK. The traffic data has also been used to assess average distance travelled by the cars at regional and local level (being approximately 57km at regional level and ~11km at local level).

6.12.8 Based on the guideline quantitative threshold conditions detailed in the assessment methodology section, the impact of the operational phase transport is medium at the national level, low at the regional level and major at the local level. The following factors were considered in the application of professional judgement, the Proposed Development being a national attraction placing more weight on the impact at national and regional scales, the embedded mitigation measure of the shuttle bus between Merthyr Tydfil and the Proposed Development and the wider context of transport decarbonisation.

6.12.9 This assessment has concluded that the emissions associated with operational transport are likely to have a moderate adverse effect. In the case of operational transport emissions, considerations of anticipated improvements to local public transport infrastructure and electric

vehicle use update over the development's lifetime has not been accounted for, therefore this conclusion should be considered as a worst case at this point in time.

6.12.10 Additional mitigation which could reduce the impact of the operational traffic emissions will also be discussed below.

6.13 Additional Mitigation, Compensation and Enhancement Measures.

Construction Phase

6.13.1 Measures which will provide additional mitigation for the construction phase effects:

- Procure energy efficient construction plant reflecting the latest technology advances.
- Monitor energy, water and waste data during the construction stage to encourage transparency and accountability.
- All waste generated during construction to be diverted from landfill (where technically feasible).
- Explore the potential for low carbon construction materials and techniques – such as timber frame and offsite manufacture – which can help reduce the embodied impact of construction.
- Section 106 (S106) contributions will aim to target employment and training opportunities to local people. This approach, while providing positive social value, will reduce emissions associated with transport of construction workers during the construction period.

6.13.2 These potential interventions have not been relied upon when assessing the significance of anticipated effects of the Proposed Development prior to the consideration residual effect. They are considered to be implemented when assessing the residual effect.

Operational Phase

6.13.3 A number of design solutions have already been built into the Proposed Development design to avoid, prevent or reduce carbon emissions associated with the energy usage and transportation during the operational phase.

6.13.4 In addition to these inherent design principles, this chapter suggests the following measures to be adopted to effectively manage and further reduce the significance of carbon emissions expected to be generated through the operational stage of the scheme:

- Design with a low form factor (practical for high rise developments) for any appropriate buildings, which minimises the surface area to volume of the building, the surfaces through which detrimental heat gains in summer and heat losses in winter can pass are reduced. In winter, this reduces energy consumption and heating bills, in summer it helps to mitigate the risk of overheating and the need for mechanical cooling.

- At detailed design stage, seek to use materials with a high albedo in the façade design, these would reflect a higher level of incident radiation away from the building rather than absorbing to reduce surface temperatures, avoiding exacerbating the overheating risk.
- At detailed design stage, seek to implement recessed window in balconies, horizontal shading on south façades and vertical shading on east/west façades help to mitigate direct solar gain in the summer when the sun is high in the sky and thus, minimize overheating risk and reduce the need for mechanical cooling.
- At detailed design stage, seek to design in flexibility and adaptability in building design, allowing buildings to evolve to meet future demands and needs.
- Install smart meters and/or sub-meters to monitor operational consumption more accurately.
- Additional detailed modelling will be further explored at detailed design stages to investigate operational energy usage.
- Suitable space for waste storage and management facilities will be factored into the design to enable adequate waste segregation for optimal collection and subsequent treatment.
- Design in cross-ventilation where possible to create temperature differences which generate pressure differentials which draws external air into the space. Specify opening windows in on-site accommodation for purge ventilation.
- Use a certified green energy tariff to offset any remaining emissions such that the site operates as a net-zero carbon site.

6.13.5 Specifically relating to operational traffic which is considered to be a potentially significant effect:

- Provide appropriate signage and information on local public transport, cycle and pedestrian routes to encourage the use of sustainable modes of transport.
- Section 106 (S106) contributions will aim to target employment and training opportunities to local people. This approach, while providing positive social value, will reduce emissions associated with transport of staff during operation.

6.13.6 As with the additional mitigation suggested for the ‘During Construction’ emissions, these potential interventions have not been relied upon when assessing the significance of anticipated effects of the Proposed Development prior to the consideration residual effect. They are considered to be implemented when assessing the residual effect.

Climate resilience and adaptation

6.13.7 The climate resilience and adaptation assessment found that for all the potential effects of climate change assessed, the risk to the Proposed Development has been identified to be not significant. This has been shown through inherent mitigation measures embedded in the design which respond to all potential effects and impacts assessed in this chapter.

6.14 Assessment Summary and Likely Significant Residual Environmental Effects.

Construction Phase

6.14.1 The overall residual effect is assessed to be a long-term and permanent effect of minor nature, with no significant effects.

Operational Phase

6.14.2 The overall residual effect of operational energy is assessed to be a long-term and permanent effect of negligible nature, with no significant effects.

6.14.3 Operational traffic is considered a significant effect of moderate adverse nature. However, if the various mitigation and other measures detailed were taken into account, this effect would be reduced. However, as the impact of these measures cannot be quantified at this outline stage, as they are still under development/unknown, we are not in a position to quantify the magnitude of the impact in relation to carbon emission reduction. Although transport is expected to be the dominant source of carbon emissions associated with the site, it is anticipated that these emissions will reduce over the lifetime of the development and will provide qualitative benefits to individuals that can be considered to offset this impact.

6.14.4 The proposed mitigation measures can be actioned during the detailed design stages. Implementing secondary mitigation measures to improve access to the site with sustainable transport modes will reduce the residual effect. But, as noted above, as the impact of these measures cannot be quantified at this stage, the residual effect should remain as moderate adverse.

6.14.5 The ongoing electrification of the transport sector and continuous decarbonisation of the national electricity grid are expected to further reduce the annual emissions of the Proposed Development during its operational stages.

Climate resilience and adaptation

6.14.6 An assessment of climate resilience and adaptation has also been undertaken to assess the potential effect of climate change on the Proposed Development.

6.14.7 The assessment has not identified any impacts as a result of climate change that are likely to result in effects which are considered either ‘moderate’ or ‘major’ and therefore the impacts of climate change are considered not significant. The Proposed Development includes various inherent mitigation measures which respond to potential risks related to climate change. In doing so these risks are reduced and none were found to pose a significance risk to the Proposed Development.

6.15 Cumulative impacts.

6.15.1 It is acknowledged that there is a need to apply a systematic, coordinated approach to climate change mitigation and adaptation on a scale beyond that of individual projects. An overarching principle of the IEMA 2022 guidelines [11] is that the greenhouse gas emissions from all projects cumulatively contribute to climate change and affect all projects, thus making climate change by its very nature a cumulative effect. As such, the cumulative effects from the Proposed Development when considered alongside other committed development schemes in proximity to the Site have been addressed inherently within the greenhouse gasses and climate change assessments and are not duplicated here.

6.16 Summary.

6.16.1 The Applicant, in response to the climate emergency, is seeking to achieve net zero carbon for the Proposed Development for embodied construction, operational emissions and transport emissions.

6.16.2 Suitable methodologies will be reviewed and adopted, where appropriate, to achieve this. An example, for the building emissions (i.e. not including transport emissions) is the UK Green Building Council (UKGBC) Net Zero Carbon (NZC) Framework that is an industry recognised approach to achieve NZC for the built environment. The framework aims to reduce, mitigate and offset emissions for construction and operational energy separately.

6.16.3 Below provides a summary of the direct and indirect measures that have been considered as part of the assessment, demonstrating that the Proposed Development will be designed, constructed and used to be a sustainable addition to the local area. Strategies and considerations that will be employed as well as projected outcomes are summarised below:

Embodied carbon during construction:

- The proposed development will adopt Circular Economy Principles during detailed design to ensure that the specification of low carbon technologies are prioritised.
- Preference for local suppliers (within Merthyr Tydfil or Wales, also see ES Chapter 5 Community & Socio-Economic) to shorten the supply chain and reduce its associated environmental footprint coupled with prioritisation of responsibly sourced goods and services where feasible whilst maximising the proportion of recycled content within materials used in construction.
- Detailed consideration on the placement of the Proposed Development within the site to minimise its impact on the site's ecology;
- Position of the buildings and structure so to minimise the number of trees that need to be felled.
- Key materials extracted as part of the enabling works to be re-used and/or recycled in accordance with the waste hierarchy giving priority to on-site uses where practical.
- Manage all waste materials during the construction phase in accordance with the construction waste management practices outlined in the Site Waste Management Plan. Facilitate this objective by providing training for site personnel regarding the correct disposal of materials.

- Procure energy efficient construction plant reflecting the latest technology advances.
- Monitor energy, water and waste data during the construction stage to encourage transparency and accountability.
- All waste generated during construction to be diverted from landfill (where technically feasible).
- Explore the potential for low carbon construction materials and techniques, such as timber frame and offsite manufacture, which can help reduce the embodied impact of construction.
- To be considered a zero-carbon development, in line with the UKGBC approach previously mentioned, residual emissions from the construction stages can be offset via recognised initiatives.

Transport emissions during construction:

- Identifying materials that can be procured and sourced locally.
- Coordinating movement of products to reduce number of trips to site.
- Employment of local workforce, where possible.
- Producing and implementing a site waste management plan that follows circular economy principles to reduce the need for movement of waste from the site wherever possible.

Emissions from operational energy demand:

- The Applicant will adopt a verified green tariff so that zero emissions are achieved from day-1 of operation.
- An “all-electric” approach to the Energy Strategy will be adopted to enable the development’s operational emissions to continue to decarbonise over its lifetime through decarbonisation of the National Grid.
- Optimisation of photovoltaic (PV) panels throughout the site, in combination with biodiverse roof and plant space will provide green energy to supply the “all electric” approach. It is estimated that the indicative PV area identified (approx. 18,000m^2 panel area) could provide 2,700 MWh/yr. of green energy alone which is approximately 10% of the annual regulated energy demand for the site.
- Waste heat will be captured from cooling systems so it can be used to offset heating demand throughout the site via an ambient heat-sharing loop network, utilising Air Source Heat Pumps to supply the buildings’ demands. In particular, this heat exchange system will enable excess heat from cooling the Indoor Snow Centre to be used to heat the Indoor Water Park.
- For all energy that is required for the operations of the development, the Energy Strategy is projected to achieve a ~92% reduction in energy demand and therefore a ~92% reduction in regulated emissions compared to the Part L 2022 Wales notional building.
- The approach to Energy Strategy for the Proposed Development has been to provide an appraisal of the anticipated energy requirements and CO_2 emissions that could arise as a result of the Proposed Development through the use of energy data benchmarks of similar buildings. These building energy data benchmarks have been produced using Part L calculation methodology. The energy requirements for the Indoor Snow Centre component of the site have been estimated based on energy usage totals from similar existing facilities.
- The proposed Energy Strategy that has been developed for the site follows the Energy Hierarchy approach (i.e. Be Lean, Be Clean, Be Green).

- Following a fabric first approach, energy demand will be reduced from high specification of building fabric, high efficiency mechanical ventilation with heat recovery, and reduce the need for artificial lighting through appropriate glazing sizing and location.
- Full details on the proposed Energy Strategy can be seen in the Submitted Energy Strategy.

Transport emissions in operation:

- The transport emissions in operation contribute to the majority of the overall emissions of the Proposed Development due to the anticipated travel patterns and distances travelled of visitors of the site.
- Estimated emissions have been based on current and predicated travel patterns which also consider modes of transport.
- As the Proposed Development consists of a world-class leisure resort attraction, it is expected that visitors will be travelling from national locations in addition to local movement that would be expected for developments such as residential or offices.
- Considering this, the level of direct mitigation measures that can be applied as a result of the proposed design as the resultant emissions will depend on behaviour patterns of the visitors for how they choose to travel.
    - It is expected that should all measures, including secondary (e.g. the forecasted increase of uptake of EV cars by ~43% by 2030) are implemented, the expected impact from transport during operations could be reduced to low over the development lifetime.

6.16.4 To support positive behaviours in relation to sustainable travel, the following measures will be implemented:

- Extensive provision of electric vehicle (EV) charging bays, which can be partially offset by the onsite PV array, to support visitors using EV private vehicles. The proposed offerings have also considered the expected increased uptake of EV use by the general public over the building's lifetime by including passive charging bays (i.e. infrastructure available from day-1 with the exception to the physical chargers) to enable 100% of parking to be EV charging should demand increase.
- Ensure public realm strategy incorporates existing and proposed cycling and pedestrian routes to the site.
- Provide safe and secure cycle storage provision for site users.
- Provide appropriate signage and information on local public transport, cycle and pedestrian routes to encourage the use of sustainable modes of transport.
- Implement dedicated sustainable transport modes, specifically by running a shuttle bus from the Proposed Development to key destinations in Merthyr including the rail station, bus station and town centre.

6.16.5 Additional measures are measures that have not been included within the assessment as they are planned outside of the Proposed Development design. However, if implemented they will also have a positive impact on transport emissions. The Additional measures considered are as follows:

- The proposed South Wales Metro will provide an integrated network of bus, rail and active travel to make sustainable travel easier across South Wales. The works will include electrification of railway infrastructure, replacement of trains and improving facilities at existing station.
- Increased uptake in use of EV vehicles for private travel (forecast to be 43% increase by 2030).
- Increased uptake in use of public transport modes to travel to and from the site.

6.16.6 IEMA's overarching principles on Climate Change Mitigation & EIA acknowledge that the carbon emissions from all projects will contribute to climate change. Therefore, additional mitigation and adaptation measures are discussed for all effects in order to identify further opportunities for reducing any potential adverse impacts of the Proposed Development.

6.16.7 This analysis has concluded that apart from operational traffic, all reviewed sources of carbon emissions are likely to result in minor adverse effects, in the context of the Welsh emissions and UK national carbon budgets (apportioned to reflect the contribution of the built environment's estimated share).

6.16.8 Operational traffic is considered a significant effect of moderate adverse nature. However, if the various mitigation and other measures detailed were taken into account, this effect would be reduced. However, as the impact of these measures cannot be quantified at this outline stage, as they are still under development/unknown, we are not in a position to quantify the magnitude of the impact in relation to carbon emission reduction. Although transport is expected to be the dominant source of carbon emissions associated with the site, it is anticipated that these emissions will reduce over the lifetime of the development and will provide qualitative benefits to individuals that can be considered to offset this impact. The proposed mitigation measures can be actioned during the detailed design stages. Implementing secondary mitigation measures to improve access to the site with sustainable transport modes will reduce the residual effect to minor, not significant. The ongoing electrification of the transport sector and continuous decarbonisation of the national electricity grid are expected to further reduce the annual emissions of the Proposed Development during its operational stages.

Table 6.23: Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect
Embodied carbon during construction	High (Global Climate)	Low	Minor adverse, not significant	• Procure energy efficient construction plant reflecting the latest technology advances. • Monitor energy, water and waste data during the construction stage to encourage transparency and accountability. • All waste generated during construction to be diverted from landfill (where technically feasible). • Explore the potential for low carbon construction materials and techniques – such as timber frame and offsite manufacture – which can help reduce the embodied impact of construction.	Low	Minor adverse, not significant
Construction traffic	High (Global Climate)	Low	Minor adverse, not significant	• Specification of materials that can be procured and sourced locally. • Coordinate movement of products to reduce number of trips to site. • Employ local workforce, where possible. • Produce and implement site waste management plan that follows circular economy principles to reduce need for movement of waste from the site where possible.	Low	Minor adverse, not significant
Regulated and unregulated energy (in operation)	High (Global Climate)	Low	Minor adverse, not significant	• Design with a low form factor (practical for high rise developments) for any appropriate buildings, which minimises the surface area to volume of the building, the surfaces through which detrimental heat gains in summer and heat losses in winter can pass are reduced. In winter, this reduces energy consumption and heating bills, in summer it helps to mitigate the risk of overheating and the need for mechanical cooling; • At detailed design stage, seek materials with a high albedo in the façade design, these would reflect a higher level of incident radiation away from the building rather than absorbing to reduce surface temperatures, avoiding exacerbating the overheating risk. • At detailed design stage, seek to implement recessed window in balconies, horizontal shading on south façades and vertical shading on east/west façades help to mitigate direct solar gain in the summer when the sun is high in the sky and thus, minimize overheating risk and reduce the need for mechanical cooling. • Install smart meters and/or sub-meters to monitor operational consumption more accurately. • Additional detailed modelling will be further explored at detailed design stages to investigate operational energy usage. • Suitable space for waste storage and management facilities will be factored into the design to enable adequate waste segregation for optimal collection and subsequent treatment. • Design in cross-ventilation where possible to create temperature differences which generate pressure differentials which draws external air into the space. Specify opening windows in on-site accommodation for purge ventilation.	Low	Negligible, not significant

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect
				• Use a certified green energy tariff to offset any remaining emissions such that the site operates as a net-zero carbon site.		
Embodied carbon (during operation – repair and maintenance)	High (Global Climate)	Low	Minor adverse, not significant	• At detailed design stage, seek to design in flexibility and adaptability in building design, allowing buildings to evolve to meet future demands and needs.	Low	Minor adverse, not significant
Operational traffic	High (Global Climate)	Medium	Moderate adverse, significant	• Improvements to Railway network proposed by METRO to encourage use of public transport nodes. • Increased uptake in use of EV vehicles for private travel • Increased uptake in use of public transport modes to travel to and from the site	Medium	Moderate adverse, significant

Table 6.24: Means by which Additional & Secondary Mitigation Measure may be Secured

Identified Effect where additional mitigation (Not design mitigation) has been identified	Type of mitigation measures (avoidance, reduction, compensation, enhancement)	Means by which mitigation measure may be secured	Resultant residual impact magnitude	Resultant residual significant and nature of effect
Construction				
N/A	N/A	N/A	N/A	N/A
Operation				
Operational traffic emissions	Avoidance, reduction	• Provision of extensive EV charging stations on site to encourage low carbon private vehicle use. • Ensure public realm strategy incorporates existing and proposed cycling and pedestrian routes to the site. • Provide safe and secure cycle storage provision for site users. • Provide appropriate signage and information on local public transport, cycle and pedestrian routes to encourage the use of sustainable modes of transport.	Low	Moderate adverse, significant
Operational energy demand	Enhancement	• Use a certified green energy tariff to offset any remaining emissions such that the site operates as a net-zero carbon site.	Low	Negligible, not significant

6.17 References

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6.18 Glossary

Term	Definition
Embodied carbon	The total carbon emissions generated to produce a built asset. It is often defined as the carbon emissions associated with energy consumption (embodied energy) and chemical processes during the extraction, manufacture, transportation, assembly, replacement and deconstruction of construction materials or products.
Climate change mitigation	Measures implemented in the design of the Proposed Development to avoid, prevent, reduce or offset GHG emissions.
Primary / inherent / embedded design mitigation	Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken. This type of mitigation encompasses design principles and solutions which have been ‘embedded’ or ‘built in’ the Proposed Development design to minimise climate-related risks.
Secondary / additional mitigation	Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the ES. This type of mitigation refers to measures that require additional action beyond the core function of the development, which can be proposed at any point within the EIA process, including during the decision-making process.
Climate change resilience & adaptation	Measures implemented to future-proof the Proposed Development and adapt to the anticipated impacts of a changing climate.
Regulated carbon emissions	Emissions associated with the regulated energy uses, i.e. uses that are inherent in the design of a building and, therefore, relate to the ‘quality’ of the building itself.
Unregulated carbon emissions	Emissions associated with unregulated energy uses within a building including small power electricity use, such as IT equipment, plug in devices and catering facilities.

7.0 Ground Conditions

7.1 Introduction

7.1.1 This chapter aims to assess the impact of the proposed development on the ground conditions at the site.

7.1.2 It assesses both the construction and operational phases of the development and will cover the site and the immediate surrounding area within which the development may have an impact on ground conditions. The following potential impacts have been considered.

- Impact of the development on the ground conditions in terms of risks associated with historical coal mining and slope stability.
- Mobilisation of contamination present on the site associated with the proposed development with respect to risks to human health and the wider environment including sensitive environmental receptors (SSSI) and statutory designations including Scheduled Ancient Monuments;
- Likelihood of contaminative materials being introduced onto the site as a result of the construction and operational phases.

7.1.3 This chapter should be read in conjunction with Chapter 11 of the Environmental Statement (ES) relating to Hydrogeology & Hydrology.

7.1.4 The proposed development boundary covers circa 30 hectares within the southern part of the wider Rhydycar West site and falls within the boundaries of the Rhydycar Gorllewin/ Rhydycar West Site of Importance for Nature Conservation (SINC) and partially overlapping with a Site of Special Scientific Interest (SSSI). The land ownership boundary covers a much larger area (circa 223 hectares) including further areas designated as SSSI and SINC. Two Scheduled Ancient Monuments (SAMs) are located nearby to the proposed development; the Cyfarthfa Balance Pond and Leat located immediately adjacent to the proposed development boundary and Cwm Pit and Head of Railway to the south.

7.1.5 Within this chapter, the proposed development boundary is referred to as the ‘site’, and the full extent of the land holding is referred to as the ‘wider site’.

7.1.6 The site is located within an area which has been subject to the impact of historical coal mining both with the placement of spoil heaps on the site surface as well as underground mine workings of numerous coal seams and mine entries (shafts and adits). Spoil heaps are present across the site consisting of colliery spoil, ironstone waste and material originating from the development of the A470 dual carriageway located adjacent to the site.

7.1.7 Infrastructure associated with the historical mining activities are also present on the site including the routes of historical railway lines and cuttings and derelict buildings.



7.1.8 The site is currently undeveloped and access is limited to informal use of short duration by member of the public and landowners, including on historically claimed and recently established public rights of way across the site.

7.2 Methodology and Scope

Policy Background

7.2.1 The assessment of baseline ground conditions was undertaken under the regulatory framework set out within the Environmental Protection Act (EPA) 1990. Part 2A of the EPA 1990 relates to contaminated land and provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment. The EPS 1990 also provides a means by which enforcing authorities should seek to find and deal with such land. Under Part 2A of the EPA 1990 the starting point should be that land is not contaminated land unless there is reason to consider otherwise.

7.2.2 The overarching objectives of the Government's policy on contaminated land and the Part 2A EPA 1990 regime are:

- To identify and remove unacceptable risks to human health and the environment.
- To seek to ensure that contaminated land is made suitable for its current use.
- To ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of sustainable development.

7.2.3 Whilst the EPA 1990 provides the underpinning legislation to contaminated land policy in the UK, the main driver for investigation, assessment and remediation of contaminated land in the UK is through the redevelopment of brownfield land, controlled via the development control process, as outlined within Chapter 6 of the Welsh Government document Planning Policy Wales (Edition 11, February 2021) which states that planning policies and decisions should also ensure that:

- Where land contamination issues arise, the planning authority will require evidence of a detailed investigation and risk assessment prior to the determination of the application to enable beneficial use of land, unless it can already be established that remedial measures can be employed.
- When considering development proposals, planning authorities should take into account the nature, scale and extent of ground instability which may pose direct risks to life and health, buildings and structures, or present indirect hazards associated with ground movement, including mine entry collapse, which provide potential pathways for the migration to the surface of landfill or mine gases. Slopes, embankments, cuttings and underground cavities can themselves be put at risk from inappropriate neighbouring development and, where relevant, land stability should be addressed and appropriate mitigation measures secured to protect both existing assets and proposed development itself.

- Made ground, the presence of tips and shallow coal workings are extensive in some parts of Wales and their proximity to the surface could present potential instability risk to future development.

7.2.4 Legislation of relevance taken into account in the assessment included the following:

- The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2017 (the EIA Regulations);
- Control of Pollution Act 1974;
- EC Dangerous Substances Directive (76/464/EEC);
- EC Fisheries Directive (78/659/EEC);
- Part 2A of Environmental Protection Act 1990;
- Land Drainage Act 1991;
- Environment Act 1995;
- The Contaminated Land (Wales) Regulations 2006, and as amended (2012); and,
- Environmental Permitting (England and Wales) Regulations 2016 and as amended.
- The Water Act 2014;
- Groundwater Regulations 2009;
- UK Water Quality (Water Supply) Regulations 2000;
- Water Framework Directive (2000/60/EC); and

7.2.5 The following guidance documents are considered relevant:

- Environment Agency Land Contamination Risk Management (LCRM), published online, dated 8 October 2020. (Last updated 19th April 2021);
- Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Impact Assessment (IEMA, 2004 as amended 2006);
- BS EN 10175:2011+A1:2013 Investigation of potentially contaminated sites. Code of practice (Ref. 15.9). National Policy;
- BS EN 5930:2015 Code of practice for ground investigations;
- Development Control Advice Note (DCAN) 10 ‘Environmental Impact Assessment’ (1999);

- Department for the Communities and Local Government, Amended Circular on EIA consultation paper 'Environmental Impact Assessment: A Guide to Good Practice and Procedures' (June 2006);
- PPG 14: Development on Unstable Land. Department of the Environment.
- CD 622. Managing Geotechnical Risk. Revision,1 2020.

7.2.6 In addition, the Construction Industry Research and Information Association (CIRIA) publish the following guidance:

- Report C532 – Control of Water from Construction Sites; and,
- Report C692 – Environmental Good Practice on Site. 3rd Ed. 2010.

Scoping Assessment Stage

7.2.7 As part of the EIA assessment process, regulatory consultation was sought following the preparation of an EIA Scoping Document. The following table outlines the relevant regulatory responses with regards to ground conditions.

Table 7.7-1 – Summary of Regulatory Responses

Regulatory Body	Scoping Opinion
Merthyr Tydfil County Borough Council (MTCBC)	*"Due to the past history of the area initial investigations and surveys, as indicated, could suggest future solutions to the site problems that may be revealed and could require further works.* *The geology of the area is paramount in the future proposals for this site and any adjacent sites. Ground contamination needs to be investigated also".*
Coal Authority	*"The site of the proposed EIA development is located largely within the defined Development High Risk Area. The following provides a summary of the Coal Authority's information relating to the significant coal mining legacy affecting the site:* • *The site is within the potential zone of influence of former mine workings in 11 coal seams, including workings at shallow depth.* • *There are parts of the site where historic unrecorded coal mining activity is likely to have taken place at shallow depth.* • *There are 34 recorded mine entries (shafts and adits) and their associated zones of influence present within the site or within 20 metres of his boundary. We hold limited treatment details for four shafts and no information relating to the past treatment of the remaining mine entries. Due to the potential plotting inaccuracies the actual positions of the mine*

Regulatory Body	Scoping Opinion
	entries could deviate from their plotted positions by several metres. *We wish to advise that any Coal Mining Risk Assessment or equivalent report prepared in relation to the proposed development should utilise up to date coal mining and geological information to assess the extent to which past mining activity poses any risk to the development proposal and, where necessary, proposed mitigation measures to address any issues of land instability. This should include further intrusive investigations to establish the exact situation regarding coal mining legacy affecting the site, as necessary.* *It would appear from the Masterplan that built development is proposed over recorded mine entries, with the footprint of the snow centre encompassing the plotted positions of a number of mine shafts and adits.* *The Coal Authority takes this opportunity to highlight that any form of development over or within the influencing distance of a mine entry can be dangerous and raises significant safety and engineering risks and exposes all parties to potential financial liabilities. The Coal Authority has adopted a policy where, as a general precautionary principle, the building over or within the influencing distance of a mine entry should, wherever possible, be avoided. Notwithstanding this the Local Authority acknowledges that there are occasionally exceptional situations where large scale development cannot feasibly be designed to avoid being located over mine entries such as the snow centre element of the proposal. Nevertheless in these cases we would expect a thorough justification for the layout proposal and a robust solution for addressing the risks posed by the mine entries to be provided to the LPA to support the submission.* *We note that Appendix 3 indicates that there are a number of spoil tips present within the site which may require stabilisation. We take this opportunity to highlight that the Coal Authority does not provide comment on matters relating to the tips in our role as statutory consultee. As such in its consideration of any future planning application the LPA would need to be seek its own technical advice regarding the matter."*

Regulatory Body	Scoping Opinion
Natural Resources Wales (NRW)	The NRW response included the following recommendations with respect to Ground Conditions. • *"Design of a Geo-Environmental Investigation to assess the baseline land quality conditions for the proposed development site with a focus on ground contamination, notably the Made Ground that underlies much of the site, and geotechnical properties of the range of ground materials present at the site.* • *Information, albeit at high level at this stage, on the degree to which the proposed development site will require ground reprofiling, ground stripping and excavation as these interim site conditions can result in environmental risks and impacts. Estimates of the duration of these interim conditions should also be provided as a combination of wet conditions and denuded ground can generate sediment and contaminant risks which can impact upon the wider environment. "*

Pre-Application Consultation Response

7.2.8 As part of the pre-application consultation process responses have been received from the Coal Authority and Natural Resources Wales relating to Ground Conditions. These responses are summarised in the following table.

Table 7.7-2 – Summary of Regulatory Responses

Regulatory Body	Scoping Opinion
Coal Authority	The Coal Authority providing the following information relating to features associated with the historical mining of the site. • *The site is within the potential zone of influence of former mine workings in 10 coal seams, including workings at shallow depth.* • *There are parts of the site where historic unrecorded coal mining activity is likely to have taken place at shallow depth.* • *There are 29 recorded mine entries (shafts and adits) and their associated zones of influence present within the site or within 20m of its boundary. We hold limited treatment details for two shafts and no information relating to past treatment of the remaining mining entries. Due to potential plotting inaccuracies, the actual positions of the mine entries could deviate from their plotted positions by several metres.*

Regulatory Body	Scoping Opinion
	• *The identified mining legacy poses a potentially significant risk not only to surface stability but also public safety, and may give rise to the emission of mine gases.* The Coal Authority highlights the implications for building within the zone of influence of any mine entries and states *"Any form of development over or within the influencing distance of a mine entry can be dangerous and raises significant safety and engineering risks and exposes all parties to potential financial liabilities. The Coal Authority has adopted a policy where, as a general precautionary principle, the building over or within the influencing distance of a mine entry should wherever possible be avoided.* *In most cases it is possible to design a layout of development which is informed by the presence of recorded mine entries and avoids these features and their associated zone of influence. However, we appreciate that this is not always possible for large scale development proposals. The proposed development at Rhydycar West could be considered to fall into this category.* *In those exceptional cases where development is proposed over recorded mine entries, the Coal Authority's Planning & Development Team would typically expect the features in question to be physically located, their condition assessed and clear information provided as part of the planning application to demonstrate how the risk posed by the mine entries is to be addressed in the detailed scheme of development.* The Coal Authority also provide comment on the feasibility of the ground investigation and state: *"We accept that the undertaking of site investigations to locate the numerous mine entries prior to securing outline planning permission may not be feasible in this case. Nevertheless, we would expect any outline planning application to set out clear justification as to why development cannot be arranged to avoid the recorded mine entries. A clear and robust methodology should also be provided which sets out how the risk posed by these features is to be addressed , including the anticipated phasing of investigation works and subsequent remedial treatment works and mitigation measures."* *"...the shape of the proposed application site and the layout of development shown on the Illustrative Masterplan, suggest that the development will take place over numerous mine entries. "*

Regulatory Body	Scoping Opinion
Natural Resources Wales (NRW)	With regards to Ground Contamination NRW provide the following comments: *Due to the size of the site, we would seek the submission of detailed historic mapping as part of the desk top study to ensure that no obvious sources of large scale gross contaminative sources have been missed. This should be submitted with any planning application. Our advice regarding land contamination will depend on the outcome of the more detailed historic mapping. If large scale gross contaminative sources are identified, we may require a number of land contamination conditions. In any event we would request a condition relating to unsuspected land contamination.* The NRW response highlighted the potential impact of the remedial works on the groundwater and surface water bodies on site and downstream / down gradient of the site, stating. *Depending upon the methods proposed for remediation of the underground workings associated with the site, we may advise a condition to ensure protection of controlled waters associated with ground improvement / grouting works. We would seek confirmation in the planning application as to the methods proposed for remediation of the underground workings associated with the site.* *For your information, we advise the following is the type of information we would require regarding grouting and ground stabilisation works:* *4.2.1 Summary of information required as part of grouting and ground stabilisation works.* *The following summary should be used as a guide in assessing the type of information NRW would require to be carried out and submitted as part of any proposed grouting and ground stabilisation and excavation of former mine-workings. It should be noted that additional information, not included in this summary may be required during such works.* *Vulnerability Survey* • *Identify all surface and groundwater features and users in the vicinity of the site including old or existing mine adits and mine-workings, drains and culverted features. In addition, all relevant historic documents held by the appropriate local planning authority should be used to identify any natural or man-made structures beneath or in the vicinity of the site.* • *It is important for a walk-over survey to be carried out to validate the vulnerability survey and identify any features not included in the formal records, i.e. disused adits or mine-workings etc.* • *In order to notify abstractors in case of grout break-out, licensed surface water bstractions downstream of a site need to be identified. For a main*

Regulatory Body	Scoping Opinion
	river this would typically be a few kilometres. NRW can supply this information. See also 1.4 "Management". *Procedure* • *Location of the area to be grouted.* • *Check area against vulnerability survey and historic land-use records.* • *Nature of any structures to be grouted, cavities in the sub-strata, mine-workings etc.* • *Is grouting to take place above or below the water table?* • *Method of grout injection, i.e. as part of an inner/outer "curtain" or individual injection boreholes etc.* • *Type of grout to be used, i.e. ratio of cement, water, other material - this should take into consideration whether grouting is to take place above or below water table.* • *Thixotropy of the grout, i.e. how far will the grout extend into the cavity when injected. Again this should take into consideration whether the works are above or below water table.* • *Duration of grouting works.* • *How much grout is to be injected into both individual points and as a total quantity.* *Monitoring* • *Identification of sites grouting material could emerge, i.e. adits/drains into water courses etc.* • *Proposals for monitoring such features during the work, i.e. which ones, frequency of monitoring.* • *Confirm details of monitoring with NRW prior to the commencement of workings.* • *Agree suitable mitigation measures with the local Environment Officer should any impact on any feature occur during to the workings.* *Management* *Keep daily records of the following:* • *Review previous days grouting operations (where grouted, how much grout used etc).* • *Location of areas to be grouted.* • *Boreholes used for grouting* • *Times of injection into each borehole.* • *Quantities of grout to be injected into each borehole (both projected and actual).* • *Records if quantity of grout "lost" in a borehole.*

Regulatory Body	Scoping Opinion
	• *Pressure used in grouting at a borehole.* • *Type of grout used.* • *Review of monitoring.* • *Details of any break-outs of any grout.* • *Details of any clean-up of grout at monitoring sites.* • *Reporting of information needs to be agreed with NRW prior to the commencement of workings.* • *In cases of an unpredicted loss of grout, emergency procedures should be agreed with NRW to include an increase in the frequency of monitoring of any identified surface water features.* • *Notification to NRW should either any outbreak or an unpredicted loss of grout occur.* • *Notification of identified downstream surface water abstractors in the event of an emergency, i.e. if there was any outbreak of grout into a surface water course.* *4.2.2 Materials Management* *It is noted that the applicant intends to manage re-use of the coal and iron working spoil via the CL:AIRE Code of Practice. We recommend the applicant contacts CL:AIRE to discuss this intended use. We do not object to the re-use of materials on site, however, as far as we are aware the code of practice cannot currently be used for mining spoil/waste.* They highlight the requirement for a Vulnerability Survey to identify groundwater, surface water and drainage features which may be at risk from the release of grout into the water environment. The requirement for liaison with those parties who abstract water within the vicinity of the site and implementation of a monitoring, response and reporting procedure to identify any unprecedented release of grout.

Assessment Methodology

7.2.9 The following section explains the methodology employed to define the baseline ground conditions on the site, and the subsequent methodology used to provide an assessment of potential impacts from the proposed development on that baseline.

Development of Ground Model

7.2.10 The available Coal Authority records and mapping relating to historical mining activities have been reviewed along with geological data for the site to create a detailed ground model. This model outlines the anticipated extent of workings in the sub surface environment and presents information for each recorded coal seam. This model will support the design of future ground investigations in liaison with the Coal Authority.

7.2.11 On completion of intrusive works the model will be updated and refined to reflect proven ground conditions. Outputs from the model are included in the Appendices of the Desk Top Study summarised below.

Desk Top Study and Coal Mining Risk Assessment

7.2.12 A ground conditions desk study and coal mining risk assessment has been undertaken as part of the compilation of this assessment, providing a preliminary summary of the ground conditions both within the site and in the immediate vicinity.

7.2.13 In order to carry out this assessment, a number of sources of information were utilised, including:

- Information obtained from a site inspection walkover.
- Current and proposed site plans.
- BGS superficial and solid geology maps.
- Flood mapping, groundwater protection and vulnerability mapping, bedrock and superficial aquifer designations, pollution incidents to controlled water register, and discharge consents.
- Historical Ordnance Survey mapping.
- Groundsure® Report
- Tetra Tech Ground Conditions Desk Study and Coal Mining Risk Assessment Report, dated April 2022.

7.2.14 A copy of the Ground Conditions Desk Top Study and Coal Mining Risk Assessment is presented in **Appendix 7.1**. The report was undertaken in accordance with guidance set out within:

- The Model Procedures for the Management of Land Contamination (CLR11) 2004.
- CIRIA C552: Contaminated Land Risk Assessment, a guide to good practice.
- PPG 14: Development on Unstable Land. Department of the Environment.
- CD 622. Managing Geotechnical Risk. Revision,1 2020.

7.2.15 A Contaminated Land Risk Assessment has been undertaken in line with the requirement of CIRIA 552 and LCRM procedures whereby risks to the environment are considered with respect to a Conceptual Site Model to identify the potential pollution linkages on the site in terms of viable Source, Pathways and Receptors linkages as defined below.

7.2.16 Sources represent potential contamination present on the site which may pose a risk to identified receptors. These may be present on the site prior to the development or introduced as part of the development or operational processes. These sources may be mobile contaminants within groundwater or surface water, contamination within near surface soils or gases / vapours derived from the site or migrating onto the site. Sources of contamination may be present within the site boundary or migrate onto site from adjacent sites.

7.2.17 Pathways are mechanisms whereby the contamination present within the source interacts with the defined receptor. In terms of risks to human health this is generally through inhalation, ingestion or direct contact. Risks to the controlled waters of the wider environment are generally via leaching and migration through groundwater and surface waters and via preferential pathways such as foundation and service runs.

7.2.18 Receptors are the elements which may affected by the defined sources of contamination, this can be human health (site users, neighbouring site residents etc) or environmental such as groundwater, surface water, ecological resources etc. Short term risks associated with the exposure of site construction workers to contaminants are controlled under the relevant health and safely legislation.

7.2.19 The pollutant linkages identified in the conceptual model allowed a qualitative risk assessment to be carried out following the methodology outlined in CIRIA 552. The risk assessment considers the site within an area context and assesses potential risks to identified receptors in relation to the existing site setting and the proposed development.

7.2.20 A geotechnical risk register has been developed in line with the principles outlined in Part 2 of CD 622 'Managing Geotechnical Risk' whereby the degree of risk is determined by combining an assessment of the probability of the hazard occurring with an assessment of the impact the hazard and associated mitigation will cause if it occurs.

7.2.21 A Coal Mining Risk Assessment has been undertaken based on the available geological and coal mining data for the site and highlights the potential risks associated with the proposed development.

Receptor Sensitivity

7.2.22 The assessment presented within this Chapter assesses the potential effects of the development on the ground conditions of the site and surroundings considering both the construction phase and operational phase of the development.

7.2.23 The potential receptors at risk are also outlined along with an assessment of their relative sensitivity. The categories are defined in the table below.

Table 7.7-3 – Classification of Sensitivity

Classification	Definition
Very High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high environmental value, or of international importance.
High	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional or national importance
Medium	The receptor has high capacity to absorb change without significantly altering its present character, has low environmental value, or is of local importance
Low	The receptor is generally insensitive to impact.

Impact Magnitude

7.2.24 The potential impacts of the final design are identified and classified according to their magnitude of change. The categories of the magnitude of change are defined in the table below. A change may be either beneficial or adverse.

Table 7.7-4 – Classification of Magnitude of Change

Classification	Definition
Substantial	There would be fundamental changes to the ground conditions, hydrology, hydrogeology. Soil contamination resulting in a contaminated land designation under Part IIA or a change in planning use deems that the concentrations of contaminants in the land may be harmful to receptors. Significant increase in risk of instability or collapse of mine workings /entries at the ground surface, impact on structures on site and site users. Remediation costs may be prohibitive to development.
Moderate	There would be material but non-fundamental changes to the ground conditions. Soil contamination providing a strong case for considering that the risks are of significant concern so as to be designated as 'contaminated land' under Part IIA or a change of planning use deems that the concentrations of contaminants in the land may be harmful to receptors and require remedial works. Increased risk of instability or collapse of mine workings / entries at the ground surface requiring additional remediation to facilitate development.

Slight	There would be detectable but non-material changes to the ground conditions, hydrology, hydrogeology Soil contamination exists but the concentrations would not be considered significant or that there is a low likelihood of serious pollution or a change of planning use deems that the concentrations of contaminants in the land are not capable of harming receptors. Limited impact on stability that may require ongoing monitoring or minor remediation.
Negligible	There would be no perceptible changes.

Impact Significance

7.2.25 The significance of the Impact is determined by the combination of the Magnitude of the impact and the Sensitivity of the receptor, with outcomes defined as Major, Intermediate, Minor or Neutral as per the assessment matrix in Chapter 2.

7.2.26 The magnitude of the impact is also considered based on whether the effect is:

- direct or indirect;
- short, medium or long term;
- permanent or temporary;
- beneficial or adverse.
- reversible or irreversible.
- cumulative and in combination.

Limitations of the Assessment

7.2.27 The assessment is based on a desk-based study only and intrusive investigation has not been carried out on the site to support the process.

7.2.28 A detailed understanding of the site has been developed through the review of available Coal Authority records and mapping to develop a ground model for the site which identifies the anticipated areas of workings in the underlying coal seams. Whilst these works have combined all data which was available to review, the actual extent of workings beneath the site will need to be proved through intrusive ground investigation in due course.

7.2.29 As such the anticipated ground conditions are based on the information presented within the Desk Study and the professional experience of the authors. With the absence of site-specific information, the assessment process is undertaken based on a conservative approach and actual ground conditions will need to be confirmed in due course to support the proposed development.

7.3 Baseline Environment

Existing baseline

Geology

7.3.1 Reference to published British Geological Survey (BGS) Mapping for the site (Sheet 231) indicates that extensive deposits of made ground are present across the site in the form of large spoil heaps present across the majority of the wider site and within the eastern part of the proposed development area. Additional areas of Made Ground are anticipated associated with former developments such including rail lines and colliery infrastructure.

7.3.2 BGS mapping also indicates the majority of the site is underlain by superficial deposits of Glacial Till, present across the entire site area with the exception of the upper half of the proposed ski slope. This stratum is defined as predominantly cohesive deposits which are noted to include poorly sorted grain sizes.

7.3.3 The superficial deposits are anticipated to be thickest in the east of the site, gradually thinning to the west.

7.3.4 The bedrock underlying the superficial deposits are noted to consist of strata from the Middle and Lower Coal Measures Formation consisting of mudstone, siltstone and sandstone. The Middle Coal Measures are recorded across the majority of the site, with the most easterly areas of the site underlain by strata of the Lower Coal Measures.

7.3.5 Numerous coal and ironstone seams are present beneath the site. The majority of which have been extensively mined both below the proposed development area and the wider Rhydycar West site.

Historical Coal Mining

7.3.6 The site is located within a high-risk development area with respect to the presence of former mine entries and shallow mine workings across the entire Rhydycar West development area. It is also noted that additional un-recorded workings are likely to be present due to informal surface extraction and incomplete Coal Authority records.

7.3.7 Historical abandonment plans held in the Coal Authority archive have been reviewed and the data combined with geological information from the British Geological Survey (BGS) to develop a Ground Model for the site identifying the anticipated extent of workings present below the site.

7.3.8 A large number of spoil tips are also present on the site, including the main development platform. It is likely that the placement of this material may have led to the burial of mining features (shafts / surface extraction). The proposed development incorporates a number of spoil tips present within the site, including the main development platform.

7.3.9 Coal Authority records indicate at least eleven coal seams outcrop at the site. The available records have been used to provide a summary of the following eight seams with workings recorded below the footprint of the proposed development. The extent of workings in each seam varies and it is possible that further workings are present, not recorded within Coal Authority records. Plans showing the extent of the workings are presented in the Desk top study presented in Appendix 7.1.

Table 7.7-5 – Summary of Worked Coal Seams within Proposed Development Area

Seam	Extent of Mining within Proposed Development Area
Upper Gelli-deg.	Extensive workings within proposed development area.
Seven Foot	Extensive workings within proposed development area.
No 2 Yard	Extensive workings within proposed development area.
Bute	Extensive workings within proposed development area.
Nine Foot	Extensive workings within southern and western areas of proposed development.
Upper Six Foot	Working limited to upper reaches of indoor snow centre.
Four Feet	Working limited to upper reaches of indoor snow centre.
Two Foot Nine	Working limited to upper reaches of indoor snow centre.

7.3.10 The Seven-foot Seam outcrops adjacent to the A470 dual carriageway at the eastern extent of the site. This seam sub crops below the site and is subsequently overlain by the other seams which outcrop from east to west. Due to the orientation of the strata and topography of the site, there is the potential for shallow workings to be present in all seams.

Hydrogeology & Hydrology

7.3.11 A more detailed assessment of the Hydrogeological and Hydrological site setting is provided in Chapter 11.

7.3.12 Where present, the superficial stratum of Glacial Till is defined as unproductive strata with the underlying bedrock strata of the Lower and Middle coal Measures defined as Secondary A Aquifer aquifers. Secondary A Aquifers are classed as permeable layers capable of storing water supplies at a local rather than strategic scale, and in some cases, form an important source of base flows to rivers.

7.3.13 The aquifer vulnerability classification varies across the site, where superficial deposits are present the groundwater vulnerability is considered to be low, with a medium vulnerability value assigned to the location of the proposed ski slope where superficial strata are assumed to be absent.

7.3.14 The site is not located within a designated Source Protection Zone for groundwater abstraction.

7.3.15 Numerous water features are present on the site including streams, rivers, drainage ditches and ponds. There are several streams which are shown to be crossing the site area, generally flowing in a west to east orientation towards the River Taff which is located approximately 600 metres to the east of the A470.

7.3.16 The majority of the site is largely characterised by a series of small streams and ephemeral channels which are shown to drain issuing streams from the base of spoils tips and water emerging from former mine entrances transmitting water to ponds within the eastern area of the site prior to being discharged off-site via a series of culverts at the boundary to the site.

7.3.17 The Cyfarthfa Balance Pond and Leat are located immediately adjacent to the site and were historically fed by water from the diverted Nant Caniad stream to provide water to the Tub Boal Canal. These features are designated as a Scheduled Ancient Monument (SAM).

7.3.18 There are no surface water abstractions recorded on the site and no active abstractions within 500m.

Radon

7.3.19 The site is located in an area where less than 1% of homes are above the action level for radon and as such, radon protection measures are not required within new developments on the site.

Summary of Site History

7.3.20 The site has been extensively mined for coal and ironstone since the late eighteenth century although small scale surface mines may pre-date the recorded activities. Intensive mining began in the 1760s when the site became the main mineral take for the Cyfartha Iron Works. Mining for Cyfartha is reported to have first occurred in the Cwm Pit in the south-eastern corner of the wider site, with coal being carried by boats along the Cyfartha Tub Boat Canal. The Canal became redundant with the rise of the railway and mineral railways across the site, becoming abandoned by the 1840s. Mining for ironstone diminished within the site by the late 19th century although coal mining continued until the mid-20th century. By this time, the site was largely derelict and abandoned with large areas of colliery spoil tips and more localised areas of made ground associated with former tramways, canal and collieries.

Site Context – Waste, Licencing and Permitting

7.3.21 Waste produced at the site is largely in the form of mining spoil, but it is possible that other incidental materials have been deposited within the spoil tips. There are no historical or registered landfills or waste management facilities recorded within 250m of the site. There are no Integrated Pollution Controls, Integrated Pollution Prevention and Controls or Local Authority Pollution Prevention and Controls recorded within 250m of the site.

7.3.22 With regards to current operational processes on site and the surrounding areas environmental setting poses a negligible risk of contaminative land uses within this vicinity of the site.

Site Context – Designated Land and Sensitive Environmental Land Uses.

7.3.23 A large part of the wider Rhydycar site is located within the Cwm Glo a Glyndyrys SSI, which is designated due to the recorded ecological features. Within the context of the proposed development area, only the upper parts of the indoor snow centre and surrounding landscaping extend in the area defined by the SSSI.

7.3.24 Additionally, the proposed development is located within the Rhydycar Gorllewin/ Rhydycar West SINC and partially within a SSSI based on the recorded habitat / ecological value of the area.

7.3.25 The historical importance of the landscape is also recorded though the presence of areas designated as Scheduled Monuments (Cyfarthfa Balance Pond and Leat and Cwm Pit and Head of Railway).

7.3.26 Further detail of the impact of the development on the Ecological, Heritage and Landscape is outlined in Chapters 8, 10 and 12 respectively.

Flood Risk

7.3.27 A flood consequence assessment has been completed for the site and is covered in Chapter 13. Apart from pluvial flood risk, there is no risk of flooding to or from the proposed development from any of the flood sources explored by the Flood Consequence Assessment (FCA) which is included with this planning application. Any potential pluvial flood risk to or from the proposed development will be mitigated using the measures detailed in this FCA; watercourses will be rerouted subject to appropriate consents and approvals, and a SuDS compliant drainage scheme will be implemented. Furthermore, the proposed development will add betterment in terms of surface water runoff rates for all events greater than Qbar.

Previous Ground Investigations

7.3.28 Ground investigation has historically been undertaken to evaluate remaining coal reserves on the site, and to assess the integrity of the numerous spoil tips that are present. The findings of these investigations confirm the geological succession as outlined above. Information relating to geotechnical or ground contamination parameters for the site is based on the experience of the authors using comparable sites to identify potential constraints. Ground conditions will need to be confirmed in due course through intrusive investigation to provide site specific information to update the assessment process.

Baseline Assessment of Risks Posed by Existing Ground Conditions

7.3.29 The following section outlines the current risk posed by existing ground conditions associated with the site.

Made Ground

7.3.30 Varying thicknesses of made ground are anticipated across the majority of the proposed development site. The extent and nature of this material will be dependent on the location and historical development within that area of the site. The main development platform consists of spoil tips associated with the construction of the A470 dual carriage way, however additional spoil tips associated with colliery and ironstone waste are also present within the development area. These features are likely to represent significant thicknesses of made ground which may pose a risk in terms of ground stability and potential contamination.

7.3.31 Localised areas of made ground may also be associated with the former infrastructure on the site associated with the historical collieries and rail lines. Whilst these features are unlikely to be associated with significant thicknesses of made ground localised contamination associated with the historical land uses will require consideration within the context of the proposed development.

7.3.32 Whilst previous ground investigations have been undertaken on the site, only limited consideration has been given to the assessment of ground contamination and therefore limited site specific information is available. Contamination may be anticipated within Made Ground strata across the site, or present in localised areas relating to point sources (spills etc). Significant contamination is not anticipated; however ground conditions will need to be confirmed through intrusive investigation in due course.

Asbestos

7.3.33 Whilst asbestos containing materials (ACM) have not been previously identified on the site due to the limited ground investigation, the age and extent of made ground deposits indicates the potential for ACM to be present within the near surface materials whereby they pose a potential risk to human health within the context of the future site users. Asbestos has not been considered within any previous ground investigation and sampling of soils and laboratory analysis will be conducted in due course.

Ground gas

7.3.34 The site poses a significant risk of ground gas generation both from the significant thicknesses of made ground anticipated to be present on the site and due to the extensive coal mine workings and mine entries which are known to be present within the boundary of the proposed development. Detailed ground gas monitoring will be conducted in due course to confirm the extent and nature of any ground gas generation and inform the level of mitigation required within the development.

Spoil Tips

7.3.35 The presence of spoil tips within the development area and the surrounding area poses a potential risk in terms of instability which may affect any development on the site. Whilst spoil tips are regularly monitored by the local authority a detailed survey of the features will be undertaken as part of any future ground investigation to support the proposed development.

7.3.36 The proposed development works will include the regrading / reprofiling of a number of tips to mitigate any potential risks associated with instability.

Mine Entries

7.3.37 Coal Authority records indicate the presence of mine entries (adits and shafts) within the proposed development area although records also acknowledged the likelihood of unrecorded features to be present on site. The nature and condition of any mine entries will be assessed in due course as part of any future ground investigation to identify and locate these features and to understand the level of remediation required to facilitate the development.

7.3.38 A detailed ground model has been developed for the site summarising the extent of recorded workings within the coal seam. This information has been based on abandonment plans and records held by the Coal Authority and the information will be used to aid the design of any future ground investigation. The findings of any future studies will also be used to update and refine the ground model based on site specific information.

Shallow Coal Mining

7.3.39 Based on information held by the Coal Authority and the ground model which has been developed for the site, shallow mine workings are anticipated across the proposed development site. Records indicate numerous coal seams have been worked within the footprint of the proposed development and the depth and extent of these coal mine workings will be determined across the site through ground investigation. In turn, the ground model will be refined to aid the development of a remediation strategy to treat and stabilise any workings which are deemed to pose a potential risk to the proposed development.

Variable and Shallow Groundwater

7.3.40 Due to the fact that the site has been extensively reworked and the presence of coal mine workings, localised bodies of perched groundwater and groundwater issues from coal mine workings are anticipated within the near surface strata. The presence of shallow groundwater may lead to increased instability during the development phase and will be managed appropriately both during the works and within the completed drainage design.

Receptors at Risk

7.3.41 The following receptors have been identified associated with the potential risks listed above.

Site Construction Workers

7.3.42 Site construction workers have been identified as receptors during the construction phase given the anticipated close contact with the near surface materials on the site. The sensitivity of this receptor is considered to be **high**.

Controlled Waters (surface waters and groundwater)

7.3.43 Controlled waters include both surface water bodies (rivers/streams) and the groundwater underlying the site. The glacial deposits are recorded as unproductive strata, with the bedrock geology of the Lower and Middle Coal Measures classified as Secondary aquifers. The sensitivity of controlled waters is considered to be **medium**.

Future Site Users

7.3.44 Following the completion of the construction phase, the future site users are considered to be the key receptors with respect to exposure to ground contamination, the accumulation of ground gases and stability issues. The sensitivity of this receptor is considered to be **high.**

Building Infrastructure

7.3.45 The building infrastructure within the development is highlighted as a potential receptor with respect to in ground contamination/imported materials, ground gas and stability. The sensitivity of this receptor is considered to be **medium.**

Ecological systems

7.3.46 The general ecological setting (SSSI) across some areas of the site is identified as a potential receptor with respect to the potential for in ground contamination/imported materials. The sensitivity of this receptor is considered to be **medium.**

Heritage Features

7.3.47 Areas of the site with archaeological significance are considered to be at risk from issues relating to instability and movement of soil on site. The sensitivity of this receptor is considered to be **medium.**

Future Baseline

7.3.48 Ground conditions on the site are not expected to change significantly overtime, however with the potential for changes in weather patterns associated with climate change, the long term stability of soil tips will need to be considered within the proposed design process.

7.4 Mitigation within the Submitted Design

Design

7.4.1 The baseline data outlined above indicates the complex nature of the ground conditions associated with the extensive legacy of coal workings on the site and in the subsurface. The development location has been chosen after considering a plethora of factors, one being to minimise risks associated with ground conditions. Notwithstanding this, further mitigation will be required to assess and manage risks. The implementation of the proposed mitigation measures will provide beneficial impacts for the site due to the improvement in ground stability and management of contaminated land, water and ground gas issues. The assessment and mitigation process will follow an iterative and phased approach to include the following elements:

Geophysical Assessment

7.4.2 Initial assessment to be undertaken utilising geophysical surveys to identify potential locations of mine entries across the site. Advice will be sought from specialists to determine the appropriate methodologies and survey techniques to gather the data whilst maintaining the safety of all staff on site.

Ground Investigation to Confirm Baseline Conditions

7.4.3 The results of the geophysical survey will be reviewed in conjunction with historical mapping, Coal Authority records and on-site observations to identify key areas to target with intrusive investigation. This will include drilling to assess for shallow workings and probe holes to locate mine entries. Any intrusive works will be undertaken following consultation with the Coal Authority and under the licensing requirements of the Authority.

7.4.4 The objectives of the ground investigation will include:

- Ground conditions and depth to competent strata and/ or bedrock;
- Nature and extent of made ground in terms of stockpiles and general made ground;
- Presence/absence of contamination, to enable an updated CIRIA 552 risk assessment;
- Presence of shallow mine workings and mine entries;
- Stability of spoil tips;
- Geotechnical properties of shallow soils and bedrock;

- Permeability of the ground encountered, hydrology and hydrogeology; and
- Presence/absence of land gas.

7.4.5 The intrusive investigation will be undertaken in phases, with detailed review undertaken at each stage to further refine the ground investigation and highlight features which may require further investigation.

7.4.6 Following the completion of the investigation works, the findings of the investigation will be used to update the ground model for the site in conjunction with the proposed development plan. The findings will be discussed with the Coal Authority to agree the remedial works which are deemed necessary to facilitate the proposed development.

Geoenvironmental Risk Assessment including geotechnical and chemical assessment of ground conditions and hydrogeological/hydrological risk assessments.

7.4.7 Information contained within the ground investigation will be used to undertake a geo-environmental assessment of ground conditions to identify areas of the site where concentrations of contamination pose an unacceptable risk to potential receptors including site users, construction workers, ecology, archaeology, local groundwater and surface water bodies. Geotechnical assessment will be undertaken to determine suitable parameters for construction design, slope stability mitigation and ground improvement.

Mining Risk Assessment

7.4.8 An assessment of mining based activities in the context of the proposed development will be carried out in order to identify potential remedial works required to stabilise former mine workings, mine entries and spoil tips etc.

Piling Risk Assessment

7.4.9 Piling risk assessment will be carried out taking into consideration known ground conditions and based on current best practice guidance for piling in contaminated sites, with particular reference to prevention of the creation of migration pathways for potentially contaminated surface and ground water and mine / ground gas;

Ground Gas Risk Assessment

7.4.10 Ground gas assessment will be undertaken compliant with CIRIA C665 guidance and protective measures adopted in the design of buildings and enclosed spaces as required.

Construction

7.4.11 With respect to the potential impacts identified in the previous section, the following mitigation measures are proposed during the construction phase:

Localised Remediation of Contamination/ Reactive Remediation Management Plan

7.4.12 The localised remediation of contaminated soil and groundwater will be carried out to reduce the risks to key receptors to an acceptable level. A Reactive Remediation Management Plan will be produced to ensure the appropriate management of previously unidentified contamination during the construction phase.

Localised stabilisation of mine workings / spoil tips

7.4.13 Based on the information obtained as part of the baseline assessment and mining risk assessment, localised stabilisation treatment of mine workings, mine entries and spoil tips is anticipated. The scope of the remedial works will be determined following the completion of the ground investigation phase, but commonly adopted methodologies include:

- Infilling and capping of mine shafts to the full depth
- Capping and backfilling of adits with granular material.
- Shallow coal and ironstone workings using a cement bentonite grout in areas of structural development.
- All works will be designed following liaison with the Coal Authority and undertaken in line with the appropriate permitting.

Adoption of appropriate working practices

7.4.14 Appropriate working practices will be adopted including method statements and proper use of appropriate personal protective equipment (PPE) and respiratory protective equipment (RPE) in order to protect construction workers during the construction phase;

Construction Environmental Management Plan

7.4.15 Implementation of a Construction Environmental Management Plan for the site outlining the requirements of the contractor, including a detailed Environmental Emergency Response Plan to protect against release of contamination to groundwater or surface water;

Materials Management Plan (MMP)

7.4.16 A MMP will be in place setting out the measures required to control and monitor the movement, reuse, importation and disposal of soils during the development phase. Where suitable, spoil can be reused to aid in the regrading of tips, or the levelling of ground. This would decrease the need for material to be imported to site and reduce vehicle movements. Topsoil will be segregated and re-used on site where possible. All works should be undertaken in accordance with a Materials Management Plan under the CL:aire Definition of Waste Code of Practice for the site which has been approved by a Qualified Person;

7.4.17 The MMP will include measures for the retention and re-use of topsoil on site for incorporation into proposed development;

Site Waste Management Plan (SWMP)

7.4.18 Implementation of a Site Waste Management Plan (SWMP) for the site to manage and reduce waste generated during the construction phase.

Construction and Validation of Ground Gas Protection Measures

7.4.19 Following the completion of the ground investigation and ground gas risk assessment, ground gas protection measures are likely to be required within new buildings in line with the recommendations outlined in BS8485:2015. Appropriate validation and inspection will also be required, dependant of the level of protection required.

Operational Phase

7.4.20 The following mitigation measures are proposed during the operational phase of the development.

Operational Management Systems

7.4.21 During the operational phase of the development Operational Management Systems will be required to ensure the correct management of fuels/oils/chemicals and waste materials.

7.4.22 Where sustainable drainage systems are put in place, discharge of surface water runoff to surface water bodies should be undertaken via suitable oil water interceptors where required.

7.4.23 A maintenance handbook will be developed outlining:

- Requirement for the maintenance and inspection of any ground gas protection measures within buildings.
- Inspection schedule for spoil tips to monitor changes in stability, works should be undertaken in collaboration with the Local Authority and The Coal Authority.
- Nature and extent of any contaminant on the site including asbestos containing materials within the near surface soils.
- Record of any remediation works undertaken, including the requirement for long term maintenance of cover systems / capping membranes (if applicable).
- Recommendations for the use of PPE / RPE during maintenance works within near surface soils.

7.5 Likely Significant Environmental Effects of the Scheme

Construction Phase Effects

Table 7.7-6 – Summary of Significant Effects of the Scheme – Construction Phase

Effect	Receptor and Sensitivity	Significance	Comments
Increased instability associated with shallow workings / mine entries. **Magnitude = Substantial**	Site Construction Workers **(High)**	**Major adverse,**	With no remedial works undertaken, the effects of the construction of new structures and associated infrastructure has the potential to increase the instability at the ground surface of mine workings and mine entries both recorded and unrecorded on the site. This effect is likely to be major adverse and of a permanent nature. The effects maybe reversible however costs are likely to be substantial and have significant impact construction time frame.
	Future Site Users **(High)**	**Major adverse**	
	Building Infrastructure **(Medium)**	**Major adverse**	
Alteration of onsite hydrology / drainage leading to potential destabilisation of spoil tips **Magnitude = Substantial**	Site Construction Workers **(High)**	**Major adverse**	A change in the established drainage system on site has the potential to destabilise existing spoil tips where new drainage routes are established. The impact is considered to be major adverse and permanent in nature, again this effect may be reversible but will have significant impact on construction timescales and cost. The implementation of the finding of the hydrogeological and drainage assessments will need to be considered as part of the mitigation process.
	Future Site Users **(High)**	**Major adverse**	
	Building Infrastructure **(Medium)**	**Major adverse**	
Removal of access to residual coal reserves **Magnitude = Slight**	Local Economy **(Medium)**	**Minor adverse**	The development of the site will ultimately lead to the sterilisation of any residual coal reserves below the footprints and within the immediate surrounding area. Current government policy is to phase out the use and abstraction of fossil fuels. The removal of access to the site is considered to pose a minor adverse impact over the long term.
Mobilisation of elevated	Future Site Users **(High)**	**Intermediate adverse**	Groundworks associated with the construction phase have the potential to

Effect	Receptor and Sensitivity	Significance	Comments
contaminants present in the natural soils or Made Ground deposits **Magnitude = Moderate**	Groundwater **(Medium)**	**Intermediate adverse**	excavate potentially contaminated ground whereby the likelihood of contaminants becoming mobilised is increased. Placement of these materials at the near surface also increases the potential for exposure to site users and construction workers. With no further assessment and mitigation measures the impact is considered to be intermediate adverse and permanent in nature over the long term. Ground investigation will be required to facilitate a site-specific risk assessment and identify the requirement for remedial works (if necessary).
	Surface water **(Medium)**	**Intermediate adverse**	
Earthworks for the proposed development could result in loss or burial of topsoil **Magnitude = moderate**	Ecology – SSI **(Medium)**	**Intermediate adverse**	The placement of excavated soils or imported materials directly onto areas of topsoil have the potential to impact the ecological setting including areas designated as SSSI. Impact is considered to be intermediate adverse and permanent in nature.
Uncovering and mobilisation of as-yet unidentified contamination, with corresponding potential impact on both human health and controlled waters/ wider environment receptors **Magnitude = Moderate**	Future Site Users **(High)**	**Intermediate adverse**	Localised areas of contamination may potentially be present within the site development boundary whereby excavation of these soils will lead to the increased mobilisation of contaminants and increased exposure to site users and construction workers. Impact is considered to be intermediate adverse and permanent in nature. Remedial works would be required to manage the identified impact if identified.
	Building Infrastructure **(Medium)**	**Intermediate adverse**	
	Groundwater **(Medium)**	**Intermediate adverse**	
	Surface water **(Medium)**	**Intermediate adverse**	
Exposure of construction workers to contaminants within Made Ground.	Site Construction Workers **(High)**	**Intermediate adverse**	Construction workers anticipated to have significant exposure to excavated soils during the development phase. The significance of these workers coming into contact with contaminated materials is considered to be intermediate adverse and

Effect	Receptor and Sensitivity	Significance	Comments
Magnitude = Moderate			would need to be managed during the construction phase to reduce this significance.
Mobilisation and accumulation of ground gas associated with the creation of migration pathways along drainage or service runs or piled foundations **Magnitude = Moderate**	Future Site Users **(High)**	**Intermediate adverse**	Ground gas generation from both made ground soils and historic coal mining features (workings and mine entries) is considered likely. The introduction of additional pathways including foundations, service runs and drainage routes has the potential to increase mobilisation and accumulation of ground gases which poses an explosive and asphyxiant risk to site users and building infrastructure. With no mitigation measures in place at the construction stage, the impact is considered to be permanent over the long term. Retrospective remedial works may be possible to reverse the impact however costs are likely to be significant with associated impact on construction time scales
	Building Infrastructure **(Medium)**	**Intermediate adverse**	
Mobilisation of contamination during removal/remediation of contaminated made ground. **Magnitude = Moderate**	Groundwater **(Medium)**	**Intermediate adverse**	The targeted removal of identified contamination has the potential to increase the mobility and exposure to contaminants. The impact is considered to be intermediate adverse and temporary over the short to medium term.
	Surface water **(Medium)**	**Intermediate adverse**	
Import of material that is chemically and geotechnically unsuitable with the potential to impact human health, controlled waters/ wider environment receptors and building infrastructure.	Future Site Users **(High)**	**Minor adverse**	The development aims to provide a balanced cut and fill model whereby importation of significant quantities of materials are unlikely. As such the impacts on receptors are considered to be minor adverse and permanent over the long term. Effects are reversible through remedial works or removal of the unsuitable materials with
	Building Infrastructure **(Medium)**	**Minor adverse**	
	Groundwater **(Medium)**	**Minor adverse**	
	Surface water **(Medium)**	**Minor adverse**	

Effect	Receptor and Sensitivity	Significance	Comments
Magnitude = Moderate			associated impact on construction timescales and costs.
Increased runoff from bare soil. **Magnitude = Slight**	Surface water **(Medium)**	**Minor adverse**	The removal of surface vegetation and excavation of soils will increase the mobilisation of sediment into surface waters. The impact is considered to be minor adverse and temporary in nature over the short term.
Potential for spillages/leaks of fuels and chemicals to occur during the construction works from the use and refuelling of mobile plant and the storage of chemicals on the site, which may result in the contamination of soils and groundwater **Magnitude = Slight**	Future Site Users **(High)**	**Minor adverse**	Localised spillages of fuels and chemicals has the potential to impact near surface soils and controlled waters of the wider environment. The impacts are likely to be small in scale, minor adverse and reversible through localised remediation.
	Building Infrastructure **(Medium)**	**Minor adverse**	
	Groundwater **(Medium)**	**Minor adverse**	
	Surface water **(Medium)**	**Minor adverse**	
Potential for the release of grout into groundwater, surface water and drainage features during the remedial works to stabilise shallow mine workings and mine entries.	Groundwater **(Medium)**	**Intermediate adverse**	The release of grout into the water environment has the potential to impact habitats within surface water bodies and also impact water resources in terms of groundwater and surface water abstraction points downstream of the development site.
	Surface water **(Medium)**	**Intermediate adverse**	

Operational Phase Effects

Table 7.7-7 – Summary of Significant Effects of the Scheme – Operational Phase

Effect	Receptor and Sensitivity	Significance	Comments
Potential for spillages/leaks of fuels, chemicals or sewage which may result in the contamination of soils or groundwater. **Magnitude = Slight**	Future Site Users **(High)**	**Minor adverse**	Localised spillages of fuels and chemicals has the potential to impact near surface soils and controlled waters of the wider environment. The impacts are likely to be small in scale, minor adverse and reversible through localised remediation.
	Building Infrastructure **(Medium)**	**Minor adverse**	
	Groundwater **(Medium)**	**Minor adverse**	
	Surface water **(Medium)**	**Minor adverse**	
Diffuse pollution from site maintenance works e.g. use of road salts and herbicides. **Magnitude = Slight**	Groundwater **(Medium)**	**Minor adverse**	Diffuse pollution is likely to result in the potential for contaminants to enter surface waters and ground waters. The impacts are likely to be minor, adverse, long term and permanent in nature.
	Surface water **(Medium)**	**Minor adverse**	
Accumulation of ground gas beneath the floor slab of new structures and subsequent migration into buildings. **Magnitude = Substantial**	Future Site Users **(High)**	**Major adverse**	Without the adoption of mitigation measures at the construction phase, ground gas accumulation within the operational building has the potential to exposure site users and building infrastructure to potentially explosive and asphyxiant ground gases potentially resulting in death and significant damage to buildings. The impact is considered to be major adverse, long term and permanent. The accumulation of ground gases may be reversed through the adoption of retrospective remedial works, although costs are likely to be significant.
	Building Infrastructure **(Medium)**	**Major adverse**	
Reduction in infiltration rates across the site due to the presence of increased low permeability hardstanding leading to	Groundwater **(Medium)**	**Minor beneficial**	The construction of managed drainage and SuDS as part of the proposed design the construction footprint will lead to the reduction in infiltration of rain water / surface waters with subsequent impact on the mobility of contaminants. The impact
	Surface water **(Medium)**	**Minor beneficial**	

Effect	Receptor and Sensitivity	Significance	Comments
reduced mobilisation of ground contamination. **Magnitude = Slight**			is considered to be minor beneficial, permanent and long term.
Beneficial improvement in ground stability as a result of stabilisation of mine workings and mine entries. **Magnitude = Moderate**	Future Site Users **(High)**	**Major beneficial**	Remedial works adopted during the development phase will lead to the improvement of ground stability across the development area, increasing accessibility to the site. The impact is considered to be major beneficial, long-term and permanent.
	Building Infrastructure **(Medium)**	**Major beneficial**	

7.6 Additional Mitigation, Compensation and Enhancement Measures

7.6.1 With regards to both ground stability and ground contamination a reactive approach will be adopted during the development phase to identify any adverse impacts on the ground conditions. The framework for this strategy will be outlined within the design phase, however implementation and revision of this approach will be made proactively in response to ground conditions which have not been identified as part of the baseline assessment.

7.6.2 Ground investigation is an iterative process and further investigation works and risk assessments may need to be undertaken during the construction phase in the light of observations made during the works (areas of contamination not identified within investigation locations, additional coal mining features not recorded within Coal Authority records).

7.6.3 On site observations undertaken through adoption of a watching brief and presence of Geotechnical Specialist (Resident Engineer) to oversee the construction phase.

7.7 Assessment Summary and Likely Significant Residual Environmental Effects

7.7.1 The application of the mitigation procedures outlined within this document is considered to reduce adverse residual effects to minor or negligible with regards to ground stability and ground contamination (see table 7.78 below).

7.7.2 Where beneficial effects have been identified (stabilisation of coal workings and reduction in surface water infiltration leading to reduced mobility of contaminants) these are considered to be a Major beneficial and minor beneficial respectively (see table 7.78 below).

7.8 Cumulative impacts

7.8.1 With regards to ground conditions, no cumulative impacts have been identified in the surrounding area.

7.9 Summary

7.9.1 This chapter outlines the extensive coal mining and A470 construction legacy of the site both in terms of ground stability (mine entries, shallow mine workings and spoil tips) but also associated with the potential for ground contamination to be present on the site which may pose a risk to human health and the controlled waters of the wider environment as well as the environmental setting of the site.

7.9.2 Based on the current level of understanding of the site intrusive investigation will be required to support the proposed development and inform the requirement for remedial works in terms of ground stability and the potential for ground contamination to be present. It is considered likely that applicable mitigation measures presented within the chapter can reduce the impact of the development to acceptable levels

7.9.3 The proposed mitigation methodologies are outlined, although the details of the mitigation measures will need to be confirmed once the baseline conditions have been reviewed following detailed ground investigation, in-situ and laboratory testing of geotechnical and chemical properties of the site. An updated coal mining risk assessment based on site specific data and remedial and reactive strategies for coal mining risks, ground stability and ground contamination will also be undertaken.

Table 7.7-8 Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Increased instability associated with shallow workings / mine entries.	Site Construction Workers **(High)**	Substantial	Major adverse,	Detailed ground investigation to develop ground model in liaison with Coal Authority and Local Authority. Development and implementation of remediation strategy, validation and monitoring. Reactive approach to additional risks identified during construction phase. Watching brief and Resident Engineer (Geotechnical Specialist) on site during construction phase.	Slight	Minor adverse	Moderate
	Future Site Users **(High)**	Substantial	Major adverse		Slight	Minor adverse	Moderate
	Building Infrastructure **(Medium)**	Substantial	Major adverse		Slight	Minor adverse	Moderate
Alteration of onsite hydrology / drainage leading to potential destabilisation of spoil tips	Site Construction Workers **(High)**	Substantial	Major adverse	Formalisation of drainage routes on site, inspection and risk assessment of spoil tips and appropriate modelling / investigation to confirm ground conditions including infiltration rates. Adoption of a management system to ensure the effective operation of on-site drainage. Long term monitoring programme for spoil tips.	Slight	Minor adverse	Moderate
	Future Site Users **(High)**	Substantial	Major adverse		Slight	Minor adverse	Moderate
	Building Infrastructure **(Medium)**	Substantial	Major adverse		Slight	Minor adverse	Moderate
Removal of access to residual coal reserves	Local Economy **(Medium)**	Slight	Minor adverse	None	Slight	Minor adverse	High
Mobilisation of elevated contaminants present in the natural soils or Made Ground deposits	Future Site Users **(High)**	Moderate	Intermediate adverse	Detailed ground investigation, risk assessments and development and implementation of remedial strategies as required. Reactive approach to previously unidentified contamination. Validation of remedial works. Monitoring of groundwater and surface waters during construction phase.	Slight	Minor adverse	Moderate
	Groundwater **(Medium)**	Moderate	Intermediate adverse		Slight	Minor adverse	Moderate
	Surface water **(Medium)**	Moderate	Intermediate adverse		Slight	Minor adverse	Moderate

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Earthworks for the proposed development could result in loss or burial of topsoil	Ecology – SSI **(Medium)**	Moderate	Intermediate adverse	Implementation of a CEMP to minimise areas affected, removal of topsoil prior to earthworks for use in restoration / enhancement schemes. Adoption of MMP to manage all on site movement and importation / disposal of soils.	Slight	Minor adverse	High
Uncovering and mobilisation of as-yet unidentified contamination, with corresponding potential impact on both human health and controlled waters/ wider environment receptors	Future Site Users **(High)**	Moderate	Intermediate adverse	Watching brief by Geo-environmental specialist, design and implementation of a reactive strategy with regards to ground contamination. Validation of additional remedial works. Monitoring of groundwater and surface waters / air quality during construction phase as deemed necessary.	Slight	Minor adverse	High
	Building Infrastructure **(Medium)**	Moderate	Intermediate adverse		Slight	Minor adverse	High
	Groundwater **(Medium)**	Moderate	Intermediate adverse		Slight	Minor adverse	High
	Surface water **(Medium)**	Moderate	Intermediate adverse		Slight	Minor adverse	High
Exposure of construction workers to contaminants within Made Ground.	Site Construction Workers **(High)**	Moderate	Intermediate adverse	Adoption of good hygiene practices and use of PPE / RPE as required. Briefing of all operatives. All works within contaminated material overseen by Geoenvironmental specialist.	Slight	Minor adverse	High
Mobilisation and accumulation of ground gas associated with the creation of migration pathways along drainage or service runs or piled foundations	Future Site Users **(High)**	Moderate	Intermediate adverse	Detailed ground gas monitoring and development of a detailed Ground Gas Conceptual Model and risk assessment to determine the requirement for remedial works and ground gas protection measures. Piling Risk Assessment to assess the potential for ground gases to migrate vertically along introduced pathways.	Slight	Minor adverse	High
	Building Infrastructure **(Medium)**	Moderate	Intermediate adverse		Slight	Minor adverse	High
Mobilisation of contamination during removal/remediation of contaminated made ground.	Groundwater **(Medium)**	Moderate	Intermediate adverse	Development of remedial strategy to manage removal of materials under a controlled methodology. Works overseen by Geoenvironmental specialist, validation of works.	Negligible	Neutral	High
	Surface water **(Medium)**	Moderate	Minor adverse		Negligible	Neutral	High

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
				Adoption of CEMP and MMP to manage all earth movements.			
Import of material that is chemically and geotechnically unsuitable with the potential to impact human health, controlled waters/ wider environment receptors and building infrastructure.	Future Site Users **(High)**	Moderate	Minor adverse	Use of MMP to manage all earth movements including importation / disposal of materials. Regular testing of imported materials prior to importation and validation once on site.	Negligible	Neutral	High
	Building Infrastructure **(Medium)**	Moderate	Intermediate adverse		Negligible	Neutral	High
	Groundwater **(Medium)**	Moderate	Intermediate adverse		Negligible	Neutral	High
	Surface water **(Medium)**	Moderate	Intermediate adverse		Negligible	Neutral	High
Increased runoff from bare soil.	Surface water **(Medium)**	Slight	Minor adverse	Minimisation of areas of bare soil, implementation of CEMP to manage the storage of soils on site. Use of sediment traps, surface water management on site during works.	Negligible	Neutral	Moderate
Potential for spillages/leaks of fuels and chemicals to occur during the construction works from the use and refuelling of mobile plant and the storage of chemicals on the site, which may result in the contamination of soils and groundwater	Future Site Users **(High)**	Slight	Minor adverse	Adoption of CEMP to manage storage of fuel / chemical and refuelling operations. Good on site practices and proactive approach to spills / leaks to aid prompt identification and management.	Negligible	Neutral	High
	Building Infrastructure **(Medium)**	Slight	Minor adverse		Negligible	Neutral	High
	Groundwater **(Medium)**	Slight	Minor adverse		Negligible	Neutral	High
	Surface water **(Medium)**	Slight	Minor adverse		Negligible	Neutral	High
Potential for the release of grout into groundwater, surface water and drainage features during the remedial works to stabilise shallow mine workings and mine entries.	Groundwater **(Medium)**	Slight	Minor adverse	Implementation of a Vulnerability assessment to identify potential water bodies at risk from the uncontrolled break out of grout. Development of a monitoring and reporting procedure including emergency response plan in the event that unprecedented release of grout is observed.	Negligible	Neutral	High
	Surface water **(Medium)**	Slight	Minor adverse		Negligible	Neutral	High
Operation							
	Future Site Users **(High)**	Slight	Minor adverse		Negligible	Neutral	High

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Potential for spillages/leaks of fuels, chemicals or sewage which may result in the contamination of soils or groundwater.	Building Infrastructure **(Medium)**	Slight	Minor adverse	Development of Operational Procedures to manage storage of fuel / chemical and refuelling operations. Good on site practices and proactive approach to spills / leaks to aid prompt identification and management.	Negligible	Neutral	High
	Groundwater **(Medium)**	Slight	Minor adverse		Negligible	Neutral	High
	Surface water **(Medium)**	Slight	Minor adverse		Negligible	Neutral	High
Diffuse pollution from site maintenance works e.g. use of road salts and herbicides.	Groundwater **(Medium)**	Slight	Minor adverse	Development of Operational Procedures to manage storage of fuel / chemical and refuelling operations. Good on site practices to minimise use of chemicals and ensure drainage routes are maintained and appropriately managed.	Negligible	Neutral	High
	Surface water **(Medium)**	Slight	Minor adverse		Negligible	Neutral	High
Accumulation of ground gas beneath the floor slab of new structures and subsequent migration into buildings.	Future Site Users **(High)**	Substantial	Major adverse	Detailed ground gas monitoring and development of a detailed Ground Gas Conceptual Model and risk assessment to determine the requirement for remedial works and ground gas protection measures. Installation and validation of gas protection measures including long term management and inspection as required. Decommissioning of all ground investigation boreholes prior to construction of buildings. Piling Risk Assessment.	Slight	Minor adverse	Moderate
	Building Infrastructure **(Medium)**	Substantial	Major adverse		Slight	Minor adverse	Moderate
Reduction in infiltration rates across the site due to the presence of increased low permeability hardstanding leading to reduced mobilisation of ground contamination.	Groundwater **(Medium)**	Slight	Minor beneficial	Not applicable	Slight	Minor beneficial	Moderate
	Surface water **(Medium)**	Slight	Minor beneficial	Not applicable	Slight	Minor beneficial	Moderate

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Beneficial improvement in ground stability as a result of stabilisation of mine workings and mine entries.	Future Site Users **(High)**	Substantial	Major beneficial	Not applicable	Substantial	Major beneficial	Moderate
	Building Infrastructure **(Medium)**	Substantial	Major beneficial	Not applicable	Substantial	Major beneficial	Moderate

Table 7.7-9 Means by which Additional Mitigation Measure may be Secured

Identified Effect where additional mitigation (Not design mitigation) has been identified	Type of mitigation measures (avoidance, reduction, compensation, enhancement)	Means by which mitigation measure may be secured
Construction		
Reactive Strategy	Avoidance	Implementation of reactive approach to previous unidentified contamination, mine features.
Geotechnical Resident Engineer	Avoidance	On site presence during earthworks phase
Validation of all remedial works	Avoidance	Specialist validation of all remediation works documented in overarching Validation report.
Operation		
Development of maintenance schedule and proactive approach to maintaining drainage systems and remedial measures (gas protection measures etc).	Avoidance	Development of maintenance schedule.
Establishment of long term monitoring regime with respect to stability of spoil tips.	Avoidance	Development of monitoring regime.

7.10 Summary

7.10.1 This Chapter provides a summary of the potential impacts of the proposed development on the ground conditions in terms of both Ground Stability and Contamination. The site has an extensive history of coal mining and associated infrastructure, including significant areas of spoil tips present across the proposed development area and surrounding wider site.

7.10.2 Shallow mine workings and mine entries are anticipated within the development footprint which will require detailed assessment and remedial works to enable the proposed development. The extent of the remedial works required will be dependent on the findings of an intrusive investigation which will be required to support the development.

7.10.3 Similarly, the geotechnical properties of the strata below the site and potential for ground contamination will require detailed assessment and risk assessment to support the proposed development in terms of foundation design and remedial works required to reduce ground contamination to an acceptable level.

7.10.4 Remedial works will be required to facilitate the development in terms of risks associated with geotechnical parameters, coal mining legacy and ground contamination. The anticipated outline requirement for remediation is presented within this document, however it is noted that further works may be required based on the findings of any future assessments. However, based on the current level of understanding, the scope and scale of these additional works are unlikely to pose a barrier to the proposed development.

8.0 Ecology and Nature Conservation

8.1 Executive Summary

8.1.1 The ecological resources within and adjoining the Application Site have been documented to an unusually high level of detail in the course of several intensive survey campaigns since 2015. The baseline conditions on the site, and the existence and importance of ecological factors capable of being material considerations in planning determination, are therefore well known.

8.1.2 The Application Site represents part of a wider landholding under the control of the applicant that is dominated by the 181.7ha Cwm Glo a Glyndyrys SSSI. That same landholding is also almost entirely underlain by non-statutory Site of Importance for Nature Conservation (SINC) designations.

8.1.3 The land upon which the rest of the development is focused, whilst outside the SSSI, is subject to SINC designations, and contains representations of many of the same habitats and some of the same species. This includes waxcap fungi, priority grassland, heathland and woodland habitats and a suite of notable species.

8.1.4 Both the location of the development within the wider landholding and the detailed positioning and extent of the Application Site have been configured through numerous design iterations in order that overlap with the designated Cwm Glo a Glyndyrys SSSI is restricted to the absolute minimum necessary. This has seen the quantum of SSSI land affected by the proposed development incrementally reduced over time in order to reduce impacts on the statutory site. Some SSSI landtake remains unavoidable, however, in order to deliver the indoor snow centre, which is the central focus of the scheme. In total, a direct landtake of 6ha of the SSSI is anticipated, which represents a little over 3% of the total land area of Cwm Glo a Glyndyrys SSSI. Due to the national importance of the SSSI series, this impact is inevitably rendered significant at that level.

8.1.5 The parts of the SSSI affected by the proposed development do not contain any significant representations of the primary features of special habitat or mycological interest underpinning the designation. Thus, it is considered that the direct loss of SSSI land to the development will have little or no impact on the national and international mycological importance of the SSSI, and will not result in the direct loss from the SSSI designated area of any substantive quantum of the cited marshy grassland, acid grassland or heathland habitats, including those supporting the site's current population of marsh fritillary.

8.1.6 Consequently, it is primarily the secondary interest features of the SSSI that will be directly affected, in particular woodland, scrub and 'ffridd' habitats of a type falling outside the scope of the primary interest features.

8.1.7 In seeking to make most efficient use of the land within the Application Site to reduce the overall magnitude of ecological impacts, the scope for mitigation and compensation to be delivered within the confines of the Application Site itself, as part of the development, is very restricted.

8.1.8 In consequence, the focus of mitigation and compensation will be outside the Application Site. In the first instance this will be in the wider landholding where the opportunity to secure optimised management of both SSSI and non-SSSI resources will be taken. Additional offsite measures, whether from securing and enhancing additional land and related habitats off-site or via financial contributions to established or new conservation projects ecologically and geographically relevant to the South Wales region will be taken. These are not yet settled, albeit significant effort has been expended already in searching for and securing an appropriate off-site compensation site or sites in discussion with NRW and a number of non-statutory agencies. This provision will be the subject of further submissions as and when additional information becomes available.

8.1.9 While there is a well-established policy presumption against development likely to damage a SSSI, the particular qualitative features of the affected area, the future security of the special interest features over the wider unaffected SSSI and the weight of need for the development are matters germane to the consideration of the weight that should be applied to the impact on the SSSI in considering the acceptability of this development in policy terms.

8.1.10 In this case, there is an opportunity for a combination of secured management of the balance of the SSSI and additional compensatory enhancement of other off-site land or via other 'in kind' measures, to substantially offset the impacts from the losses of SSSI and SINC land, and associated impacts on attendant habitat and species resources. The precise magnitude of such offset, and whether it delivers an outcome approaching or exceeding neutral in terms of overall net change, is contingent on the precise details of the off-site measures that will be submitted in support of the application in due course.

8.2 Introduction

8.2.1 This chapter summarises the baseline ecological conditions on the site, identifies the key ecological receptors for impact assessment purposes, describes the likely significant ecological effects arising from the proposals, identifies measures that will be taken to prevent, reduce or offset any significant adverse effects, and finally describes the predicted residual effects taking into account the mitigation and compensation committed to as part of the application scheme.

8.2.2 The chapter is supported by a series of thirteen technical appendices setting out in more detail the results of the various desk-based and field surveys undertaken by Bioscan between 2015 and 2022. These surveys have been informed by scoping discussions and formal correspondence with Natural Resources Wales (NRW) and Merthyr Borough Council (MBC). Accordingly, the surveys cover:

- Information on statutory and non-statutory designations and pre-existing records (including those from South East Wales Biodiversity Records Centre (SEWBReC) and from past studies on the site relating to a previous application);
- Habitats and flora, including documenting community change since previous detailed surveys, mapping priority habitats and searches for notable species with a particular focus

on unimproved grasslands and other habitats underpinning the various designations pertaining to the site;

- Surveys of grassland fungi in accordance with the known importance of the Cwm Glo a Glyndyrys SSSI for these taxa.
- Surveys of specially protected fauna including industry-standard surveys for great crested newts, bats and badgers;
- Surveys of breeding and wintering birds, including specially protected (Schedule 1) species and documenting presence and populations of other species of conservation concern;
- General and targeted surveys of invertebrates, including specific focus on the site's marsh fritillary population.

8.2.3 This chapter and the technical appendices supporting it have been produced in line with the standard guidance for ecological impact assessment, as set out in CIEEM (2018)[1].

8.2.4 The Application Site forms part of a wider landholding under the control of the applicant which has been the subject of intensive ecological studies since 2015. These studies have become progressively more focused on the current Application Site as the scheme has been settled upon and refined. Consequently, the study area covered by the various surveys detailed in technical appendices 1-14 encompasses the entirety of the applicant landholding, comprising some 223ha of land south-west of Merthyr Tydfil and west of the A470 on the slopes of Mynydd Aberdâr. Some elements (e.g. desk survey) encompassed additional land up to 5km from the site centre. The most recent field surveys were focused on the current Application Site and (where relevant) surrounding areas up to 250m.

8.3 Methodology and Scope

Baseline Data Collection

8.3.1 As well as drawing on data from previous third-party surveys between 1994 and 2008, this assessment draws upon data from several Bioscan survey campaigns between 2015 and 2018, an across-the-board update of field surveys by Bioscan in 2020-2021 and verification surveys and targeted additional work on bats in 2022. Full details of the methodologies and results from the Bioscan surveys since 2015 are contained in Appendices 8.1 to 8.14 and a summary is presented at Table 8.1 below:

[1] CIEEM (2018) (Version 1.1 September 2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.

Table 8.1: Surveys completed and other data sources

Ecological feature/survey	Surveys completed (including year/s undertaken)	Study area for 2021/22 surveys
Desk study	Formal commercial data request from SEWBReC, 2018 and again in 2021. Review of archive material and reports relating to previous remediation and development proposals for the site dating back to 2006. Review of Bioscan surveys dating back to 2015.	Desk study considers Natura 2000 designations within 10km of site and local designations and species records within a 5km radius centred on grid reference SO 04507 04942. Pre-2021 surveys cover the wider landholding with 2021 surveys focused on Application Site and adjoining areas to 250m.
Habitats and flora	As well as a review of archive material, including a comprehensive community classification survey by Bosanquet and Stevens in 2005, the baseline is informed by site-wide surveys by Bioscan since 2015, most recently in 2021, with targeted additional work in 2022.	Pre-2021 surveys cover the wider landholding with 2021 and 2022 surveys focused on Application Site and adjoining areas to 250m.
Grassland fungi	As well as a review of archive material, including a CCW study by Griffith et al in 2006, the baseline is informed by site-wide surveys by Sturgess Ecology in 2015 and 2020.	Wider landholding, including the Application Site.
Marsh fritillary	As well as a review of archive material, including the last known sighting (1994) prior to Bioscan re-confirming presence in 2015, the baseline is informed by targeted additional surveys for this species by Sturgess Ecology in 2015 and 2020, and observations ancillary to the general invertebrate surveys in 2015, 2018 and 2021 as well as other field work since 2015.	Wider landholding, including the Application Site.
Great crested newt	As well as a review of archive material, presence/absence surveys conducted in 2015, 2017, 2018 and 2021 (including eDNA plus follow up of positive ponds).	Wider landholding in 2015, eastern and southern part of landholding in 2017/2018, Application Site plus 250m in 2021.

Ecological feature/survey	Surveys completed (including year/s undertaken)	Study area for 2021/22 surveys
Bats	As well as a review of archive material, activity surveys: transect and automated surveys were undertaken in 2015, 2016, 2018 and 2021. Roost surveys, including building inspections and emergence surveys were undertaken in 2015, 2016, 2018 and 2021. Tree roost potential surveys within the Application Site were undertaken in 2021, with follow up tree-climbing surveys in 2022.	Wider landholding in 2015, eastern and southern part of landholding in 2017/2018, Application Site plus adjoining land in 2021 and 2022.
Birds	As well as a review of archive material, including a CCW study in 2008, the baseline is informed by breeding bird surveys by Bioscan in 2015, 2018 and 2021, and wintering bird surveys in 2015/16 and 2020/21.	Wider landholding in 2015, 2015/16 and 2018, Application Site plus adjoining land in 2020 and 2021.
Badgers	Site-wide surveys in 2015 and 2018, focused surveys in 2021.	Wider landholding in 2015, eastern and southern part of landholding in 2018, Application Site plus adjoining land in 2021.
Dormouse	Nest tube and box surveys in 2015 and 2021.	Targeted areas of suitable habitat in wider landholding in 2015 and focused on Application Site and contiguous habitat in 2021.
Water vole and otter	Water vole and otter surveys carried out as an adjunct to other survey work in 2015, 2018 and with a targeted survey of Application Site watercourses in 2021	Targeted areas of suitable habitat in wider landholding in 2015 and focused on Application Site and contiguous habitat in 2021
Reptiles	Ad hoc observations (as per scoping) in 2015-2018. Full refugia survey in 2021.	Wider landholding in 2015-2018. Application Site and contiguous suitable habitat in 2021.
Other mammals	Ad hoc observations 2015-2018.	Wider landholding in 2015-2018. Application Site and contiguous suitable habitat in 2021.
Invertebrates	As well as a review of archive material, site-wide surveys were conducted in 2015, 2018 and update surveys in 2021.	Wider landholding in 2015, 2018 and 2021.

Assessment Methodology

8.3.2 The approach adopted for the assessment in this chapter formed the basis of pre-application submissions and discussions, as discussed with NRW and Merthyr Council, and is based on the industry-standard guidelines published by the Chartered Institute of Ecology and Environmental Management (CIEEM; September 2018, as updated most recently in April 2022), hereafter referred to as the 'CIEEM Guidelines'[2] .

8.3.3 The baseline used for assessment is an assimilation of the data from the survey work and archive material presented in full at Technical Appendices 8.1-8.14. Bioscan have close familiarity with the landholding from repeat commissions and survey campaigns dating back to 2015 and consequently, the evaluations of ecological interest and conclusions drawn for the site as a whole are considered robust and appropriate for enabling a confident assessment of impacts to be made.

Identification of Key Ecological Receptors

8.3.4 To enable a judgement on the overall magnitude and significance of identified ecological effects, the assessment considers the relative importance and sensitivity of the more important ecological features (key receptors) identified by the baseline desk and field studies and how these are likely to be impacted and affected.

8.3.5 The decision as to which ecological features are 'key' for assessment purposes is informed by factors such as national and local conservation status and legal protection, as well as expert professional judgment. Certain parameters and points of reference are used to help ensure consistency: they include the type and level of any statutory or non-statutory designations affected, any special legal protection applied to individual species[3] and whether habitats or species have been formally identified as 'priorities' for conservation[4] or as having an 'unfavourable' conservation status (for example as defined by the Red Data Book system[5] or the Red and Amber lists for birds[6]).

8.3.6 Sites already possessing statutory or non-statutory nature conservation designations will have been subjected to some form of evaluation process in the past, and their importance defined at a geographical scale (e.g. international, national, county). For species or habitats with a formally recognised conservation status, importance can be defined by reference to national or more local population or distribution assessments.

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[2] CIEEM (2018) (Version 1.2 April 2022) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.

[3] Principal legislation being the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2017 (as amended) which implements the EC Habitats Directive. Some animals are protected under separate legislation (e.g., the Protection of Badgers Act 1992).

[4] E.g. Species and Habitats of Principal Importance under Section 7 of the Environment (Wales) Act 2016.

[5] Following the British Red Data books published by the JNCC/RSNC and the Nationally Notable (Nationally Scarce) categorisations recognised by the JNCC

[6] Stanbury et al. (2021). The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114: 723-747. Via: https://britishbirds.co.uk/sites/default/files/BB_Dec21-BoCC5-IUCN2.pdf.

8.3.7 Characteristics such as extent, naturalness, rarity, fragility, connectivity and diversity have all been considered in the determination of ecological importance, and for the evaluation of sites and habitat features outside designated sites, these and other criteria as described by Ratcliffe[7] have been applied. Ratcliffe's criteria are integral to the procedure for selecting SSSIs[8] as well as many non-statutory designation systems in the UK, and therefore they remain an accepted standard for site evaluation. The Ratcliffe criteria include measures by which both relative importance can be attributed (e.g. 'rarity') and indications of how likely it is that a given ecological feature will be affected by a change connected to construction or operation of a proposed development (e.g. fragility').

8.3.8 In accordance with the CIEEM Guidelines, ecological receptors are valued and ascribed a level of importance by reference to geographic terms of reference. Table 8.2 provides the categories of importance that have been adopted for this assessment.

Table 8.2: Geographic terms of reference for Ecological Importance

Scale of Importance	Criteria	Example
International and European	High importance and rarity, international scale and limited potential for substitution	Internationally designed sites (e.g. SACs, SPAs and Ramsar Sites, Candidate SACs, potential SPAs, proposed Ramsar Sites and biosphere reserves), including features or populations of species integral to the maintenance of the 'integrity' of such designations; Internationally significant area/quantity of a habitat listed in Annex I of the Habitats Directive[9], or smaller areas of such habitat where they are essential to maintain the viability of a larger whole; or Internationally significant population (e.g. >1% of western European population) of a species listed in Annex IV of the Habitats Directive or Annex I of the Birds Directive.
National (UK or Wales)	High importance and rarity, national scale, or regional scale with	Nationally designated sites (e.g. SSSIs and National Nature Reserves, Marine Nature Reserves, NCR Grade I Sites);

[7] Ratcliffe, (1977). A Nature Conservation Review: The Selection of Biological Sites of National Importance to Nature Conservation in Britain. Cambridge University Press

[8] JNCC (2013). Guidelines for the Selection of Biological SSSIs. Via: https://data.jncc.gov.uk/data/dc6466a6-1c27-46a0-96c5-b9022774f292/SSSI-Guidelines-Part1-Rationale-2013.pdf

[9] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Scale of Importance	Criteria	Example
	limited potential for substitution	Regionally important sites with limited substitution possibilities; Nationally significant (e.g. >1% of Welsh or UK resource) area of a priority habitat identified under Section 7 of the Environment (Wales) Act 2016 and/or the UK BAP; or Nationally significant population of a species listed on Schedules 1, 5 or 8 of the Wildlife and Countryside Act 1981, or of a priority species identified in the Environment (Wales) Act 2016, UK Red Data book species, or of a nationally rare species (15 or fewer 10km squares in the UK).
Regional (in the context of specific assessment guidance[10]) or County (i.e. Glamorgan)	High or medium importance and rarity, local or regional scale and limited potential for substitution	Regionally or county significant representations of priority habitats or priority/protected species; Locally designated sites (e.g. SBI); Effectively 'irreplaceable' habitats such as designated or undesignated ancient semi-natural woodland; or Sustainable populations of nationally scarce species (16-100 10km squares in the UK).
District (Merthyr Borough))	Medium importance and rarity, local scale	Undesignated sites that are good examples of a more widespread habitat, or species-poor examples of a habitat of note (as described above); Populations of scarcer species occurring on an intermittent, transient or casual basis; or Population of a species that is of medium importance/rarity but adjudged to represent a significant (e.g. >1%) proportion of the likely District resource.

[10] E.g. CIEEM (June 2021). *Bat Mitigation Guidelines. A guide to impact assessment, mitigation and compensation for developments affecting bats.* Beta version 1.0. Via: https://cieem.net/i-am/current-projects/bat-mitigation-guidance/

Scale of Importance	Criteria	Example
Local (e.g. Parish)	Low importance and rarity, local scale	Undesignated sites that are good (e.g. species-rich) examples of a more widespread habitat, or species-poor examples of a habitat of note (as described above); or Population of a species that is of low importance/rarity but may represent a significant proportion of the total occurring locally.
Immediate local context – i.e. at level of Site	Low importance and rarity, site scale.	Features, habitats and species not meeting any of the above criteria, including low grade, readily re-creatable and widespread habitats.

Predicting Ecological Impacts and Effects

8.3.9 Impacts and effects[11] arising from the proposed development that have the potential to be significant have been identified from review of the proposed development plans (including consideration of construction phasing and duration) and review of parallel assessments in terms of landscape, air quality, hydrology, traffic and matters such as remediation and ground stabilisation.

8.3.10 Whether impacts (in the sense imparted by the CIEEM Guidelines) give rise to significant effects in EIA terms is dependent in large part on the sensitivity of receptors. The sensitivity of an affected habitat, site or species (receptor) to predicted impacts is a product of various factors including:

- *habitat extent or population size (at a given geographical level);*
- *habitat or population fragility (including ability to recover);*
- *the rarity of a species or habitat; and*
- *susceptibility to environmental change (e.g. from disturbance or pollution).*

8.3.11 Applying the above criteria, the sensitivity of individual receptors in this assessment is classified according to Table 8.3 below:

[11] The terms 'impact' and 'effect' are used here in the sense that they are defined in the CIEEM Guidelines. It should be noted that these terms have a different relative meaning in assessments carried out pursuant to The Conservation of Habitats and Species Regulations 2017.

Table 8.3: Sensitivity of receptors

Sensitivity	Habitat Example	Species example
High	Habitat is highly susceptible to nutrient enrichment or invasion from competitive species; Habitat has highly specialised hydrological or soil/geology requirements (e.g. calcareous fen); Habitat is present as small and isolated fragments vulnerable to edge effects; Habitat takes an extended period to develop full suite of components (e.g. ancient woodland which is considered effectively 'irreplaceable' in land-use planning on the basis that this process takes at least 400 years).	Species is highly intolerant of disturbance or pollution; Species is present in a small and isolated population and/or has low dispersal rates; Species has low recruitment rates and population recovery is likely to be very slow.
Moderate	Habitat can tolerate some elevated levels of pollution or will recover within a short-medium term (e.g. <20 years); Habitat has hydrological or soil/geology requirements that can be recreated or are fairly widely met; Habitat may be isolated, but is present at an extent that provides resistance to edge effects and is better able to accommodate damage; Habitat develops over a moderate timescale given the right conditions (e.g. unimproved acid grassland).	Species is able to tolerate some levels of disturbance or pollution (e.g. sub-lethal effects); Species population is restricted, but large enough to accommodate some temporary reduction without long term consequences for viability; Species has moderate recruitment rates.
Low	Habitat is highly resistant to nutrient enrichment or other forms of pollution and physical disturbance (e.g. improved grassland); Habitat has non-specific requirements that are readily met elsewhere; Habitat is extensive and well able to accommodate localised or more extensive damage; Habitat is easily recreated over a short timescale (e.g. improved grassland).	Species is highly resistant to disturbance and pollution (e.g. most urban wildlife). Species' population is widespread and recolonisation in the wake of any localised range reduction likely to occur readily; Species has high recruitment rates likely to lead to rapid recovery of population levels.

Characterising Ecological Impacts and Effects

8.3.12 Likely significant impacts/effects on key ecological features, whether occurring during preparatory works (e.g. land remodelling and stabilisation), during construction (e.g. noise disturbance from piling or other activities) or during the operational phase (e.g. noise, lighting, human disturbance) are classified by reference to the following parameters:

Beneficial, adverse or neutral - a beneficial or positive effect being one that improves the quality of the ecological resource at a given scale; and an adverse or negative effect being one that diminishes it;

Extent - the geographical area over which the impact/effect may occur;

Magnitude - the size, amount or intensity of the impact, quantified where possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population (see Table 8.4 below);

Duration - effects may be described as short, medium or long-term and permanent or temporary;

Frequency and timing - in terms of frequency of the activity and engagement with seasonal animal/plant cycles; and

Reversibility - an irreversible effect being one from which recovery is not possible within a reasonable timescale, or there being no reasonable chance of action being taken to reverse it; whereas a reversible effect is one from which spontaneous recovery is possible.

Table 8.4: Impact Magnitude

Impact magnitude	Definition
High	An example of a high magnitude impact would be direct loss or mortality, indirect displacement or habitat loss that would be likely to substantially reduce the population level or degree of habitat representation at the given geographical level being considered. An example of a very high magnitude impact would be direct mortality or displacement of a significant proportion of a species' population or loss of habitat at a level likely to remove its continued representation at the given geographical level being considered.
Medium	Medium or moderate magnitude impacts include those likely to result in a net reduction of population or habitat representation (at least in the absence of effective mitigation or compensation) at the given geographical level being considered.
Low	Low or minor magnitude impacts include those that may result in loss of a few individuals from a species' population or minor reduction in habitat extent at the given geographical level being considered.
Negligible	Negligible magnitude impacts are those that are not likely to give rise to measurable effects on population level or habitat representation at the given geographical scale.

Significance of Effects

8.3.13 In accordance with standard EIA process, impacts are only discussed in detail in this assessment where there is a reasonable likelihood of the development giving rise to a significant effect on an important ecological feature.

8.3.14 Whether a potential impact or effect is 'significant' or not at the given geographical level that the receptor is valued at, is determined by quantifying the magnitude of effect and considering the importance and sensitivity of the affected receptor. Thus, for receptors of national or international value and high sensitivity, adverse impacts measured at high or very high magnitude are likely to represent a significant effect at that geographical level. At the other end of the scale, low magnitude impacts on receptors of low sensitivity and only immediate local value are likely to be below significant effect thresholds. Substantial impacts or effects on high value receptors that are of low sensitivity may fall either side of the significance threshold - in such cases mitigation may be able to be employed to ameliorate effects. A key consideration is whether the 'integrity' of a site or ecosystem (e.g. the coherence of its structure and function) and/or the 'conservation status' of a species or habitat (e.g. the ability of a population/habitat to maintain itself at pre-development levels/quality) will be compromised.

8.3.15 The CIEEM guidelines define a 'significant effect' as one that "either supports or undermines biodiversity conservation objectives for 'important ecological features'…or for biodiversity in general".

8.3.16 The term 'likely significant effects' is used in the sense imparted by the EIA Regulations to describe residual effects on the environment after avoidance and mitigation measures are taken into account. Significant effects are qualified with reference to an appropriate geographic scale, but it is important to note that the scale of the significance of an effect may not be the same as the geographic context in which the feature is considered important. This approach remains standard and consistent with the EIA Regulations and current CIEEM Guidelines but it should also be noted that sub-significant (in EIA terms) effects on ecological receptors may still give rise to policy conflicts, particularly when considered cumulatively and in the context of the national policy requirement for all developments to protect against further net loss of biodiversity and deliver enhancement/net gain wherever possible[12]. The implications of the application proposals for delivery of net biodiversity gain are discussed at the conclusion of this assessment.

Impact Prediction Confidence

8.3.17 For the impacts identified, confidence levels in the assessments made may be attributed and/or discussed where there is a significant degree of uncertainty. This is particularly relevant to the assessment of residual effects where there inevitably remains a degree of uncertainty around the delivery and the efficacy of future compensatory enhancement through on and off-site habitat management.

8.4 Baseline Conditions

Designations

8.4.1 The proposed development site is subject to both statutory and non-statutory nature conservation designations. An overview of these applicable designations is given below in the approximate order of weight afforded to each in planning constraint terms:

[12] Planning Policy Wales (PPW) 11 sets out that the planning system should contribute towards "*improving the resilience of ecosystems and ecological networks, halting and reversing the loss of biodiversity and maintaining and enhancing green infrastructure based on seeking multiple ecosystem benefits and solutions*" including via "*ensuring appropriate mechanisms are in place to both protect against loss and to secure enhancement*". This policy and subsequent policies in Chapter 6 of PPW 11 respond to the Section 6 Duty of the Environment (Wales) Act 2016, for example, reinforcing that planning authorities must seek to ensure that "*development should not cause any significant loss of habitats or populations of species, locally or nationally and must provide a net benefit for biodiversity*" via following the mitigation hierarchy (PPW11 para 6.4.21)..

Statutory designation (Site of Special Scientific Interest (SSSI))

8.4.2 The Application Site includes around 6ha of the 181.3ha Cwm Glo a Glyndyrys SSSI (**Figure 8.1**). This SSSI is designated due to the presence of extensive areas of unimproved marshy, neutral and acid grassland, the intimate association of these habitats as a matrix with others (including woodland and heath) and the "outstandingly diverse" assemblage of grassland fungi, for which it is cited as one of the best sites in Britain, and one of the best sites for waxcaps (*Hygrocybe* spp) in western Europe.

8.4.3 The current delimitation of the SSSI, at 181.3ha (c.78% of the wider landholding), is an expansion of a previously much smaller 29.1ha designated site which covered several enclosures in the NW of the landholding and remote from the current Application Site. The interest features supporting the SSSI at that stage were focussed on unimproved grassland habitats and the mycological (fungi) interest. Specifically, in the context of previous land remediation and redevelopment proposals by the site's former owner during the mid-2000's, the then Countryside Council for Wales commissioned a series of surveys of both the grassland fungi across the wider site, and of the habitats more generally. The results of the former (Evans and Mitchell 2007) are discussed within the more recent fungi survey reports at appendices 8.1 and 8.2 and the results of the latter (Bosanquet & Stevens 2005) are attached in full at Appendix 8.3. These surveys underpinned an expansion of the SSSI to its current extent around 2008.

8.4.4 As a function of constraints analysis and subsequent design decisions and avoidance measures, the 6ha portion of SSSI falling within the Application Site does not contain any significant examples of the unimproved marshy, neutral and acid grasslands representing the prime SSSI features, or any grasslands of higher value for fungi. It is dominated in part by closed canopy woodland, and in part by an expanse of 'ffridd' vegetation comprising tall bracken stands between scattered mature trees. The principal interest features underpinning the SSSI designation have thus been largely avoided by virtue of the design process.

Non-statutory Site of Importance for Nature Conservation (SINC) designations

8.4.5 Non-statutory or 'second tier' designations in Merthyr are called SINCs. They are designated with reference to "Criteria for the selection of Sites of Importance for Nature Conservation in the County Borough Councils of Caerphilly, Methyr Tydfil and Rhondda-Cynon-Taff (Mid Valleys Area) (2008)", and were reviewed as part of the Local Plan review process in 2017[13]. They are afforded protection under national policy[14] and adopted LP policies EnW1 and EnW3.

[13] Jones, J. (2017) Merthyr Tydfil County Borough Council Local Development Plan (2016 – 2031) Background Paper: Review of Sites of Importance for Nature Conservation.

[14] E.g. PPW11 para 6.4.20

8.4.6 The Application Site includes parts of two designated SINCs (**Figure 8.1**). The larger part of the Application Site overlaps with the Rhydycar West SINC (SINC 36) which is stated to qualify for designation under a range of applicable SINC criteria on the basis of the mosaic of unimproved and species-rich grassland, heath and other open habitats, extensive wet woodlands, areas of upland oak woodland, 'ffridd' complexes, the presence of great crested newts, badgers and noctule and pipistrelle bats, the 'possibility' of water vole and marsh fritillary, a range of nationally scarce invertebrates, UK BAP Priority bird species (equivalent to 'Welsh Priority' species as referred to elsewhere in this chapter), the butterflies dark-green fritillary and small pearl-bordered fritillary and a range of uncommon or scarce vascular plants.

8.4.7 Representations of the above listed habitat features can be found within the Application Site portion of SINC 36, but not all of the species have been confirmed, as discussed further below.

8.4.8 A very small part of the Application Site also overlaps with the Cwm Glo SINC (SINC 12). This SINC is stated to qualify under a range of applicable SINC criteria on the basis of the mosaic of unimproved and species-rich grassland, heath and other open habitats, 'ffridd' complexes and both wet and upland oak woodland, as well as for the presence of great crested newts and other more common amphibians, reptiles including adder, UK BAP Priority bird species (equivalent to 'Welsh Priority' species as referred to elsewhere in this document), a population of marsh fritillary, the butterflies dingy skipper and grayling, up to eleven nationally scarce species of invertebrates, the possibility of water vole and otter, a range of uncommon or scarce vascular plants and because of the site's importance for grassland fungi.

8.4.9 The small part of SINC 12 that overlaps with the Application Site does not contain most of the above-listed features and few of the qualifying species have been confirmed, as discussed further below

Other non-statutory nature conservation (or related) designations

8.4.10 There is no ancient woodland mapped as occurring within the main part of the Application Site (i.e. the areas proposed for built development) (**Figure 8.1**) albeit the south-western spur encompassing the retained heritage features overlaps with some 1.09ha of woodland identified as ancient on both the replacement LDP 2016-2031 Proposals Map and the NRW ancient woodland inventory.

8.4.11 There is, however, scant documentary or field evidence to support ancient woodland in this location, and indeed the weight of evidence points to these woodlands not being ancient. In terms of documentary evidence, a file note obtained from the NRW SSSI file in 2015 sets out the results of a desk and field-based investigation carried out by Dr Jim Latham in 2005 into the presence and extent of any ancient woodland on the wider landholding. This stated that "*The available evidence suggests a long-term woodland presence in the vicinity, but cannot confirm its continuity at any given point required for the formal label of 'ancient woodland'*". It goes on to say "*The area of woodland (some 3ha) along the northern fringe*[15] *probably has the best claim to be 'ancient' as there is less obvious disturbance than across the rest of the site and to this day it holds the highest density of mature trees. However given the degree of*

[15] Outside the application site

disturbance in the area, more evidence would be needed (e.g. maps from the 1700s) to be confident about this".

8.4.12 Documentary and field investigations by Bioscan since 2015 align with this conclusion, at least in respect of the expansive areas of woodland in the central and southern parts of the landholding, including the elements that overlap with the Application Site. These all appear to be secondary stands developed on land disturbed by past mine/colliery workings. A somewhat stronger claim to ancient woodland survival found by Bioscan relates to an area with a high frequency of mature trees in the central part of the landholding. This fractionally overlaps with the Application Site but the larger part of this area is avoided. The area coincides with an area shown as established woodland on the 1850 Tithe Map. On the ground, this area correlates with a concentration of older and/or veteran trees on the site, albeit there is not a well-developed woodland ground flora and once again disturbance from historic mining activity complicates the picture across much of this area. The strongest claim for the presence of ancient woodland within the entire landholding would appear to be some of the ribbon woodland along more undisturbed stretches of incised stream courses in the northern part, outside and well removed from the Application Site (e.g. along Nant Cwm Glo, Nant Rhyd-y-car and Nant Cwm-pant-bach). These fragments may be at least part ancient in origin. These appear to be the areas 'along the northern fringe' being referred to by Latham in 2005.

8.4.13 The Application Site also encompasses a rather larger area of TPO designated woodland (reference TPO 15), including around 4ha in the part of the Application Site proposed for development. This is clearly secondary woodland, in large part on land formerly disturbed by coal mining, and not ancient. The policy protection afforded to this resource is therefore in large part for landscape/amenity purposes as against ecological reasons and in any event is encapsulated within the general biodiversity protection policies at national and local level, e.g. LP Policy EnW1.

Habitats, flora and fungi

8.4.14 The broad distribution of the key habitats on the wider landholding and within the Application Site (including 'Priority' habitats) is indicated on **Figure 8.2**.

8.4.15 In general, the wider landholding retains the highly complex assemblage of habitat types and intergrades studied and described in detail by Bosanquet and Stevens (**Appendix 8.3**). There are extensive areas of woodland, marshy 'rhos'-type *Molinia*-dominated grasslands, dwarf shrub heath and acid grassland (often on colliery spoils) and damp and dryer neutral grasslands as well as scrub, waterbodies, 'ffridd' type habitats (bracken & scrub), watercourses, areas of disturbed ground and structures, and localised stands of invasive plant species (in particular Japanese knotweed). Representations of the Welsh Priority habitats Lowland Heathland, Lowland Meadow, Purple Moor Grass and Rush Pastures, Acid Grassland, Wet Woodland, Upland Oakwood and Ponds are all found within the landholding, although of these only Lowland Heath, Ponds and Wet Woodland have substantive representations within the Application Site.

8.4.16 Scarce and other notable plants including soft leaved sedge, intermediate lady's mantle and others have been recorded in the wider landholding and re-confirmed by Bioscan since 2015. Other notable species found since 2015 include ivy-leaved bellflower. Of these, only intermediate lady's mantle has been found within the Application Site. Less desirable is the presence of both Japanese knotweed and Himalayan balsam: the former is present locally within the Application Site but not to the extent of the larger stands found elsewhere within the landholding, in particular to the north in the vicinity of Collier's Row.

8.4.17 The focus of grassland fungal interest remains outside the Application Site and elsewhere within the SSSI (especially in the north of the landholding). The results of specialist mycological surveys carried out across the landholding in autumn 2015 (**Appendix 8.1**) and autumn 2020 (**Appendix 8.2**) indicate that these areas retain a high value for grassland fungi, consistent with the position reported in 2007 (Evans and Mitchell 2007), albeit abundance in 2020 was somewhat reduced in some areas, in part due to the vagaries of seasonal and other conditions and in part due to a relaxation of grazing management in some areas.

8.4.18 By contrast the Application Site is dominated by closed canopy woodland or (locally) more open woodland and scrub interspersed with bracken-dominated vegetation ('ffridd'). These habitats have little value for grassland fungi and do not contribute to the mycological interest feature of the wider landholding. The only area of the Application Site supporting grassland fungi interest is on the less recently disturbed area of tips associated with the former Glyndyrys Pit in the central part of the Application Site. A total of 20 waxcap species have been recorded here since 2015, placing it joint 8th out of 26 subsites within the wider landholding that have been noted to support at least one species over the 2015-2021 period (see **Appendices 8.1 and 8.2**).

Fauna

8.4.19 Great crested newt: (full European and UK protection, Welsh Priority). The overall status of this species, both within the wider landholding and on the Application Site, has changed little from the position reported in the 2008 ES and as found in 2015. The collective results indicate a small core breeding pond in the north of the current Application Site (**Appendix 8.10**). The pattern of results from the ponds on the wider landholding suggests that as well as the northern part of the Application Site the terrestrial range of this population is likely to encompass most of the SSSI to the north of the Application Site, with an increasing likelihood of animals being present as one moves away from the south and east, significantly limiting the scope for significant effects from the proposed development.

8.4.20 Great crested newts are protected under The Conservation of Habitats and Species Regulations 2017 (as amended), and the Wildlife and Countryside Act 1981 (as amended). They are also Species of Principal Importance under Section 7 of the Environment (Wales) Act 2016.

8.4.21 Marsh fritillary: (full UK protection, Annex II Habitats Directive, Welsh Priority). The current status of this species within the wider landholding appears at its highest level since at least the 1990's. Comparison of the 2015 (**Appendix 8.4**) and 2020 (**Appendix 8.5**) surveys for the larval webs of this species confirms more recent consolidation and expansion and the population is now fairly widespread within the wider landholding, albeit some suitable habitat patches do not appear to have yet been colonised. The Application Site avoids the locations where larval webs have been found in 2015 and 2020.

8.4.22 Bats: (full European and UK protection, several are Welsh Priority species). Active and static surveys of bat activity since 2015 (**Appendix 8.11**) have recorded a diverse range of 14 bat species with summer, autumn and winter roosts confirmed (or strongly suspected on balance of evidence) in a number of built structures falling within or close to the Application Site. Species found in roosts in built structures within the Application Site to date have included lesser horseshoe and brown long-eared bat, with Myotis species suspected to roost in bridge structures and both Myotis and horseshoe bats suspected to roost in the nearby Aberdare tunnel.

8.4.23 The woodland habitats within the Application Site and the more open-grown mature trees within the SSSI component of the Application Site offer additional potential roosting sites for bats. Trees with medium or higher potential to support bat roosts have been identified by ground-based assessments in 2021 and 2022 and subject to campaigns of climbing inspections in November 2022. This confirmed the presence of a small number of tree roosts for brown long-eared and Daubenton's bats (**Appendix 8.14**)

8.4.24 In addition to the above bat species confirmed as using roost sites, the following additional bat species have been recorded within or close to the Application Site during activity surveys since 2015: greater horseshoe (Welsh Priority), barbastelle (Welsh Priority), Whiskered/Alcathoe/Brandt's, noctule, serotine, common, soprano and Nathusius' pipistrelle (**Appendix 8.11**).

8.4.25 Adder, grass snake, slow worm and common lizard: (UK protection from killing or injuring, Welsh Priority). All four of these reptile species have been recorded within the wider landholding since 2015, but specific surveys of the Application Site in 2021 only confirmed populations of the last three. This included exceptional numbers of common lizard (**Appendix 8.12**). These species are considered to be distributed across the Application Site (and the wider landholding) wherever suitable habitat structure (open habitats and habitat edges, not woodland) persists.

8.4.26 Birds: (UK protection afforded to active nests, eggs and nestlings, with Schedule 1 species further protected from disturbance. Several species Welsh Priority as discussed below). Since 2015 a number of notable bird species have been noted in and around the Application Site and within the wider landholding (**Appendix 8.9**). Up to three nightjar (Welsh Priority species, Annex 1 Birds Directive, UK Red List) territories were present in 2015 and 2021, including one close to the Application Site. Willow tit (Welsh Priority, UK Red List), redstart (UK Amber List), cuckoo (Welsh Priority, UK Red List), wood warbler (Welsh Priority, UK Red List) tree pipit (Welsh Priority, UK Red List) and spotted flycatcher (Welsh Priority, Red List) have all been noted to hold breeding territories within or adjoining the Application Site since 2015, albeit of these, only willow tit and spotted flycatcher held territory within the Application Site in 2021. A good

assemblage of breeding species on the wider landholding generally, includes (in addition to the above) lesser redpoll (Welsh Priority, UK Red List), stonechat, tawny owl (Amber List), raven and high densities of willow warbler (Amber List), bullfinch (Welsh Priority, UK Amber List), song thrush (Welsh Priority, UK Amber List) and other more common species. Species confirmed to date only on a transient basis within the Application Site, but which may breed nearby, include crossbill (Schedule 1), kingfisher (Schedule 1) and dipper (Amber List).

8.4.27 Other invertebrates: (various species are Welsh Priority). Surveys in 2015 (**Appendix 8.6**) and 2018 (**Appendix 8.7**) recorded a notable assemblage of wetland beetles (including two nationally rare and eleven nationally scarce species from this taxonomic group), confirmation of the presence of the moths white barred clearing (first record for Glamorgan since 1910) and scabious longhorn (first record for Glamorgan since 1920), several other nationally scarce species, and the 'Welsh Priority' butterflies marsh fritillary (discussed above), small pearl-bordered fritillary and dingy skipper. Brown-banded carder bee (also a 'Welsh Priority' species) was also noted as present. Surveys in 2021 (**Appendix 8.8**) recorded a number of the same or additional rare, scarce or 'priority' species, including dingy skipper and marsh fritillary, the millipede *Ceratosphys amoena* subsp. *confusa*, the brown banded nomad bee, and a number of additional Hymenoptera and Coleoptera of note.

8.4.28 The habitats associated with the former Glyndyrys Pit tips in the central and southern part of the Application Site are a focus for several of these species, with marshy and standing water habitats downslope of the tips and towards the A470 also of note. The Application Site also encompasses the 'ffridd' habitats that are the focus of the site's small pearl-bordered fritillary population, as well as open grown birch trees in the same area that are likely favoured by white barred clearwing. Conversely, many of the notable species associated with unimproved grasslands are unlikely to be dependent on the Application Site as compared with similar representations of such habitats in the wider landholding.

8.4.29 Badger: (Protection of Badgers Act 1992). Badgers are resident within the wider landholding, and field sign evidence (prints, worn paths, snagged hair and snuffle holes) has frequently been found within the Application Site since 2015. Only one significant sett has been found to date however and this is some distance from the Application Site (**Appendix 8.13**).

8.4.30 Other fauna of note: Polecat (Welsh Priority) was observed just outside the Application Site in 2015 and the site supports a range of other mammal species including good populations of small mammals such as bank and field voles and common shrew.

8.4.31 Species surveyed for but not confirmed as present: Nest tube surveys for dormice (full European and UK protection, Welsh Priority) in 2015 and 2021 (**Appendix 8.13**) found no evidence of the species, either on the Application Site or anywhere else within the landholding. Similarly, no evidence of water vole (UK Protection, Welsh Priority) or otter (full UK and European Protection, Welsh Priority) has been found to date, although transient use of the wider landholding by otter (e.g. when travelling between catchments) is to be expected.

Key Receptors

8.4.32 Table 8.5 below summarises the key receptors either within the Application Site or within range of any potentially significant effects (beneficial or adverse) arising from the development. It thus includes the wider landholding dominated by the Cwm Glo a Glyndyrys SSSI[16]. The table also defines the geographic level at which each receptor is considered to be important.

Table 8.5: Key Ecological Receptors

Scale of Value	Receptors scoped into assessment with notes on conservation/legislative status
International (European)	Blaen Cynon SAC (c.9km west of site) Designated for its population of the Annex II (Habitats Directive) species marsh fritillary "*Blaen Cynon contains an extensive complex of damp pastures and heaths supporting the largest metapopulation of marsh fritillary Euphydryas aurinia on the southern edge of the Brecon Beacons National Park*[17]". The re-colonisation and population expansion of this poorly dispersing species on the wider landholding (as documented by Bioscan since 2015, albeit it has not been found to date within the Application Site) very likely derives from dispersing adults originating from satellite or stepping-stone colonies on the other side of Mynydd Aberdâr, and in turn linked in some capacity to the Blaen Cynon SAC metapopulation. The degree of such 'functional linkage' to the SAC is very likely weak, but in accordance with the precautionary principle this SAC is screened in for assessment. All other European Sites are deemed beyond the zone of influence of any impacts or functional linkage to the Application Site and wider landholding.
National (Wales/UK)	Cwm Glo a Glyndyrys SSSI The SSSI that overlaps with and surrounds much of the Application Site is designated under national legislation. SSSIs are classified as being of National importance for nature conservation. The citation for this site, dating from 2008, describes the principal interest features thus: "*Cwm Glo a Glyndyrys is of special interest for its extensive areas of marshy grassland, species-rich neutral grassland and acid grassland, and for the association of these habitats with others including woodland and heath. It is also of special interest for its outstandingly diverse assemblage of grassland fungi, including 32 species of waxcap Hygrocybe spp, making it one of the best sites in Britain*".

[16] Additional receptors may be identified when the full details of off-site compensation are settled, but impacts on these are considered likely to be net beneficial.

[17] https://sac.jncc.gov.uk/site/UK0030092

Scale of Value	Receptors scoped into assessment with notes on conservation/legislative status
Regional ('Mid-Valleys')	Secondary interest features of the Cwm Glo a Glyndyrs SSSI can be regarded as of regional level importance. They include the woodland, heath and flush habitats of the SSSI, and a range of scarce and local species *"…including whorled caraway Carum verticillatum, petty whin Genista anglica, bladder sedge C. vesicaria, soft-leaved sedge C. montana, hairy lady's-mantle Alchemilla filicaulis, intermediate lady's-mantle A. xanthochlora, narrow buckler-fern Dryopteris carthusiana and adder's tongue Ophioglossum vulgatum. The marsh fritillary butterfly Eurodryas aurinia has been noted in the marshy grassland areas, where its food plant, devil's bit scabious occurs. A nationally scarce moth, the cloaked carpet Euphyia biangulata, has been recorded in the southern part of the site. A number of bird species are found at Cwm Glo a Glyndyrs and, including nightjar Caprimulgus europaeus, cuckoo Cuculus canorus, tree pipit Anthus trivialis, whinchat Saxicola rubetra, wood warbler Phylloscopus sibilatrix and redstart Phoenicurus phoenicurus. Great crested newts Triturus cristatus have been recorded in ponds on the site*". There is significant overlap between these secondary interest SSSI features and those underpinning the following non-statutory SINC designations pertaining to the wider landholding and the Application Site: 'Rhydycar West SINC (SINC 36) 'Cwm Glo SINC (SINC 12) The land within these designations has been determined to meet the selection criteria for SINCSs in the Mid-Valleys regional area, primarily due to the same interest features as are cited as underpinning the SSSI, but expanding beyond these to include attributes such as ffridd vegetation, wet woodland, scarce invertebrates (other than marsh fritillary) bat roosts and uncommon and declining butterfly and bird species. Also deemed to be of overall county interest is the concentration of county uncommon and county rare plant species occurring within the landholding, albeit in large part these are again confined to the areas designated as either SSSI and/or SINC, and therefore are dealt with under the ambit of 'designated sites' in this assessment. Similarly, the site's invertebrate (other than marsh fritillary) populations would probably be valued at this level of importance if disaggregated from the SSSI and SINC designations for which they form a key contributive component.
Borough (Merthyr)	Bat assemblage By reference to emerging guidance[18] on impact assessment for bats, the known on-site roosts could be assigned a level of importance up to 'County', but overall, the assemblage is assessed to be measurable at District

[18] CIEEM (June 2021). *Bat Mitigation Guidelines. A guide to impact assessment, mitigation and compensation for developments affecting bats.* Beta version 1.0.

Scale of Value	Receptors scoped into assessment with notes on conservation/legislative status
	(Borough) level of importance. The assemblage includes a good diversity of species in South Wales context, including national rarities such as greater horseshoe and barbastelle. Several of these are Priority species which, along with their habitats, are afforded protection by national legislation (Wildlife and Countryside Act 1981, and the Conservation of Habitats and Species Regulations 2017 (both as amended)). The Application Site's great crested newt, reptile and bird populations would probably be valued at this level of importance if disaggregated from the SSSI and SINC designations for which they form key contributive components.
Local (Parish)	Non-designated habitats including: Non-designated semi-improved grasslands Skeletal grasslands/mosaic habitats scrub A total of 0.3ha representing a matrix of the above habitat types falls outwith the SINC and SSSI designations at the easternmost fringe of the Application Site, adjoining the access road from the A470 roundabout. The small size of this area limits its value, but the habitats here are continuations of those within the adjoining SSSI and SINC and support notable plant and invertebrate species and protected reptiles. Part of this habitat has been recently damaged and disturbed from use as a temporary compound for contractors working for MBC, but it is retained at this level of value due to the potential for recovery. The site's importance to local badger populations would also probably be valued at this level of importance.
Immediate local context – i.e. at level of Site	Other non-designated habitats, comprising 0.35ha of unremarkable vegetation associated with the cutting slopes adjoining the Parish Road leading to Upper Abercanaid, where it drops down to pass beneath the A470.

8.5 Predicted Impacts Without Mitigation/Compensation

Design of the proposals

8.5.1 Details of the proposals are provided in Chapter 3 of this ES as well as in the Design and Access Statement and other submission material. In respect of the scope for impacts, the proposals will require extensive remodelling of ground levels in the northern part of the Application Site to create the platforms and gradients required to construct the indoor snow centre, indoor water park, indoor & outdoor adventure centres, ancillary indoor leisure features and plaza, car-parking, site access and the drainage infrastructure. The development impact in the southern part of the Application Site will beless intensive, although there will be various interventions required for ground remediation and stability in the areas of former mining activity and tips, the construction of woodland lodges and associated infrastructure and localised clearance and works on and around historic built features to stabilise their structure and enhance interpretation. This may also entail some modification of surface water drainage patterns in these areas, albeit recent works (although unfinished) by Merthyr Borough Council, funded by the Welsh Assembly Government, and with the purpose of improving control and routing of drainage to address tip stability concerns, have already delivered some such changes.

8.5.2 Habitat losses during the construction phase will, to all intents and purposes, be absolute in the northern part of the Application Site but in the southern area significant elements of the existing woodland cover and as much as possible will be retained, subject to land remediation and stabilisation requirements.

Scope for impact on European Sites (Blaen Cynon SAC)

8.5.3 The scope for a functional linkage between the marsh fritillary populations of the wider landholding, including areas adjoining the Application Site, and the populations within and/or intrinsically linked to the Blaen Cynon SAC, some 9km away, has been considered. Given the poor dispersal powers of the species and the distances involved, it is considered unlikely that any weak functional linkage between the two (e.g. via stepping stone or satellite colonies) could translate to a significant impact vector, even in the event that impacts on the species from the development were identified. In any event, the siting of the development within the wider landholding avoids the known colonies of the species and no scope for significant direct impacts has been identified. Consequently, the Blaen Cynon SAC is screened out of requiring any further consideration in this assessment.

Impact on statutory designations (Cwm Glo a Glyndyrys SSSI)

Construction phase

8.5.4 Both the location of the development within the wider landholding and the detailed positioning and extent of the Application Site have been configured through numerous design iterations in order that overlap with the designated Cwm Glo a Glyndyrys SSSI is restricted to the absolute minimum necessary. This has seen the quantum of SSSI land affected by the proposed development incrementally reduced over time in order to reduce impacts on the statutory site. Some SSSI landtake remains unavoidable, however, in order to deliver the indoor snow centre, which is the central focus of the scheme. In total, a direct landtake of 6ha of the SSSI is anticipated, which represents a little over 3% of the total land area of Cwm Glo a Glyndyrys SSSI.

8.5.5 The parts of the SSSI affected by the proposed development do not contain any significant representations of the primary features of special habitat or mycological interest underpinning the designation. Thus, it is considered that the direct loss of SSSI land to the development will have little or no impact on the national and international mycological importance of the SSSI, and will not result in the direct loss from the SSSI designated area of any substantive quantum of the cited marshy grassland, acid grassland or heathland habitats, including those supporting the site's current population of marsh fritillary.

8.5.6 Consequently, it is primarily the secondary interest features of the SSSI that will be directly affected, in particular woodland, scrub and 'ffridd' habitats of a type falling outside the scope of the primary interest features.

8.5.7 In the absence of mitigation or compensation, there would however be the scope for indirect construction-phase impacts on habitats more central to the cohesion and integrity of the SSSI. In particular, the constructed slopes to the south of the indoor snow centre building will fractionally overlap with and immediately abut one of the better areas of *Molinia* dominated marshy grassland and/or fen meadow on the site, with its population of marsh fritillary. This proximity creates scope for hydrological disruption and impacts from dust, noise and lighting on this sensitive part of the site during both the construction and operational phases. Surface water discharge from the Application Site also has the potential to impact on downstream wetland systems in the tongue of SSSI that extends between the Application Site and the A470.

8.5.8 Construction-phase impacts on the SSSI are, without mitigation, measurable and significant in EIA terms at all scales up to the national level. Their potential magnitude has been substantially reduced through iterative design but, as direct landtake from the SSSI is proposed, they remain significant and adverse, even if of minor magnitude in the context of the quantum of loss taken against the total national SSSI resource. At regional level the magnitude would increase to moderate and at the Borough level of reference these impacts would be major adverse.

8.5.9 Given these unavoidable impacts and the general policy presumptions against damage to or loss of SSSI land, a substantial suite of mitigation measures (to restrict the scope for indirect effects) and compensation measures (to offset the unavoidable losses) is therefore proposed, as discussed later in this chapter.

Operational phase

8.5.10 In the operational phase, the scope for ongoing and expanded effects on the SSSI is restricted to indirect impacts from lighting, noise and disturbance, including both that arising within and emanating from the operational site, and also the inevitable and to some extent encouraged increase in public access across the retained part of the SSSI.

8.5.11 In respect of the parts of the SSSI adjoining the application site, the spatial extent of these impacts has been restricted wherever practical by design, to the extent that (by reference to Chapters 14 and 16) no significant effects on any of the primary SSSI interest features that are retained are anticipated to arise. This includes the open expanse of *Molinia*-dominated marshy grassland/mire to the south of the indoor snow centre building which will have its landscape context significantly changed, but (on the basis of the conclusions presented in the hydrology chapter), not its habitats. Consequently, significant adverse impacts or effects on associated SSSI species such as marsh fritillary are not anticipated during the operational phase. Whilst there is again scope for localised adverse effects on secondary interest features such as woodland, scrub and 'ffridd' habitats in retained parts of the SSSI immediately adjoining the operational site, these are assessed to be minor and substantially outweighed by the improved management of both the SSSI and non-SSSI land delivered by the scheme.

8.5.12 Similarly, any adverse effects arising from the anticipated uplift in visitor pressure on the retained parts of the SSSI following completion of the development is expected to be outweighed by improved habitat and visitor management across the larger part of the SSSI that will be retained, such that the balance delivered is net positive in ecological terms. The applicant is also committed to the delivery of off-site compensation to ensure that the net effect of the proposals on ecological receptors is indubitably in the positive.

Impacts on non-statutory designations – Rhydycar West SINC and Cwm Glo SINC

Construction phase

8.5.13 The entirety of the Application Site, bar a small c.0.3ha area around the site access off the A470 roundabout, and a similarly small area in the extreme south-east near where the Parish Road passes under the A470, is subject to SINC designation. This includes the part of the Application Site that is further designated SSSI, and where the two designations are layered over each other.

8.5.14 The relevant SINCs are numbers 12 (Cwm Glo) and 36 (Rhydycar West). They are afforded policy protection under PPW 6.4.20 and under the generic adopted MTLDP Policy EnW1 and the more specific EnW3. By far the larger impact is on the Rhydycar West SINC, with only a sliver of the Cwm Glo SINC being affected.

8.5.15 The Application Site, including the non-SSSI areas, contains a suite of features that comfortably qualify against the relevant SINC selection criteria used in Merthyr Borough. In particular the Application Site contains representations of acid and neutral grasslands with not insignificant botanical and grassland fungi interest, areas of lowland heath and woodlands ranging from mature stands with a significant complement of over-mature trees to extensive ash or alder dominated stands, in places transitional to the Welsh Priority habitat 'wet woodland'. The

representations of these habitats within the Application Site would mostly be removed by the development.

8.5.16 By far the larger impact will be on the Rhydycar West SINC, with perhaps 25% of the total designated area being lost to the development. By contrast, the impact on the Cwm Glo SINC would be slight, with perhaps 0.2ha of the total 127.1ha site being lost (0.16%). Considered cumulatively these losses would be of moderate to major magnitude and a significant adverse effect at all scales up to Regional/County level, commensurate with the geographical frame of reference at which such sites are valued.

8.5.17 While there is no meaningful scope to mitigate for these losses within the confines of the Application Site itself, compensation is proposed to be delivered by means of wider site measures (including improved management of both SSSI and non-SSSI land under the applicant's control) and off-site measures, as discussed later in this chapter.

Operational phase

8.5.18 In the operational phase, the scope for ongoing and expanded effects on the retained portions of the Rhydycar West and Cwm Glo SINCs is restricted to indirect impacts from lighting, noise and disturbance, including both that arising within and emanating from the operational site, and also the inevitable and to some extent encouraged increase in public access across their wider extents.

8.5.19 In common with the approach taken to limit indirect impacts on the SSSI, the spatial extent of these impacts has been restricted wherever practical by design such that the scope for localised adverse effects on SINC interest features such as woodland, scrub and 'ffridd' habitats in zones immediately adjoining the operational site is assessed to be minor. Chapters 14 and 16 conclude that impacts from noise and lighting will be negligible. Any residual sub-significant effects are adjudged to be substantially outweighed by the improved management of SINC designated land that will be delivered by the scheme.

8.5.20 Similarly, any adverse effects arising from the anticipated uplift in visitor pressure on the retained parts of the Rhydycar West and Cwm Glo SINCs following completion of the development is expected to be outweighed by improved habitat and visitor management across the larger part of these designations that will be retained, such that the balance delivered is net positive in ecological terms. The applicant is also committed to the delivery of off-site compensation to ensure that the net effect of the proposals on ecological receptors is indubitably in the positive.

Impacts on Ancient Woodland and TPO woodland

Construction phase

8.5.21 The area of putative ancient woodland in the south-west of the Application Site, as identified on both the NRW inventory and the Merthyr Local Plan Proposals Map, encompasses areas historically impacted by mining and mining-related infrastructure, including areas contained within Scheduled Monument designations protecting late C18th or later built structures. The veracity of the claim to ancient woodland in these locations is therefore highly questionable, as discussed at 8.4.10 to 8.4.12 of this chapter. These putative ancient woodlands would not in any event be affected by development works, but might be impacted by limited related interventions (such as removal of trees growing out of structures), as necessary to preserve the historic structures and improve access and interpretation; however, such interventions would be kept as minimal as possible. However, woodland affecting these historic structures is by its very nature and location likely to be secondary, not ancient.

8.5.22 On balance, it is assessed that there is no substantive threat to ancient woodland resources from the development and impacts on ancient woodland have therefore been screened out of any further consideration.

8.5.23 The TPO designation falling within and affecting rather more of the woodland on the Application Site (TPO 15) is there primarily for more generic amenity reasons and/or to protect significant groups of more mature trees, rather than being indicative of any confirmed or assumed surviving ancient woodland resource. In this context, a grading of quality within the currently TPO designated areas can be drawn, from secondary woodlands of relatively low biodiversity value, derived from recent scrub development on former mining land at one end (here including localised areas invaded by Japanese knotweed along the former railway lines in the south of the Application Site) to the more open-grown trees in the 'ffridd' type areas in the northern and western part of the Application Site, including the SSSI designated area.

8.5.24 Impacts on these TPO woodlands will vary from slight magnitude where localised tree removal might be required for amenity, health and safety or land stabilisation purposes but where woodland cover is otherwise maintained, through to wholesale clearance where overlapping with (for example) the proposed indoor activity and indoor snow centre parts of the development.

8.5.25 Again, while there is no meaningful scope to mitigate for losses of these habitats within the confines of the Application Site itself, compensation is proposed to be delivered by means of wider site measures (including improved management of both SSSI and non-SSSI land) and off-site measures, as discussed later in this chapter.

Operational phase

8.5.26 The spatial extent of indirect impacts on TPO woodland from lighting, dust and other sources emanating from the Application Site has been restricted wherever practical by design. Given the nature and purpose of TPO designations, the scope for localised additional adverse effects from these sources to materially impact on the ecological quality of retained TPO woodland immediately adjoining the operational site is assessed to be very minor and substantially outweighed by the improved management of the much larger quantum of such woodland that will be delivered by the scheme.

Impacts on protected species

Construction and operational phases

8.5.27 The presence of a diverse (in a Welsh context) bat assemblage and known bat roosts, including transient summer roosts, suspected maternity roosts and wintering roost sites, imparts a further tier of legal protection to several of the historic structures within and adjoining the Application Site, over and above the status of some as Scheduled Monuments. Over and above this, the presence of bats, including the rare species barbastelle and both greater and lesser horseshoe, represents a feature underpinning the SINC designations discussed above, and indicates the potential for further roost sites to be present in the mature tree resource within the Application Site (several tree roosts having already been confirmed). In the absence of mitigation and/or compensation, the impacts on bats could include the loss of several roost sites, including roost sites for rare species such as lesser horseshoe. Such impacts would be significant at Borough level.

8.5.28 Mitigation and compensation for such impacts is necessary for legal compliance reasons, including as a requirement of licensing, and includes the requirement to achieve no diminution of 'Favourable Conservation Status' for any individual species, in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended). The EIA and determination processes require consideration of whether such mitigation and compensation is achievable such that a grant of a licence to derogate from impacts during construction would not be 'unlikely'. In this case, the type and nature of the roosts confirmed to date, the availability of land that will remain undeveloped, and the inherent low-impact and flexibility associated with the non-built recreational and leisure components of the development mean there is the ability to achieve an appropriate level of mitigation for any impacts that become more clearly defined through the detail of future development control stages to the extent that there would be no threat to the maintenance of favourable conservation status of any European Protected Species in their natural range. Mitigation and licensing is discussed further in later sections of this chapter.

8.5.29 Similarly, the presence of known breeding ponds and terrestrial habitat for great crested newts, while imparting a further tier of legal protection to certain of the ponds within and adjoining the Application Site, and a greater or lesser extent of the terrestrial habitat surrounding them, and representing a primary or secondary feature underpinning the SSSI and SINC designations discussed above, generates the same statutory requirement for mitigation and compensation if impacts cannot be first avoided. This again includes the requirement to achieve no diminution of 'Favourable Conservation Status'. In the absence of mitigation and/or compensation, the impacts on great crested newts would include the loss of breeding sites and terrestrial habitat for a low and sparsely distributed wider site population. It is considered such impacts would be significant at Borough level. Again, due to the availability of the wider landholding which will remain undeveloped, and the clear scope to deliver enhancements on that land by improving the condition of ponds, there is the ability to achieve an appropriate level of mitigation for any impacts that become more clearly defined through the detail of future development control stages, and even to deliver net enhancement for this species. This is also discussed further later in this chapter.

8.5.30 The presence of good populations of reptiles within the Application Site will similarly require that appropriate measures to avoid killing or injuring individual animals are taken and thereby ensure compliance with the Wildlife and Countryside Act 1981 (as amended) are secured prior to the commencement of any development. In the absence of such mitigation and/or compensation measures, the impacts on reptiles would include impacts that may diminish, but probably not threaten the continuation of, wider site populations. Such impacts would be significant at Borough or possibly Parish level. Considering the availability of habitat in the wider landholding, the scope to enhance such habitat consistent with arresting scrub control and other measures compatible with the SSSI designation, and/or the availability of suitable off-site locations for receiving translocated animals, there can be confidence that an appropriate level of mitigation for impacts on reptiles can be secured, as discussed further later in this chapter.

8.5.31 The loci of both marsh fritillary and badger presence within the landholding fall outside the Application Site and no direct impacts on these species are envisaged. The scope for low magnitude impacts from indirect effects does however necessitate precautionary mitigation measures such as precautions to avoid badger becoming entrapped in construction excavations and careful lighting design, even where those effects are unlikely to be significant in EIA terms.

8.5.32 In consideration of the absence from the Application Site of dormouse, water vole and otter, there is considered to be no scope for likely significant effects on other specially protected species requiring to be taken into account in this assessment.

Impacts on Welsh Priority habitats and species

Construction and operational phases

8.5.33 The Application Site contains representations of the following 'Welsh Priority' (i.e. Section 7 of the Environment (Wales) Act 2016) habitat types:

- *Lowland mixed deciduous woodland*
- *Wet woodland*
- *Lowland dry acid grassland*
- *Lowland heathland*
- *Purple moor grass and rush pastures*
- *Ponds*

8.5.34 As there is no meaningful scope to mitigate or compensate for the losses of most of these habitats to construction within the confines of the Application Site itself, in the absence of off-site compensatory measures, there is likely to be some degree of 'net loss' in the context of the local quantum of each resource. Cumulatively, such impacts would be significant at the Borough level, even if only of minor to moderate magnitude at that scale of reference.

8.5.35 The statutory public duty obligations (under the 2016 Act) surrounding the conservation of these habitats, provide a clear driver for compensatory provision to be sought, to avoid such net losses. To a greater or lesser extent this may be able to be delivered via interventions such as invasive species control and/or improved management of the undeveloped balance of the site (e.g. reinstating or restoring ponds and controlling scrub invasion), although care will need to be taken to ensure that such interventions do not themselves impact on existing features of value. This is discussed further later in this chapter.

8.5.36 In addition to the above, the Application Site also supports, has supported or can be expected to support a significant number of 'Welsh Priority' (i.e. Section 7 of the Environment (Wales) Act 2016) species, including (but not restricted to):

Table 8.6: Welsh Priority Species on the Application Site

Welsh Priority Species on the Application Site				
MAMMALS	BIRDS	HERPETOFAUNA	LEPIDOPTERA	OTHER INVERTEBRATES
Barbastelle bat	Nightjar	Great crested newt	Marsh fritillary	Brown banded carder bee
Hedgehog#	Cuckoo	Common lizard	Small pearl-bordered fritillary	
Polecat	Tree pipit	Slow worm	Dingy skipper	

Welsh Priority Species on the Application Site				
Brown hare	Redpoll	Grass snake	Small heath#	
Noctule bat	Linnet#		Grey dagger*	
Common pipistrelle#	Reed bunting#		Knotgrass*	
Soprano pipistrelle#	Kestrel		Flounced chestnut*	
Brown long-eared bat#	Willow tit		Green brindled crescent*	
Greater horseshoe bat	Wood warbler		Ear moth*	
	Dunnock#		Dusky brocade*	
	Bullfinch#		Mottled rustic*	
	Song thrush#		Small square spot*	
			Small phoenix*	
			Autumnal rustic*	
			Broom moth*	
			Shoulder-striped wainscot*	
			White ermine*	
			Buff ermine*	
			Blood vein*	

Welsh Priority Species on the Application Site				
			Cinnabar*	
			Sallow*	
			Dark-barred twin-spot carpet*	
			Neglected rustic*	

8.5.37 Of the above, the moth species marked with an asterisk "*" were included on the Welsh Priority lists for precautionary and monitoring reasons. They remain common and widespread in a national context and should not be afforded equal weight to other Section 7 species that are demonstrably rare in the local (i.e. Merthyr Borough) or wider (e.g. regional or national) contexts. To a greater or lesser extent, the same considerations apply to certain other species in the above list that remain fairly common and for which impacts up to and including wholesale displacement from the Application Site would not be significant above the immediate local (i.e. site) context. These additional species of lower weight are marked with a hash "#".

8.5.38 Notwithstanding these qualifiers, the cumulative impact on the resource of Welsh Priority species would, in the absence of mitigation or compensation, be significant at least at Borough level. There is overlap between the above list of 'Welsh Priority' species and those subject to higher echelons of statutory protection. For the latter, the relevant framework of regulation will require that mitigation and compensation measures be delivered to ensure legal compliance, in particular via the licensing schemes for European Protected Species. For the former, the compunction on public bodies to conserve such species as part of the duty towards biodiversity similarly provides a driver for the delivery of proportionate mitigation and/or compensation, as discussed later in this chapter.

Impacts on other notable species

Construction and operational phases

8.5.39 A number of nationally rare and nationally scarce invertebrates which do not enjoy the statutory protections or specific statutory obligations of the species discussed in previous sections may also be impacted by the development. Amongst the most recently confirmed or reconfirmed from the site are the Red Data Book bee *Nomada signata*, and the nationally rare millipede *Ceratosphys amoena* subsp. *confusa*, the mirid bug *Lygus pratensis* and the nomad bee *Nomada lathburiana*. A wide range of formally 'nationally scarce' invertebrates are also present. The Application Site contains representations of the open neutral to acid grassland, heathland, woodland edge and wetland habitats favoured by these scarcer species and therefore there is the potential for cumulative impacts significant at least at District/Borough level to occur in the absence of mitigation and/or compensation. The mitigation and compensation measures discussed later in this chapter would however reduce or offset impacts on these species.

Impacts on non-designated assets

Construction and operational phases

8.5.40 The loss of skeletal and species-rich grassland habitats in the small 0.3ha pocket of land near the A470 roundabout would have been adjudged as significant at Local (Parish) level, however the baseline position has now changed and such impacts have already at least partly been realised due to the recent use of this area by Merthyr Tydfil Borough Council contractors for a compound. For the purposes of this assessment, it is assumed that the value of these areas, which includes the presence of colonies of dingy skipper, may recover to some degree.

8.5.41 As there is no meaningful scope to mitigate or compensate for the losses of these habitats within the confines of the Application Site itself, in the absence of off-site compensatory measures, this would contribute to 'net loss' in the local quantum of such resources. The compensatory off-site measures proposed and discussed later in this chapter are intended to reduce or offset such losses.

8.6 Mitigation and Compensation Proposals

Mitigation and compensation for impacts on Cwm Glo a Glyndyrys SSSI

8.6.1 The larger part of the Cwm Glo a Glyndyrys SSSI, some 97%, is not directly affected by the proposed development and will, furthermore, remain under the ownership and control of the Applicant. While parts of this wider SSSI landholding have been subject to management by tenants under various landowners since designation, such management has been fairly ad hoc in application and uneven in coverage. One consequence of this is that key open grassland habitats in the north-western part of the SSSI (outside the Application Site) have been reduced in extent and quality as a consequence of management neglect. Indeed, the open fen-meadow grasslands in this area are amongst the most threatened on the SSSI due variously to lack of grazing and scrub encroachment, or (in contrast) localised overgrazing. While the statutory authority NRW has powers at its disposal to enforce suitable management *in extremis*, these are rarely used. Consequently, the future of these parts of the SSSI is uncertain and the development provides a mechanism for increasing the certainty of delivery of appropriate management in the long term.

8.6.2 Responding to this, the applicant will bring the wider landholding under comprehensive and optimised management as part of the development to ensure (*inter alia*); the continuity of optimum sward structure in the grasslands of mycological interest, the rotational availability of optimum structure and conditions for marsh fritillary and the scarce plants associated with the marshy grasslands generally (and the species-rich neutral and *Molinia* dominated grasslands in particular) and conditions compatible with maintaining the other secondary SSSI interests on the site, including the bird assemblage (in particular in maintaining conditions for nightjar and willow tit), the great crested newt population (including via restoration of ponds to optimal breeding condition for the species) and the other invertebrates of note (including the wetland assemblage and the Welsh Priority species). The opportunity will also be taken to expand nuclei of important open habitats by localised and selective scrub control, especially where scrub has more recently invaded grasslands of botanical or invertebrate interest. Other opportunities for

habitat expansion are likely to follow in the wake of invasive species control, in particular tackling the extensive stands of Japanese knotweed in the Collier's Row area and in localised areas elsewhere within the SSSI.

8.6.3 Key to the long-term maintenance of the SSSI special interest features (and indeed the secondary and ancillary interest features) will be the more consistent and better tailored reintroduction and management of grazing, in particular cattle grazing. The extent of formalised and/or de facto paths across the site (which are inevitably likely to receive increased use as a consequence of the development) and the complexity of the site as a matrix generally, present significant challenges to securing appropriate grazing management. The site therefore lends itself to the application of novel but increasingly proven[19] means to overcome such challenges by mob grazing in patches via the control and 'enclosure' of livestock through 'fenceless' grazing management techniques (e.g. collared livestock with GPS-based systems delimiting their movement via 'virtual fences', and with remote sensing monitoring feedback to adjust grazing pressure and location). This would need careful implementation and monitoring, but by this means the development would provide a solution for securing the right level of livestock grazing on the site.

8.6.4 The beneficial outcomes of securing such management on the undeveloped balance of the Cwm Glo a Glyndyrys SSSI will substantially counterbalance the more localised impacts associated with direct loss of a proportion of the designated area to development, and the additional but very localised indirect effects around the Application Site. In accordance with the Welsh Government's approach to determining net benefits for biodiversity and use of the DECCA framework within the planning system[20], application of standard metrics to assess biodiversity change[21] is not the preferred approach in Wales, and in any event cannot legitimately be used to assess or address impacts from the loss of statutory sites or irreplaceable habitats. However, the guidance recognises that it is nonetheless instructive to use them as a guide to determine what level of additional mitigation might be required to deliver outcomes close to net neutral and that are more compatible with the legal and policy presumptions against SSSI loss. In this case, outputs from Metric 3.1 indicate that, of itself, beneficial management of the balance of the landholding, including the larger part of the SSSI, has the potential to deliver net outcomes close to neutral .

[19] For example, fenceless grazing systems have been successfully employed on common land in the Gower, in a partnership initiative between Gower Commoners and Natural Resources Wales.

[20] CIEEM Briefing Paper (September 2022) 'Welsh Government's Approach to Net benefits for Biodiversity and the DECCA Framework in the Terrestrial Planning System'

[21] The Biodiversity Metric 3.1

8.6.5 Furthermore, in this case, the outcomes of application of the Metric provide confirmation that further off-site enhancement to deliver substantive biodiversity benefits of relevance to both the Cwm Glo resource and the wider region would be appropriate in order that the negative impacts on the SSSI could be outweighed, in both technical and policy terms. Significant effort has been expended already in searching for and securing an appropriate off-site compensation site or sites. This has included discussions with NRW and a number of non-statutory agencies, and a number of sites have been visited and assessed, and negotiations commenced with landowners. The search remains ongoing and the applicant is committed to securing a site of appropriate scale, geographical relevance and potential. Acquisition or lease of land to be secured for conservation purposes is currently favoured over less direct means such as financial contributions towards established and ecologically relevant conservation initiatives, but it has been determined already that a range of relevant and viable options to offset the on-site impacts are available. Once settled, the detail of the on and off-site compensation package will be fed into the application process as appropriate, for example as Further Environmental Information, along with quantitative measures of the balance of loss versus gain in terms of biodiversity. In the fall-back position where no such detail is available prior to determination, the applicant undertakes to commit a proportionate financial contribution to a suitable and relevant project or organisation to ensure a measurable offset is delivered. Suitable repositories for such contributions might include initiatives by Butterfly Conservation to expand and enhance marsh fritillary habitat (and by extension marshy grassland, including purple moor grass and rhos pastures) in the South Wales valleys region. The applicant is aware that developer funding has been used for this offset purpose in Rhodda Cynon Taff recently.

8.6.6 The detail of these various wider landholding and off-site measures will be secured by a Compensation and Habitat Management Plan (or similar appropriate vehicle) secured via a pre-commencement condition on the planning consent. This would also detail the opportunities for delivery of compensatory or new habitat within the Application Site as part of the proposals, including in particular how the made-ground slope to the south of the indoor snow centre building will be formed of substrates conducive to the development of complementary vegetation to the surrounding SSSI, such as acid grassland and dwarf shrub/heath vegetation, and how those habitats will be delivered.

8.6.7 Measures to restrict the zone of influence of indirect impacts arising from the development to the immediate confines of the Application Site wherever possible will be pursued as part of detailed design. This will include strict delimitation of construction zones by robust fencing (Chapter 3 of this ES), secured construction management and pollution prevention techniques (Chapter 3 of this ES) and sensitive design of lighting (Chapter 16) and surface water drainage (Chapter 13). The objective of these standard and enhanced controls is to ensure indirect effects on adjoining areas and the biodiversity resources within them are kept to the minimum possible. These measures will be fully detailed via a Construction-phase Environment Management Plan (or similar) secured via a pre-commencement condition on the planning consent.

Mitigation and compensation for impacts on other receptors

8.6.8 In terms of impacts on the Rhydycar West and Cwm Glo SINCs, and the broad suite of individual flora and fauna species associated with both the SSSI and SINC designations, the same essential principles as set out at 8.6.1 to 8.6.7 above apply. In particular, enhancing and/or optimising the condition of the wider site, and (directly or indirectly) land beyond the current ownership boundary, will provide the means to offset the impacts arising from loss of parts of these SINCs. Similarly, measures such as secure site boundary fencing and controls on drainage to confine impacts to a zone of influence as coterminous to the Application Site boundary as possible will reduce the amount of offset requirement generated and will help deliver a balance of loss versus gain that is either policy compliant in its own terms, or will at least render any residual net loss of lower weight in the planning balance than in the absence of such measures.

8.6.9 In terms of protected species, including bats, great crested newts, reptiles and nesting birds in particular, standard form mitigation will be adopted, where appropriate as part of licensing processes, to both minimise impacts and ensure legal compliance. This will include measures such as suitably timed habitat manipulation to encourage protected species to move out of areas subject to imminent construction activity and clearance of vegetation outside of sensitive nesting or hibernation periods as well as pre-commencement checks of structures and mature trees capable of supporting bat roosts. Where there are known bat roosts, licences will be sought as soon as practicable in the implementation process and these will secure appropriate mitigation and compensation in line with statutory tests and requirements. The availability of the wider landholding for secured delivery of such measures is a significant advantage in determining their practical efficacy. These various measures would be secured by a Species Protection Plan (or similar) secured via a pre-commencement condition on the planning consent.

8.7 Likely Significant Residual Ecological Effects

Residual impacts on designated sites

8.7.1 There will unavoidably be net loss of designated SSSI land as a short-medium term consequence of the direct impacts of the development, albeit loss of features forming part of the primary basis for designation has been largely or wholly avoided. Indirect effects will be much more spatially delimited as a consequence of effective design mitigation, e.g. in respect of lighting and drainage treatments at the boundaries of the Application Site. It is intended that the on and off-site compensation proposals will secure a means to compensate for these direct and indirect effects in the medium to long-term via enhancements to other designated or non-designated land. This could deliver a net neutral result in terms of SSSI land area in the medium to long term, but this remains subject to uncertainty at this stage and is thus best portrayed as a best case. The worst-case outcome is that there will be a permanent net loss of SSSI land area of minor magnitude at national level, moderate magnitude at regional level and major magnitude at Borough level and below. This would be a significant adverse impact on a nationally important resource that would need to be weighed in the balance against the economic and social benefits of the scheme to determine if the presumption against such losses was overcome, and also against the significance of that loss in terms of the ecological integrity

of both the remaining part of the Cwm Glo a Glynydrys SSSI and the wider SSSI series more generally. In this context, it is significant that through development design, the elements of SSSI land directly affected do not support the principal interest features underpinning the designation.

8.7.2 The policy protections afforded to non-statutory SINC sites are less stringent, but in the context that impacts on the Rhydycar West SINC would be severe, adverse and significant at regional (mid-valleys) level, they would again have to be weighed in the balance and against the weight of local and national need for the scheme and the economic benefits arising. As with the SSSI loss, it is intended that the compensation proposals both across the wider land-holding, and off-site, will secure a means to compensate for this quantitative and qualitative loss in the medium to long-term via enhancements to other designated or non-designated land.

Residual impacts on protected and other notable species

8.7.3 Again, in advance of final details of off-site compensation proposals, the assessment of residual impacts on the diverse quotient of protected and notable species that are resident on or otherwise use the Application Site is necessarily provisional and likely worst case. The greater scope for impact naturally rests in the construction phase. Incumbent statutory regimes will ensure appropriate protections are delivered to avoid, minimise or offset impacts on species subject to stringent statutory protection, and the availability of the wider site and the management enhancements committed to in respect of that land, which will include arresting terrestrialisation of ponds and improving their status for breeding, mean that this is likely to reduce residual effects to near neutral for most such species, and likely net beneficial for great crested newts.

8.7.4 The broader range of uncommon, scarce or otherwise notable species that fall below the strict statutory regimes, and which include species central to the biodiversity duty set out at Section 7 of the Environment (Wales) Act 2016 are also likely to be subject to reduced adverse residual effects or even net benefits as a consequence of the same management enhancements on the balance of the landholding.

8.7.5 In the operational phase, appropriate management of the wider landholding is likely to deliver neutral or net benefits for the majority of protected and otherwise notable species. The greatest measure of uncertainty around this assessment relates to certain more sensitive bird species such as nightjar, which in the absence of suitable access controls, might be displaced from parts of the site with substantially increased human traffic.

8.8 Cumulative impacts

8.8.1 There is the potential for the impacts assessed above to act in-combination with impacts arising from other proposed developments in the locality. In particular, the consented developments at Bike Park Wales and the latest phases of development to the north of the site at Trago Mills affect the same side of the Taff Valley, and to the extent that these act on some of the same receptors as are affected by the Rhydycar West proposals, this is considered below.

8.8.2 The Bike Park Wales scheme (MBC reference P/19/0073) was granted consent by Merthyr Borough Council in January 2020. The consent relates to the construction of construction of additional camping and chalet accommodation at the established Bike Park Wales site (around 1km to the south of the Application Site) with associated infrastructure improvements. Construction would necessitate the loss of trees and woodland, with the imposition of conditions securing appropriate mitigation and compensation in respect of protected species and landscaping. This consented development site lies some distance to the south of the Rhydycar West application site and is buffered from it by retained woodland and grassland habitats. In-combination, the two schemes would result in a somewhat increased denudation of woodland cover on this part of the valley side, and loss of part of an additional SINC (SINC 30 – Graig Gethin), but in light of the mitigation provisions secured in respect of protected species, no other significant cumulative or additive effects are anticipated.

8.8.3 The Trago Mills site encompasses post-industrial land to land north of Heolgerrig, some 1.5km to the north of the Application Site. Much of this site has already been developed for retail and commercial development, but there remain active consents for future phases, and the most recent permissions (e.g. P/17/0333) are essentially variations to the phasing. The main ecological receptor common to the Rhydycar West Application Site is great crested newt, which has been the subject of past mitigation and compensation measures under licence at the Trago Mills site. It is unknown to what extent these measures have been successful in securing the continued presence of the species at pre-development population levels, but as there is adjudged to be no surviving functional linkage between the Trago Mills and Cwm Glo populations (in large part due to the obstruction to dispersal imposed by the intervening settlement of Heolgerrig), there is not adjudged to be any scope for in-combination effects, albeit additive effects on the local (e.g. Borough) population of this species are possible. However, as the impacts arising from the Rhydycar West development are adjudged as likely to deliver mitigation and compensation to a level where net benefits for the species are assessed as likely, it is not considered that the development could act cumulatively to reduce the local conservation status of this species.

8.8.4 Essentially the same principles apply in respect of other local consented or proposed (e.g. by way of site allocation) developments. In general, these concern post-industrial sites with a different suite of receptors to Rhydycar West, or will be required by means of mitigation and compensation to ensure no net loss of biodiversity in conformity with local and national policy. The most relevant of these to the Rhydycar West scheme is the housing site at Brondeg (Local Plan reference SW3-4). This will impact on grassland and skeletal vegetation habitats and secondary woodland associated with former colliery spoils, but not to a degree likely to give rise to additive or cumulative impacts that are significant in EIA terms.

8.9 Assessment Summary and Conclusions

8.9.1 The ecological resources within and adjoining the Application Site have been documented to an unusually high level of detail in the course of several intensive survey campaigns since 2015. The baseline conditions on the site, and the existence and importance of ecological factors capable of being material considerations in planning determination, are therefore well known.

8.9.2 The Application Site represents part of a wider landholding under the control of the applicant that is dominated by the 181.7ha Cwm Glo a Glyndyrys SSSI. That same landholding is also almost entirely underlain by non-statutory Site of Importance for Nature Conservation (SINC) designations.

8.9.3 The land upon which the rest of the development is focused, whilst outside the SSSI, is subject to SINC designations, and contains representations of many of the same habitats and some of the same species. This includes waxcap fungi, priority grassland, heathland and woodland habitats and a suite of notable species.

8.9.4 Both the location of the development within the wider landholding and the detailed positioning and extent of the Application Site have been configured through numerous design iterations in order that overlap with the designated Cwm Glo a Glyndyrys SSSI is restricted to the absolute minimum necessary. This has seen the quantum of SSSI land affected by the proposed development incrementally reduced over time in order to reduce impacts on the statutory site. Some SSSI landtake remains unavoidable, however, in order to deliver the indoor snow centre, which is the central focus of the scheme. In total, a direct landtake of 6ha of the SSSI is anticipated, which represents a little over 3% of the total land area of Cwm Glo a Glyndyrys SSSI. Due to the national importance of the SSSI series, this impact is inevitably rendered significant at that level.

8.9.5 The parts of the SSSI affected by the proposed development do not contain any significant representations of the primary features of special habitat or mycological interest underpinning the designation. Thus, it is considered that the direct loss of SSSI land to the development will have little or no impact on the national and international mycological importance of the SSSI, and will not result in the direct loss from the SSSI designated area of any substantive quantum of the cited marshy grassland, acid grassland or heathland habitats, including those supporting the site's current population of marsh fritillary.

8.9.6 Consequently, it is primarily the secondary interest features of the SSSI that will be directly affected, in particular woodland, scrub and 'ffridd' habitats of a type falling outside the scope of the primary interest features.

8.9.7 In seeking to make most efficient use of the land within the Application Site to reduce the overall magnitude of ecological impacts, the scope for mitigation and compensation to be delivered within the confines of the Application Site itself, as part of the development, is very restricted.

8.9.8 In consequence, the focus of mitigation and compensation will be outside the Application Site. In the first instance this will be in the wider landholding where the opportunity to secure optimised management of both SSSI and non-SSSI resources will be taken. Additional offsite measures, whether from securing and enhancing additional land and related habitats off-site or via financial contributions to established or new conservation projects ecologically and geographically relevant to the South Wales region will be taken. These are not yet settled, albeit significant effort has been expended already in searching for and securing an appropriate off-site compensation site or sites in discussion with NRW and a number of non-statutory agencies. This provision will be the subject of further submissions as and when additional information becomes available.

8.9.9 While there is a well-established policy presumption against development likely to damage a SSSI, the particular qualitative features of the affected area, the future security of the special interest features over the wider unaffected SSSI and the weight of need for the development are matters germane to the consideration of the weight that should be applied to the impact on the SSSI in considering the acceptability of this development in policy terms.

8.9.10 In this case, there is an opportunity for a combination of secured management of the balance of the SSSI and additional compensatory enhancement of other off-site land or via other 'in kind' measures, to substantially offset the impacts from the losses of SSSI and SINC land, and associated impacts on attendant habitat and species resources. The precise magnitude of such offset, and whether it delivers an outcome approaching or exceeding neutral in terms of overall net change, is contingent on the precise details of the off-site measures that will be submitted in support of the application in due course.

Table 8.7 Assessment Summary and Residual Environmental Effects

Key Receptor	Value	Potential Impact	Significance of Impact without Mitigation / Compensation	Proposed Mitigation / Compensation	Residual Impact	Confidence Level
Construction						
Blaen Cynon SAC (c. 9km west of site)	International (European)	Impacts on marsh fritillary butterfly populations associated with Blaen Cynon SSSI	No likely significant effect (not assessed to be functionally linked with the application site)	None required	No likely significant effect	High
Cwm Glo a Glyndyrys SSSI (Primary Interest Features)	National (Wales/UK)	Direct loss of habitat	Significant effect (minor adverse) at national level.	CEMP, improved management of remainder of SSSI, offsite compensation	Best case: no likely significant net effect Worst case: minor adverse effect significant at national level	Best case: Moderate Worst case: High
Cwm Glo a Glyndyrys SSSI (Primary Interest Features)	National (Wales/UK)	Additional indirect impacts (e.g. dust, noise, lighting, surface water discharge)	Minor magnitude impacts significant at local/regional level	CEMP, improved management of remainder of SSSI, offsite compensation	Best case: no likely significant effect at any geographic level Worst case: sub-significance threshold effects at national level, minor magnitude impacts significant at local/regional level	Best case: Moderate to High Worst case: High
Cwm Glo a Glyndyrys SSSI (Secondary Interest Features)	Regional (Mid-Valleys)	Loss of secondary interest features and localised indirect effects (the majority of the c.3% landtake from the SSSI affects secondary interest features)	Moderate magnitude adverse effect significant at Regional level	CEMP, improved management of wider site, offsite compensation	Best case: no likely significant net effect Worst case: moderate adverse effect significant at regional level	Best case: Moderate Worst case: High
Rhydycar West SINC (SINC 36) and Cwm Glo SINC (SINC 12)	Regional (Mid-Valleys)	Direct loss of habitat and associated localised indirect effects	Moderate magnitude adverse effect significant at Regional level	CEMP, improved management of wider site, offsite compensation	Best case: no likely significant net effect Worst case: moderate adverse effect significant at regional (mid-valleys) level	Best case: Moderate Worst case: High
Ancient woodland	National	Loss of habitat	No likely significant effect	None required – no ancient woodland adjudged to be affected	No likely significant effect	High
TPO woodland	Borough (Merthyr)	Loss of habitat	Moderate magnitude impact significant at Borough level	CEMP, improved management of wider site, offsite compensation	Minor magnitude adverse impact significant at Borough level, depending on quantum of existing tree resource that can be retained in lodge area	Moderate

Key Receptor	Value	Potential Impact	Significance of Impact without Mitigation / Compensation	Proposed Mitigation / Compensation	Residual Impact	Confidence Level
Bat assemblage	Borough (Merthyr)	Loss of bat roosts, foraging area and indirect impacts (e.g. from lighting)	Significant, in large part due to rare species being implicated	NRW mitigation licensing, species protection plan, to include provision for re-use of built structures where practicable	Minor magnitude adverse impact at Borough level, potentially reduced to near neutral by licensed mitigation.	Moderate-high
Great crested newts	Borough (Merthyr)	Loss of breeding sites and terrestrial habitat	Significant	To be subject to NRW licensing, species protection plan	Minimal adverse effects (near neutral), potential for long-term net positive effects over wider landholding	High
Reptiles	Borough (or possibly Parish)	Loss of habitat / impacts on populations	Significant	Species protection plan and legal compliance	Minimal adverse effects (near neutral)	High
Marsh fritillary butterfly	Borough (Merthyr)	Indirect impacts (e.g. from lighting, trampling, hydrological change)	Possible minor adverse effect	Sensitive lighting design, species protection plan	No likely significant effect	High
Welsh Priority habitats	Borough (Merthyr) (when considered cumulatively)	Net loss	Minor to moderate adverse effect	Improved management of wider site, offsite compensation	No likely significant effect	Moderate-high
Welsh Priority species	Borough (Merthyr) (when considered cumulatively)	Direct (and indirect) impacts on species	Significant	Species protection plan	Minimal adverse effects (near neutral)	Moderate-high
Other notable invertebrates	Borough (Merthyr) (when considered cumulatively)	Direct (and indirect) impacts on species	Significant	Species protection plan	Minimal adverse effects (near neutral)	Moderate-high
Non-designated habitats (including semi-improved grassland, skeletal grasslands / mosaic habitats, and scrub)	Local (Parish)	Loss of habitat	Significant	Improved management of wider site, offsite compensation	No likely significant effect	High
Badgers	Local (Parish)	Indirect impacts (e.g. from badgers getting trapped in construction excavations)	Possible minor adverse effect	Measures to avoid badgers getting trapped in construction excavations, species protection plan	No likely significant effect	High

Key Receptor	Value	Potential Impact	Significance of Impact without Mitigation / Compensation	Proposed Mitigation / Compensation	Residual Impact	Confidence Level
Other non-designated habitats (0.35ha unremarkable vegetation associated with cutting slopes adjoining the Parish Road to Upper Abercanaid)	Immediate Local (Site)	Loss of habitat	Not significant	Improved management of wider site, offsite compensation	No likely significant effect	High
Operation						
Blaen Cynon SAC (c. 9km west of site)	International (European)	Impacts (e.g. from lighting, recreational use) on marsh fritillary butterfly populations associated with Blaen Cynon SSSI	No likely significant effect (not assessed to be functionally linked with the application site)	None required	No likely significant effect	High
Cwm Glo a Glyndyrys SSSI (Primary interest features)	National (Wales/UK)	Localised indirect impacts from lighting and noise, wider impacts from increased recreational pressure	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Improved management, offsite compensation, sensitive lighting scheme	Net neutral to minor positive effect	Moderate-high
Cwm Glo a Glyndyrys SSSI (Secondary Interest Features)	Regional (Mid-Valleys)	Localised indirect impacts from lighting and noise, wider impacts from increased recreational pressure	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Improved management, offsite compensation, sensitive lighting scheme	Net neutral to minor positive effect	Moderate-high
Rhydycar West SINC (SINC 36) and Cwm Glo SINC (SINC 12)	Regional (Mid-Valleys)	Localised indirect impacts from lighting and noise, wider impacts from increased recreational pressure	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Improved management of wider site, offsite compensation, sensitive lighting scheme	Net neutral to minor positive effect	Moderate-high
TPO woodland	Borough (Merthyr)	Localised indirect impacts from lighting and noise, wider impacts from increased recreational pressure	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Improved management of wider site, offsite compensation, sensitive lighting scheme	Net neutral to minor positive effect	Moderate-high
Bat assemblage	Borough (Merthyr)	Localised indirect impacts from lighting and noise	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Sensitive lighting scheme, benefits of improved management of wider site	No significant effect	Moderate-high
Great crested newts	Borough (Merthyr)	Localised indirect impacts from lighting. Potential fragmentation effect due to barrier effect of development	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Sensitive lighting scheme, benefits of improved management of wider site	Net neutral to minor positive effect due to improved habitat condition in wider landholding	Moderate-high

Key Receptor	Value	Potential Impact	Significance of Impact without Mitigation / Compensation	Proposed Mitigation / Compensation	Residual Impact	Confidence Level
Reptiles	Borough (or possibly Parish)	Localised indirect impacts from lighting. Potential fragmentation effect due to barrier effect of development. Possible effects from increased recreational use.	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Sensitive lighting scheme, benefits of improved management of wider site	No significant effect	Moderate-high
Marsh fritillary butterfly	Borough (Merthyr)	Localised indirect impacts from lighting. Potential fragmentation effect due to barrier effect of development. Possible effects from increased recreational use	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Sensitive lighting scheme, benefits of improved management of wider site	No significant effect	Moderate-high
Welsh Priority habitats	Borough (Merthyr) (when considered cumulatively)	Localised indirect impacts from lighting and noise, wider impacts from increased recreational pressure	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Improved management of wider site, offsite compensation, sensitive lighting scheme	Net neutral to minor positive effect	Moderate-high
Welsh Priority species	Borough (Merthyr) (when considered cumulatively)	Localised indirect impacts from lighting. Potential fragmentation effect due to barrier effect of development. Possible effects from increased recreational use	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Sensitive lighting scheme, benefits of improved management of wider site	No significant effect	Moderate-high
Other notable invertebrates	Borough (Merthyr) (when considered cumulatively)	Localised indirect impacts from lighting. Potential fragmentation effect due to barrier effect of development. Possible effects from increased recreational use	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Sensitive lighting scheme, benefits of improved management of wider site	No significant effect	Moderate-high
Non-designated habitats (including semi-improved grassland, skeletal grasslands / mosaic habitats, and scrub)	Local (Parish)	Localised indirect impacts from lighting and noise, wider impacts from increased recreational pressure	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Improved management of wider site, offsite compensation, sensitive lighting scheme	Net neutral to minor positive effect	Moderate-high
Badgers	Local (Parish)	Localised indirect impacts from lighting. Potential fragmentation effect due to barrier effect of development. Possible effects from increased recreational use	Potential for minor magnitude adverse impact in absence of mitigation/compensation	Sensitive lighting scheme, benefits of improved management of wider site	No significant effect	Moderate-high

9.0 Transportation and Movement

9.1 Introduction

9.1.1 This chapter presents an assessment of the likely significant transport and access effects of the Development. Consideration is given within the chapter to changes to traffic flows within the local highway network and associated implications for drivers, pedestrians, and other highway users in the vicinity of the Site. An overview is also given to the potential for the completed Development to positively contribute to more sustainable modes of transport, with consideration also given to the traffic effects associated with the construction phases of the Development.

9.1.2 The chapter provides a summary of relevant legislation, planning policy and guidance, alongside a description of the methodology for the assessment. This is followed by a description of the relevant baseline conditions of the Site and the surrounding area, and an assessment of the potential effects of the Development during construction and once the Development is operational. Mitigation measures are identified, where appropriate, to avoid, reduce or offset any adverse effects, following which, a summary of the likely significant residual effects of the Development post-mitigation is provided.

9.1.3 In addition, Tetra Tech has prepared a Transport Assessment (TA) and a Framework Travel Plan (TP) for the development, dated August 2022. These contain more detailed transport-related information upon which this chapter is based. Both stand-alone documents have been submitted separately to accompany the outline planning application and are included for ease of reference as **Appendix 9.1 and 9.2**. These documents should be referred to for further detail regarding methodology and data sources.

9.1.4 This chapter is supported by the following figures and appendices:

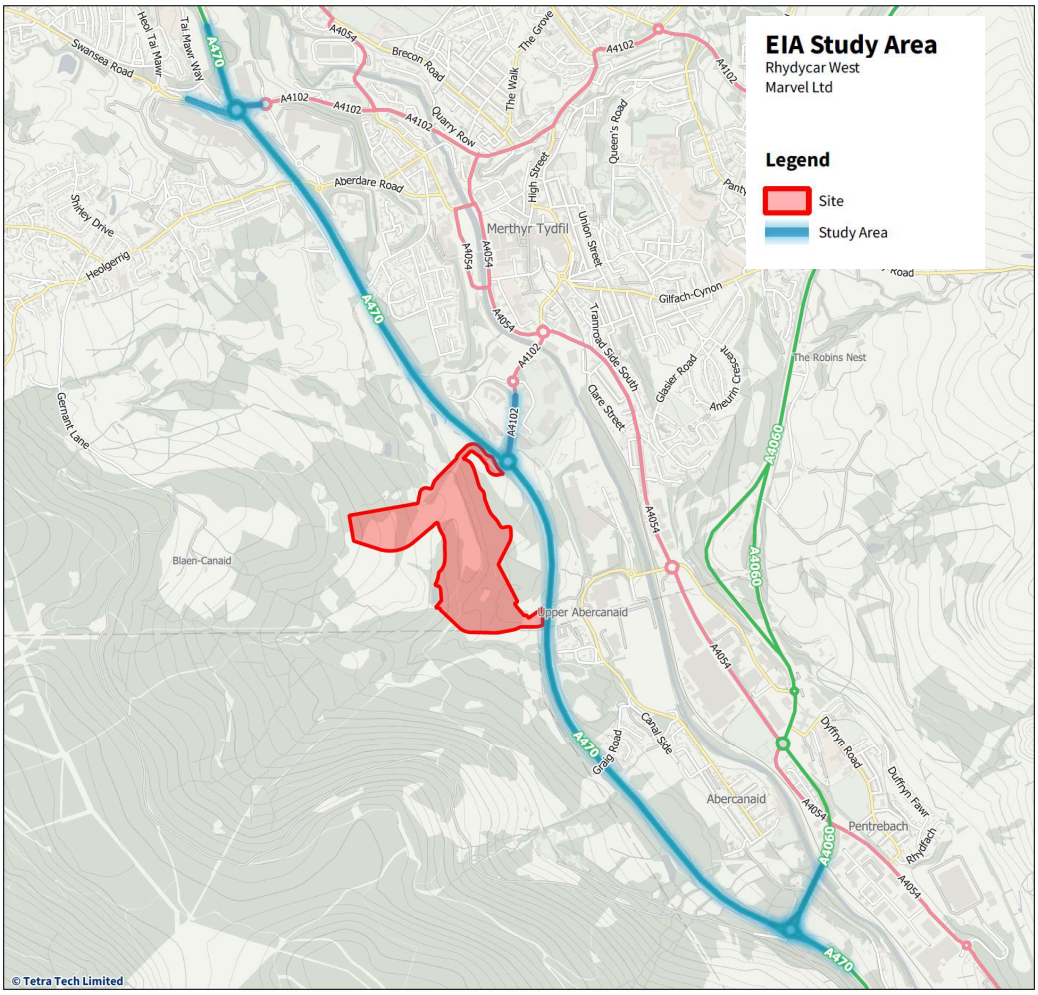
- **Appendix 9.1** - Transport Assessment.
- **Appendix 9.2 -** Framework Travel Plan; and,
- **Appendix 9.3 -** Net Impact Traffic Flows.

9.1.5 The Study Area for this EIA Chapter is based on the study area considered by the Transport Assessment. The Transport Assessment assessed the road network where the site would have the most significant vehicular impact.

9.1.6 The study area is shown in **Figure 9.1** and comprises the following carriageways:

- A470 (north of Swansea Road roundabout).
- A4102.
- Swansea Road.
- A470 (between Swansea Road and Site Access Roundabouts).
- A4120.
- A470 (south of Site Access roundabout).
- Bike Park Wales Access.
- A470 (Bike Park Wales Roundabout northern arm).
- A4060; and,
- A470 (Bike Park Wales Roundabout southern arm).

Figure 9.1 Study Area



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9.2 Methodology and Scope

Policy Background

9.2.1 A detailed review and assessment of relevant planning policy specific to traffic and transport is included within the TA, contained as **Appendix 9.1**. This section provides a summary of the key Welsh Government and Local Policy which has been considered, in preparing this Chapter.

Future Wales – The National Plan 2040

9.2.2 Future Wales – The National Plan 2040 sets out the national development framework and the direction for development in Wales, covering the period up to 2040. It sets out an aspiration for all methods of travel to increasingly have low environmental impact and low emissions, with increased use of public transport and ultra-low emission vehicles.

9.2.3 The document specifically discusses Merthyr Tydfil and the Valleys, highlighting it as a priority area for the Welsh Government. The area has seen significant investment in the A465, and, in the future, it will be better connected through the delivery of the South Wales Metro. It is highlighted as having the potential to build on its tourism offer.

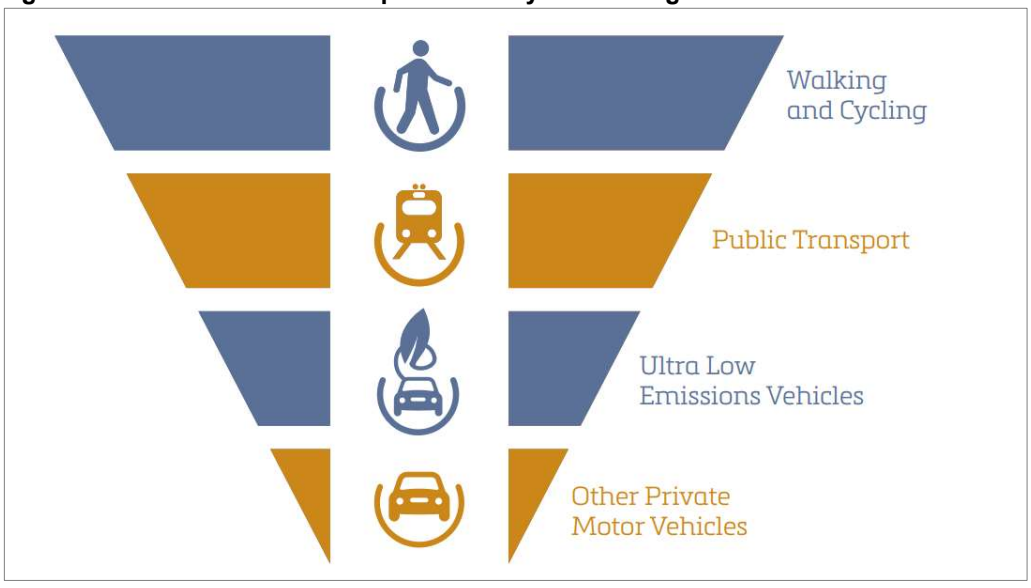
Planning Policy Wales

9.2.4 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government, with Edition 11 published in February 2021. PPW sets out a strategic framework to guide development across the country. The document promotes a transport hierarchy to give priority to sustainable transport first, then by private motor vehicle.

9.2.5 PPW promotes development that reduces the need to travel, promotes sustainable travel and ensures, as far as possible, that transport infrastructure does not contribute to land take, urban sprawl, or neighbourhood severance.

9.2.6 PPW advises on ensuring the use of the sustainable transport hierarchy in relation to new development, prioritising walking, cycling and public transport ahead of the private motor vehicles. The transport hierarchy recognises that Ultra Low Emission Vehicles also have an important role to play in the decarbonisation of transport, particularly in rural areas with limited public transport services. The hierarchy is outlined at **Figure 9.2**.

Figure 9.2: The Sustainable Transport Hierarchy for Planning



Source: Planning Policy Wales – Figure 8

Active Travel Wales Act

9.2.7 The Welsh Government enacted the Active Travel Wales Act in 2013, which requires Local Authorities to continuously improve facilities and routes for pedestrians and cyclists and to prepare maps identifying current and potential future routes for use. The Act should also be considered at the design stage for new road schemes to consider the needs of pedestrians and cyclists.

Planning Wales Act

9.2.8 The Welsh Government enacted the Planning Wales Act in 2015. The Act is a set of provisions derived from an extensive evidence base and stakeholder engagement that will provide a modern legislative framework for the operation of the planning system. It puts in place delivery structures, processes, and procedures, to make the planning system fit for the 21st Century. Taken together the provisions will allow the planning system to support the delivery of national, local and community aspirations by creating sustainable places where citizens have improved access to quality homes, jobs and built and natural environments and supports the use of the Welsh language.

Well-being of Future Generations Act

9.2.9 The Well-being of Future Generations (Wales) Act 2015 requires public bodies in Wales to think about the long-term impact of their decisions, to work better with people, communities, and each other, and to prevent persistent problems such as poverty, health inequalities and climate change. Objectives are required to support the delivery of the seven well-being goals which are creating a more prosperous; resilient; healthier; equal; cohesive; vibrant and globally responsible Wales.

9.2.10 Public bodies need to make sure that when making their decisions they consider the impact they could have on people living their lives in Wales in the future. This must balance short- and long-term needs; prevent problems occurring; integrate aims in wider objectives; collaborate on supporting well-being goals and ensure that those people reflect the diversity of the area which the body serves.

South East Wales Valleys Local Transport Plan (2015)

9.2.11 The LTP aims to reach a “low carbon future, which has a transport network and mobility culture that positively contributes to a thriving economy and the health and wellbeing of its citizens, and where sustainable travel is the option of choice”. It aims to improve access for all and promote equality of opportunity to employment opportunities, tourism, and leisure facilities.

Technical Advice Note 18: Transport

9.2.12 Technical Advice Note 18: Transport provides national advice on transport related issues when planning for new development including integration between land use planning and transport, location of development, parking, and design of development.

9.2.13 The document promotes inclusive developments which cater for all travel users. It prioritises movements by sustainable modes, improving the attractiveness of urban areas by helping to avoid or manage congestion through encouraging movements by walking, cycling and public transport over car travel.

Merthyr Tydfil County Borough Council's Local Development Plan, 2016-2031

9.2.14 The LDP forms the basis for land use planning decisions in the County Borough, excluding the Brecon Beacons National Park. It highlights the need for development that encourages a modal shift towards sustainable transport, as well as the need for a development to demonstrate that any traffic movements will not have an unacceptable impact on the local amenity or highway safety and satisfy the Council's parking standards. Through Objective 15, the LDP supports sustainable tourism, leisure and recreation developments and encourages a year-round tourism industry.

Institute of Environmental Management Guidelines for the Environmental Assessment of Road Traffic (1993)

9.2.15 The Town and Country Planning Environmental Impact Assessment, Wales Regulations (2017) does not set out the environmental factors that should be considered for road traffic and transport. This is delegated by the document to the Institute of Environmental Management (IEMA).

9.2.16 The IEMA Guidelines for the Assessment of Road Traffic relate to the assessment of the environmental impact of the road traffic associated with major new development, irrespective of whether the development would be subject to formal EIA or not.

9.2.17 The purpose of the guidelines is to provide the basis for the systematic, consistent, and comprehensive coverage for the appraisal of traffic effects for a wide range of development projects.

9.2.18 The guidelines indicate that:

- The environmental effects of traffic will be dependent on existing conditions and adjacent land uses as well as changes in traffic levels.
- Assessments should consider the period at which the effect is greatest and the period at which the effects exhibit the greatest change.
- Peak environmental impacts may occur at other times than the 'peak' hour.
- Environmental assessments may need to be undertaken separately for different phases of the development; and,
- Assessment should be undertaken in the year of opening (or first year of a phase) when, generally, the perceived environmental impact is the greatest.

9.2.19 The guidance identifies that the study area should include highway links where traffic flows will increase by at least 30% (vehicles or HGVs) or where flows increase by at least 10% in sensitive areas.

Assessment Methodology

Overview

9.2.20 The current Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations came into effect in May 2017.

9.2.21 The 2007 Welsh Assembly Government (WAG), Department for Communities and Local Government (DCLG) and Department for Transport (DfT) publication Guidance on Transport Assessment refers to Circular 02/99: Environmental Impact Assessment (Circular 02/99) published by the former Department of the Environment, Transport, and the Regions (DETR), which provides details on environmental assessment in general. However, Circular 02/99 does not provide specific guidance on the approach to traffic and transport related assessment.

9.2.22 Therefore, this assessment has been undertaken in accordance with the guidance provided in the 1993 Institute of Environmental Assessment publication Guidance Notes No. 1: Guidelines for the Environmental Assessment of Road Traffic. This guidance is the only document available for Great Britain and sets out a methodology for assessing potentially significant traffic-related environmental impacts where a proposed development is likely to give rise to changes in traffic flows.

9.2.23 The IEMA guidelines set out within the document originated from Directive 337, issued by the European Council in 1985, which were confirmed within regulations published by the Department of the Environment in 1998. The IEMA guidelines are specifically designed to cover aspects of road traffic associated with major new developments. The document is therefore material for consideration for the assessments provided within this Chapter, given its publication history and adoption.

9.2.24 Given the above, this section sets out the methodology adopted in the assessment of the likely significant transport and access effects of the Development, in relation to the changes on the local highway network traffic flows and the opportunities for future occupiers of the Development to use sustainable transport forms. Consideration is also given to the traffic effects associated with the construction phases of the Development.

9.2.25 Potential effects during the construction period are typically considered as either short-term or medium-term, while potential effects during the operational phase are typically considered as either medium-term or long-term.

9.2.26 The assessment of the Development's likely significant transport and access effects has comprised a combination of both quantitative and qualitative assessments. The assessment of likely significant effects has been carried out following the 'Guidelines for the Environmental Assessment of Road Traffic', produced by the IEMA.

9.2.27 The IEMA document (as explained at paragraph **9.2.17** to **9.2.20**) identifies, as a guide, **that a 30% change in traffic flow (or 10% in sensitive areas) represents a reasonable threshold for including a highway link within the assessment**. Where there are major changes in the composition of traffic flow, such as a greater flow of HGVs, a lower threshold may be appropriate.

9.2.28 A Net Impact Assessment has been undertaken to IEMA requirements to identify those roads where a net increase in traffic flows of 10% (for robustness) or more would occur because of the Development. The Net Impact Assessment has been undertaken based on the 2-way Annual Average Daily Traffic flow (AADT) on a link in accordance with the IEMA guidelines.

9.2.29 The Net Impact Assessment has assessed the effect of Development traffic against an Assessment Scenario of 2026 with the results provided in **Appendix 9.3**.

Data Sources

9.2.30 The information used in compiling this chapter of the EIA has been derived from the TA prepared in support of the Development (refer to **Appendix 9.1**), which is based upon traffic survey data. The TA provides details of the existing vehicular and pedestrian highway conditions as well as public transport facilities. It also contains an assessment of five-year accident data for the study road network. More information on the sources of existing baseline information is contained within the TA.

9.2.31 Following the description of existing conditions, the TA describes how the multi-modal trip generation has been calculated for the Development and quantifies the number of trips that will be generated during the morning, afternoon, and Saturday peak hours.

9.2.32 The TA then describes how highway capacity modelling has been undertaken in accordance with national standards. It provides a review of key transport related aspects of the Development including Site access layouts, internal road functions and people movements, together with the principles for car and bicycle parking at the Site.

9.2.33 Tetra Tech have estimated the development traffic generation, with traffic on local junctions assigned using a spreadsheet desktop model of traffic flows. The development traffic distribution and assignment of demand is provided within the TA.

Receptors

9.2.34 A Net Impact Assessment has been carried out to identify which roads are expected to experience an increase in traffic flows of 30% or more because of the Development at full operation.

9.2.35 The results of the Net Impact Assessment are contained at **Appendix 9.3.** The Net Impact Assessment did not identify any roads that experienced a net impact of 10% or more. For the purpose of a robust assessment, the link(s) experiencing the largest net impact will be assessed. This is outlined at **Table 9.1**. This is to identify any environmental road traffic constraints within the network.

Table 9.1 Net Impact Assessment

Receptor	2026 Forecast Year	2026 Forecast Year with Development Traffic	Net Impact
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	31,626	34,130	8%
A470 (between Swansea Road Roundabout and Site Access Roundabout)	20,788	22,472	8%

9.2.36 The traffic data outlined in **Table 9.1** considers the movement of all site users, which includes, staff, visitors, customers, and service vehicles.

9.2.37 **Table 9.1** indicates that both the A470 (between Site Access Roundabout and Bike Park Wales Roundabout) and the A470 (between Swansea Road Roundabout and Site Access Roundabout) will experience a net impact of 8% and will therefore be assessed.

Receptor Sensitivity

9.2.38 The significance of potential traffic and transport effects has been determined using criteria developed from best practice techniques. **Table 9.2** sets out the following terms that have been used to define the classification of sensitivity where the receptors are the local roads and its users.

Table 9.2 Net Impact Assessment

Receptor	2026 Forecast Year
Major	Where the Development could be expected to lend to an increase of over 90% change in traffic
Moderate	Where the Development could be expected to lend to an increase of 60-89% change in traffic
Minor	Where the Development could be expected to lend to an increase of over 30-59% or 10-59% in sensitive areas in traffic
Negligible	Where no discernible effect is expected, the change in traffic is less than 30%, or less than 10% in sensitive areas, because of the Development at full operation

*Thresholds based on the guidance provided by Guidelines for the Environmental Assessment of Road Traffic (IEMA, 1993)

Effect Magnitude

9.2.39 The IEMA Guidelines for the Environmental Assessment of Road Traffic sets out the broad principles of how to assess the magnitude of change for each of the following categories.

- Effects on Traffic Flows.
- Severance.
- Driver Delay.

- Pedestrian Delay.
- Pedestrian Amenity.
- Fear and Intimidation; and,
- Accidents and Safety.

9.2.40 The assessment principles as set out above are summarised in remaining parts of this section.

Severance

9.2.41 The guidance states that severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. However, the guidance acknowledges that the measurement and prediction of severance is extremely difficult. The assessment of severance pays full regard to specific local conditions, in particular the location of pedestrian routes to key local facilities and whether crossing facilities are provided.

9.2.42 LA 112 'Population and Human Health' of the Design Manual for Roads and Bridges (DMRB) provides further guidance on this aspect of severance within a community. LA 112 provides criteria against which the magnitude of change shall be reported, as shown in **Table 9.3**.

Table 9.3 Pedestrian Severance Thresholds

Magnitude of Impact (change)	Typical Description
Major	>500m increase (adverse) / decrease (beneficial) in journey length.
Moderate	>250m - 500m increase (adverse) or decrease (beneficial) in journey length.
Minor	>50m - 250m increase (adverse) or decrease (beneficial) in journey length.
Negligible	<50m increase (adverse) or decrease (beneficial) in journey length.
No change	No loss or alteration of characteristics, features, elements, or accessibility; no observable impact in either direction.

Driver Delay

9.2.43 Driver Delay is likely to be significant when the traffic on the network surrounding the Development is already at, or close to, the capacity of the system. Driver delay is a result of the net impact generated by the development when compared to the baseline.

9.2.44 The guidance suggests that assessors use their judgement and modelling forecast software to determine whether driver delay is a significant effect. Modelling of the network was undertaken within Chapter 8 of the TA, which is contained in **Appendix 9.1**. The modelling was undertaken using industry standard software and best practice.

Pedestrian Delay

9.2.45 Pedestrian delay refers to the changes in the volume, composition or speed of traffic that may affect the ability of people to cross a road. The guidance suggests that assessors use their judgement to determine whether pedestrian delay is a significant effect. As such, the magnitude of change for pedestrian delay has been ascribed qualitatively, using professional judgement.

Pedestrian Amenity

9.2.46 Pedestrian amenity is broadly defined as the relative pleasantness of a journey. It is affected by traffic flow, traffic composition and pavement width / separation from traffic. The guidance suggests that assessors use their judgement to determine whether change to pedestrian amenity is a significant effect. As such, the magnitude of change for pedestrian amenity has been ascribed qualitatively, using professional judgement.

Fear and Intimidation

9.2.47 Fear and intimidation are dependent upon the volume of traffic, the level of HGV's, the proximity of traffic to people and the lack of protection caused by such factors as narrow pavement widths. The guidance states that there are no commonly agreed thresholds for estimating this from known traffic and physical conditions, but it does nevertheless suggest some thresholds which could be used, based on previous research, and these are shown in **Table 9.4**.

Table 9.4 Fear and Intimidation Thresholds

Magnitude of Impact (change)	Average Hourly Traffic Flow over 18hr Day (vehicles per hour)	18hr HGV Flow (vehicles per hour)
Major	1,800+	3,000+
Moderate	1,200 – 1,799	2,000 – 2,999
Minor	600 – 1,199	1,000 – 1,999
Negligible	599 or less	999 or less

Thresholds based on the suggestions provided by Guidelines for the Environmental Assessment of Road Traffic (IEMA, 1993)

Accidents and Safety

9.2.48 The guidance suggests that professional judgement is used to assess the implications of local circumstances or factors which may elevate or lessen risks of accidents. The safety information contained within **Chapter 4** of the TA, provided in **Appendix 9.1**, has been used to inform this assessment, with the magnitude of change for accidents and safety assessed qualitatively, using professional judgement.

Change in Traffic Flows

9.2.49 The Net Impact Assessment sets out the likely change to traffic flows for the assessment scenarios. The significance of the effect to traffic flows will use the criteria set out in **Table 9.2**, which is considered appropriate to enable an assessment of environmental factors.

Effect Significance

9.2.50 The criteria for magnitude of change and receptor sensitivity, as outlined above, have been used to determine the significance of effect, as shown in **Table 9.5**.

Table 9.5 Effect Significance Thresholds

		Receptor Sensitivity			
		Major	**Moderate**	**Minor**	**Negligible**
Magnitude of Change	**Major**	Major Adverse	Major Adverse	Moderate Adverse	Minor Adverse
	Moderate	Moderate Adverse	Moderate Adverse	Minor Adverse	Negligible
	Minor	Moderate Adverse	Minor Adverse	Minor Adverse	Negligible
	Negligible	Minor Adverse	Negligible	Negligible	Negligible

Limitations of the Assessment

9.2.51 The assessments derived within this chapter have been prepared using material contained within the associated TA (contained in **Appendix 9.1**). The TA has been prepared in accordance with national and local policy. Traffic flow data derived from the TA has been obtained via a third-party traffic surveying consultancy, which undertakes surveys to a best practice industry standard. The assessments provided within this chapter are reliant on the robustness of the data sources used by the TA, which are considered robust and fit for purpose.

9.2.52 Traffic modelling assessments within the TA have been undertaken using industry standard modelling software. The modelling outputs derived for the TA provide a forecast of the likely operation of the road network following the development of the Site, which is considered appropriate to consider potential mitigation strategies. It should be noted that traffic is dynamic and subject to change, but nonetheless information contained within the TA is considered robust for use in forecasting the environmental effects of the Development.

9.2.53 The information contained within this chapter is based on several industry standard assumptions which are considered appropriate for forecasting the operation of the local and wider road network.

9.3 Baseline Environment

Existing Baseline

9.3.1 A detailed audit of the baseline environment is provided in the Transport Assessment, contained at **Appendix 9.1**.

Pedestrian and Cycle Networks

9.3.2 The main pedestrian and cycle access to the site is gained via an existing bridleway connection from Merthyr Tydfil. The bridleway connects to the site via an existing bridge over the A470 carriageway. The bridge provides a connection from the site over the A470 to the bridge over the A4102 which connects to the Taff Trail / National Cycle Route 8 and provides access to the local active travel network within Merthyr Tydfil. The bridge benefit from ramps which accommodates both pedestrian and cycle movements to and from the site, with the bridleway route forming part of the existing Public Right of Way (PROW) network within Merthyr Tydfil.

9.3.3 Ancillary pedestrian connections will also be provided through connections to local Public Right of Ways, including a number of rights of way which have recently been established as a result of an application to modify the definitive map and a positive dialogue and collaboration between the landowners and MTCBC. These connections will likely be used for leisure activities.

9.3.4 National Cycle Route 8 is known locally as Lôn Las Cymru, but forms part of the Taff Trail. Route 8 runs from Cardiff through Brecon to terminate in Holyhead (Anglesey). Route 8 connects locally to the Local Route 477 providing cycle access between Merthyr Tydfil and Abercynon, including Merthyr Tydfil and Pentre-Bach Rail Stations.

9.3.5 The Taff Trail is a 55-mile cycleway / footway which runs between Cardiff Bay and Brecon. The Taff Trail follows the River Taff along most of its route and joins NCN Route 8. The Taff Trail makes use of the abandoned branch of the Taff Vale Railway and the Glamorganshire Canal which provides a mostly traffic free route.

9.3.6 Given the site's position to the cycle network, it is well placed to benefit from any enhancements that will be made in future years. For example, Merthyr Tydfil and Rhondda Cynon Taf County Borough Councils are working together with the aim of making the journey easier for people who travel between Aberdare and Merthyr Tydfil for reasons including work, education, shopping, and entertainment. One strategy being investigated is the Abernant Tunnel, which could provide a traffic-free and direct cycling route of around four miles between the two town centres, reducing the current journey by around three miles.

Public Transport Network and Facilities

9.3.7 The closest bus stops to the site are the 'Leisure Centre' bus stop, located approximately a 1.2km walk northeast of the site within the grounds of the Merthyr Tydfil Leisure Village. This bus stop is marked and benefits from a layby, shelter, and timetabling information.

9.3.8 The stops benefit from a regular level of services which operate Monday to Sunday, providing connections to the town centre (including a new award-winning bus interchange, which opened in 2021), and wider parts of Merthyr Tydfil. From the bus interchange several destinations are available including services to local towns and villages and more strategic services to Cardiff, Brynmawr, Abergavenny, Newtown, Llandrindod Wells, Builth Wells and Brecon.

9.3.9 The nearest railway station to the site is Merthyr Tydfil Rail Station, which is located approximately 1.7km northeast of the site (22-minute walk). The station is set to be improved by the Merthyr Tydfil Rail Interchange project which will create a 'fit-for-purpose, modern, high quality gateway station' adjacent to the new bus interchange. While funding has been approved, work has yet to commence at time of writing. Pentre-Bach Rail Station is also located approximately 2.7km south-east of the site (37-minute walk).

9.3.10 Both stations are operated by Transport for Wales and provide an hourly service Monday to Saturday to and from Cardiff Central, with services continuing onwards to Barry, Barry Island and Bridgend. On Sundays, a service every two hours is provided.

9.3.11 From Cardiff Central, connecting services are available providing direct links to the wider parts of Great Britain, including Swansea, Manchester, Bristol, Reading, London, Exeter, and Birmingham.

Highway Network

9.3.12 The site will be accessed from the A470 / A4102 four arm roundabout, via an extension and improvement to the existing stub provided at the southwestern arm.

9.3.13 The A4102 provides a link from the site access roundabout eastbound into Merthyr Tydfil Town Centre. The A4102 is subject to a 30mph speed limit, is street lit and benefits from footways on both sides of the carriageway between the A4102 / High Street / Lower High Street / A4054 roundabout and the A4102 / Merthyr Leisure Village Access / Rhydycar Business Park Access roundabout.

9.3.14 As a part of the Welsh Trunk Road Network, the A470 provides a key route from the site, connecting to the A465 Heads of the Valleys Road and continuing onwards to Brecon in the North, and linking to the M4 at Junction 32 to the south. Near the site, the A470 is subject to the national speed limit.

9.3.15 The A456 Heads of the Valleys Road routes east west and provides a connection between Neath and Abergavenny, providing a principal road link between southwest Wales and the Midlands. This route is in the process of being improved as a result of a Welsh Government scheme, as part of recognising and enhancing the strategic importance of the Heads of the Valleys area.

9.3.16 The M4 Motorway is part of the Welsh Trunk Road Network and the English Strategic Road Network (SRN), linking between London and Swansea and provides connections to the M5 and several other strategic links. This assists in the strategic movement of traffic from south-east Wales and provides key connections to the wider parts of the UK.

Accidents and Safety

9.3.17 The TA (contained in **Appendix 9.1**) has identified that there are no particularly significant accident trends identified for the existing situation, within the study area. The TA considers there are no road safety implications that would be materially affected by the increase in traffic generated by the proposed Development.

Future Baseline

9.3.18 The TA (contained in **Appendix 9.1**) details the assessment scenarios fully. For the purposes of a robust worse case assessment, a 2026 Forecast scenario is used, representing a five-year forecast. Future traffic flows have been growthed from surveyed flows using TEMPro growth rates, an industry standard forecasting software, as detailed fully within the TA. The information contained within the TA is considered robust for use in forecasting the Future baseline scenario.

9.4 Likely Significant Environmental Effects of the Scheme

9.4.1 Assessments undertaken within this section have been prepared against the following scenarios:

- 2026 Assessment Year: Forecast highway operation inclusive of background traffic growth; and,
- 2026 Assessment Year plus Development Traffic: The cumulative impact of forecast traffic on the highway together with the presence of traffic associated with the development.

9.4.2 It should be noted that the 2026 Assessment Year is inclusive of cumulative (committed) development.

Construction Phase Effects

9.4.3 This section should be read in conjunction with Chapter 3.

9.4.4 Construction vehicle traffic will access the site via the A470 / A4102 four arm roundabout. The construction of the development will result in additional traffic associated with traffic movements generated from construction workers' cars and vans, and daily HGV movements. It is considered that the traffic flows during construction of the development will be lower than the predicted number of trips following full occupation of the development. As such, no specific separate analysis of construction traffic has been undertaken, as the assessments undertaken for the effects of operational development traffic effectively provide a robust approach.

9.4.5 In any event, applying professional judgement, it is considered that the construction of the development is unlikely to generate a net impact to AADT of 10% or more along the local road network, and therefore falls outside the requirement for a formal EIA assessment. Nonetheless, guidance can be taken from the assessments outlined within 'Operational Phase Effects' section of this report.

9.4.6 Assessment results outlined at **Table 9.11** evidence that during the 'Operational Phase Effects' stage of the development, the site is forecast to experience a Residual Significance and Nature of Effect that will be Long-term, Permanent, and Negligible Adverse.

9.4.7 Given the result of this assessment, there is a high confidence level that for the 'Construction Phase' the site will generate a Residual Significance and Nature of Effect that will be negligible, with or without mitigation.

9.4.8 This level of significance is expected for all aspects under consideration i.e., increase in traffic flows, driver delay, severance, pedestrian delay and amenity, fear and intimidation, accidents and safety, access to public transport, and pedestrian and cycle permeability.

9.4.9 Nonetheless, mitigation is proposed by this development, to accord to best practice, health, and safety requirements and to maintain a low potential for generating an adverse impact. This will be the implementation of a Construction Environmental Management Plan and Construction

Traffic Management Plan, which will significantly reduce the risk of any impacts to transport based environmental factors.

Operational Phase Effects

9.4.10 In line with the TA, an Assessment Scenario of 2026 has been used as the baseline for the Operational Development scenario in accordance with the traffic impact assessments undertaken within the TA (provided in **Appendix 9.1**).

9.4.11 The Net Impact Assessment, provided at **Appendix 9.3,** identified that no receptors will experience a traffic increase of at least 10%. Nevertheless, to provide a robust assessment, the links experiencing the greatest impact will be assessed.

9.4.12 **Table 9.6** provides a summary of the links identified by the Net Impact Assessment as experiencing the greatest net impact and indicates the sensitivity of the receptors based on the descriptions provided in **Table 9.2**.

Table 9.6 Net Impact Assessment

Receptor	Net Impact	Sensitivity
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	8%	Negligible
A470 (between Swansea Road Roundabout and Site Access Roundabout)	8%	Negligible

Changes in Traffic Flows associated with Completed Development

9.4.13 The change in AADT traffic flows for the assessed roads following the addition of the predicted development traffic flows, and with reference to the net impact criteria set out in **Table 9.6**, is shown in **Table 9.7**.

Table 9.7 Operational Phase Effects – Change in Traffic Flows

Receptor	2026 Assessment Year (AADT)	2026 Assessment Year + Development	Net Impact	Magnitude of Change	Sensitivity	Significance of Effect
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	31,626	34,130	8%	Minor	Negligible	Negligible
A470 (between Swansea Road Roundabout and Site Access Roundabout)	20,788	22,472	8%	Minor	Negligible	Negligible

9.4.14 **Table 9.7** outlines that the A470 between the Site Access and Bike Park Wales roundabout, and the A470 between the Swansea Road and Site Access Roundabout is forecast to experience a **long-term permanent effect** of **negligible significance** regarding changes in traffic flows.

Severance

9.4.15 **Table 9.8** provides a summary of the change in pedestrian journey distance for the assessed roads following the addition of the predicted development traffic flows, and with reference to the net impact criteria set out in **Table 9.5**.

Table 9.8 Operational Phase Effects – Change in Severance

Receptor	2026 Assessment Year (AADT)	2026 Assessment Year + Development	Change	Magnitude of Change	Sensitivity	Significance of Effect
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	No Pedestrian Journeys (Dual Carriageway with no pedestrian infrastructure)	No Pedestrian Journeys (Dual Carriageway with no pedestrian infrastructure)	No Change	No Change	Negligible	Negligible
A470 (between Swansea Road Roundabout and Site Access Roundabout)	No Pedestrian Journeys (Dual Carriageway with no pedestrian infrastructure)	No Pedestrian Journeys (Dual Carriageway with no pedestrian infrastructure)	No Change	No Change	Negligible	Negligible

9.4.16 **Table 9.8** outlines that the A470 between the Site Access and Bike Park Wales roundabout, and the A470 between the Swansea Road and Site Access Roundabout is forecast to experience a **long-term permanent effect** of **negligible significance** regarding severance.

Driver Delay

9.4.17 **Table 9.9** provides a summary of the change in driver delay for the assessed roads following the addition of the predicted development traffic flows. The assessment is based on the junction capacity assessment provided within **Chapter 8** of the TA, contained in **Appendix 9.1**.

Table 9.9 Operational Phase Effects – Driver Delay (seconds)

Receptor	2026 Assessment Year	2026 Assessment Year + Development	Magnitude of Change	Sensitivity	Significance of Effect
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	7s	10s	Negligible	Negligible	Negligible
A470 (between Swansea Road Roundabout and Site Access Roundabout)	3s	5s	Negligible	Negligible	Negligible

9.4.18 As outlined in **Table 9.9**, the A470 (between Site Access Roundabout and Bike Park Wales Roundabout) is forecast to experience a **long-term permanent** effect of **negligible significance** regarding the level of driver delay. The A470 (between Swansea Road Roundabout and Site Access Roundabout) is forecast to experience a **long-term permanent** effect of **negligible significance** regarding the level of driver delay.

Pedestrian Delay

9.4.19 The development has been designed to the principles of best practice design guidance documents (such as Manual for Streets (2007), Manual for Streets 2 (2010) and Active Travel Act Guidance (2021)). Thereby providing a walkable development with links to the existing pedestrian network. The development of the site will extend the local pedestrian network, accommodating the safe and suitable movement of pedestrian users.

9.4.20 Given that new infrastructure will safely accommodate pedestrian movement and not generate a delay to their activities, professional judgement advises that in the absence of any mitigation for the effects associated with the operation of the development, the impact to pedestrian delay is likely to be a **long-term permanent effect** of **negligible significance**.

Pedestrian Amenity

9.4.21 The development has been designed to the principles of best practice design guidance documents (such as Manual for Streets (2007), Manual for Streets 2 (2010) and Active Travel Act Guidance (2021)). Thereby providing a walkable development with links. The internal pedestrian network of the site will comprise a network of crossing points, dropped kerbs and facilities to assist the safe movement of pedestrians along key desire lines.

9.4.22 Given that new amenities will be provided for pedestrians to use when travelling along the network, professional judgement advises that in the absence of any mitigation for the effects

associated with the operation of the development, the impact to pedestrian amenity is likely to be **long-term permanent** effect of **negligible significance.**

Fear and Intimidation

9.4.23 The assessment of the effect on fear and intimidation is summarised in **Table 9.10**. It should be noted that the magnitude of change has been determined by using the thresholds set out in **Table 9.4** for the vehicle 'hourly average' rather than the AADT used elsewhere in this assessment. This is a requirement of the assessment, as shown at **Table 9.4**.

Table 9.10 Operational Phase Effects – Fear and Intimidation

Receptor	2026 Assessment Year	2026 Assessment Year + Development	Magnitude of Change	Sensitivity	Significance of Effect
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	1,536	1,660	Moderate	Negligible	Negligible
A470 (between Swansea Road Roundabout and Site Access Roundabout)	1,257	1,339	Moderate	Negligible	Negligible

9.4.24 The links assessed on fear and intimidation within this section, as outlined in **Table 9.10**, are forecast to experience a **long-term permanent** effect of **negligible significance** regarding fear and intimidation.

Accidents and Safety

9.4.25 As noted in the Baseline Conditions section above, the TA assessed the safety of the local road network and concluded that there are no particularly significant accident trends identified for the existing situation. Based on the above, it is considered there are no road safety implications that would be materially affected by the increase in traffic generated by the development.

9.4.26 It is therefore considered that the magnitude of change in relation to accidents and safety generated by the development is **negligible**.

9.4.27 It is therefore considered, in absence of any mitigation for the effects associated with the operation of the development is likely to be **long-term**, **permanent**, and of **negligible significance**, in regards accidents and safety.

9.5 Additional Mitigation, Compensation and Enhancement Measures

9.5.1 This section discusses the mitigation measures that are proposed for the Construction and Operation Phases.

Construction Phase

9.5.2 During the construction phase, there are expected to be no significant short or medium-term effects on links or junctions in the vicinity of the Site because of construction traffic flows. Nevertheless, it is proposed that a Construction Traffic Management Plan (CTMP), which will form part of the Construction Environmental Management Plan (CEMP), will be prepared prior to the commencement of construction work.

9.5.3 The CTMP will set out agreed routes to and from the Site for construction vehicles, together with details of any relevant mitigation measures, designed to minimise effects associated with the works.

9.5.4 There is unlikely to be any material disruption for highway and footway users associated with the construction of the Development. However, if a potential disruption is identified during the construction process, appropriate mitigation will be provided (likely through the implementation of the CTMP / CEMP) and agreed in advance with the Local Authority.

9.5.5 This will include relevant signage in the surrounding area, and an agreement with the contractor to inform drivers of the planned routes to and from the Site. Additionally, measures such as wheel cleaning facilities will be provided on Site, to minimise material left on the roads frequently used by HGV traffic during construction.

9.5.6 The measures contained within the CEMP / CTMP will minimise the effects of construction traffic upon the local highway network and its users including effects on severance, driver delay, pedestrian delay, pedestrian amenity and fear and intimidation.

9.5.7 However, as all these effects were previously assessed as minor adverse / negligible, the residual effect will remain minor adverse across the study area.

Operational Phase

9.5.8 Mitigation measures to be provided as part of Completed Development, in addition to those which are part of the development design and that have already been described in the previous section, are as follows:

- Framework Travel Plan - a Framework Travel Plan (TP) is provided to accompany the planning application that outlines a package of measures with the aim of reducing the number of single occupancy car trips generated by Site users by promoting travel by sustainable travel modes. The TP will run in perpetuity and will be implemented / monitored by a Site-specific Travel Plan Coordinator. A copy of the TP is included in **Appendix 9.2**, which sets out the TP strategy, measures, responsibility, and monitoring process. In brief the TP includes measures such as:
    - A shuttle bus service linking the site to the railway station, bus interchange, Leisure Centre town centre and other key destinations.
    - improvements (including upgrading, lighting, and paving) of the bridleway route via the bridge across the A470 to the Merthyr Tydfil Leisure Centre.

- Electronic booking and ticketing measures to encourage public transport and multi modal trips.
- EV charging points; and,
- Staff travel measures.

all of which are aimed at meeting ambitious targets for the reduction of the need to travel by unsustainable means.

9.5.9 In terms of the wider receptor network, the development of the site generally generates a low environmental impact. For this reason, while the mitigation provided is considered unlikely to significantly reduce the level of impact to environmental factors across the remainder of the network, nevertheless they represent a realistic alternative to travel by unsustainable means.

9.5.10 It is therefore considered that the operation of the development post mitigation will generally provide a long-term, permanent, and of minor adverse to negligible significance.

9.6 Assessment Summary and Likely Significant Residual Environmental Effects

9.6.1 This report has considered the Traffic and Transport environmental impact of the development site on the local area.

9.6.2 A net impact exercise has been undertaken to identify the areas of the network which may be significantly affected following operation of the site. The assessment identified one road which was at potential of being subject to an environmental impact though the development of the site.

Construction Phase

9.6.3 Assessments concluded that, in the absence of mitigation, the traffic effects associated with the construction of the development would be short-term temporary, and of negligible significance.

Operational Phase

9.6.4 The assessment concluded that the A470 (between Site Access Roundabout and Bike Park Wales Roundabout) and the A470 (between Swansea Road Roundabout and Site Access Roundabout) are both forecast to experience a **long-term permanent** effect of **negligible significance** following the full operation of the site, regarding the effects on traffic flows, Severance, Driver Delay, Pedestrian Delay, Pedestrian amenity, Fear and Intimidation, and Accidents and Safety. Nonetheless, mitigation strategies, including in the construction phase a CTMP and at operational phases, an ambitious Travel Plan incorporating a shuttle bus to Merthyr Tydfil railway station, bus interchange, town centre, the Leisure Centre and other key destinations and improvements (including upgrading, lighting and paving) of the bridleway route via the bridge across the A470 to the Merthyr Tydfil Leisure Centre are proposed, to assist in keeping the environmental impact of this development **negligible**, with regards to highways.

9.6.5 All other parts of the network were considered by the exercise to not be significantly impacted by the operation of the site and subsequently do not require a formal assessment.

9.6.6 A summary of the potential effects, mitigation and significance of likely residual effects is described in **Table 9.11**.



Table 9.11 Assessment Summary and Residual Environmental Effects

Location	Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction								
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	Impact to local traffic	Negligible	Negligible	Negligible	CTMP within CEMP	Negligible	Negligible	High
	Severance							
	Driver Delay							
	Pedestrian Delay							
	Pedestrian Amenity							
	Fear and Intimidation							
	Accidents and Safety							
A470 (between Swansea Road Roundabout and Site Access Roundabout)	Impact to local traffic	Negligible	Negligible	Negligible	CTMP within CEMP	Negligible	Negligible	High
	Severance							
	Driver Delay							
	Pedestrian Delay							
	Pedestrian Amenity							
	Fear and Intimidation							
	Accidents and Safety							

Operation								
A470 (between Site Access Roundabout and Bike Park Wales Roundabout)	Impact to local traffic	Negligible	Minor	Long-term Permanent Negligible	Travel Plan	Minor	Long-term Permanent Negligible	High
	Severance	Negligible	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	n/a	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	High
	Driver Delay	Negligible	Negligible	Long-term Permanent Negligible	Travel Plan	Negligible	Long-term Permanent Negligible	High
	Pedestrian Delay	Negligible	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Minor Adverse	n/a	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	High
	Pedestrian Amenity	Negligible	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Minor Adverse	n/a	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	High
	Fear and Intimidation	Negligible	Moderate	Long-term Permanent Minor Adverse	n/a	Moderate	Long-term Permanent Negligible	High
	Accidents and Safety	Minor	Negligible	Long-term Permanent Minor Adverse	n/a	Negligible	Long-term Permanent Negligible	High

Location	Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
A470 (between Swansea Road Roundabout and Site Access Roundabout)	Impact to local traffic	Negligible	Minor	Long-term Permanent Negligible	Travel Plan	Minor	Long-term Permanent Negligible	High
	Severance	Negligible	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	n/a	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	High
	Driver Delay	Negligible	Negligible	Long-term Permanent Negligible	Travel Plan	Negligible	Long-term Permanent Negligible	High
	Pedestrian Delay	Negligible	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Minor Adverse	n/a	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	High
	Pedestrian Amenity	Negligible	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Minor Adverse	n/a	No Pedestrian Infrastructure (provision provided elsewhere)	Long-term Permanent Negligible	High
	Fear and Intimidation	Negligible	Moderate	Long-term Permanent Minor Adverse	n/a	Moderate	Long-term Permanent Negligible	High
	Accidents and Safety	Minor	Negligible	Long-term Permanent Minor Adverse	n/a	Negligible	Long-term Permanent Negligible	High

Table 9.12 Means by which Additional Mitigation Measure may be Secured

Identified Effect where additional mitigation (Not design mitigation) has been identified	Type of mitigation measures (avoidance, reduction, compensation, enhancement)	Means by which mitigation measure may be secured
Construction		
Impact of Construction Traffic	Construction Traffic Management Plan	S106 or Planning Condition
Operation		
Vehicular traffic levels generated by the development	Travel Plan	S106 or Planning Condition

9.7 Glossary

9.7.1 **Table 9.13** sets out the glossary for the Chapter.

Table 9.13 Glossary

Term	Definition
AADT	Annual Average Daily Traffic
AT	Active Travel
CEMP	Construction Environmental Management Plan
CTMP	Construction Traffic Management Plan
DCLG	Department for Communities and Local Government
DETR	Department of the Environment, Transport, and the Regions
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
HGV	Heavy Goods Vehicle
IEMA	Institute of Environmental Management and Assessment
LDP	Local Development Plan
LTP	Local Transport Plan

MTCBC	Merthyr Tydfil County Borough Council
NCN	National Cycle Network
NPA	National Park Authority
PPW	Planning Policy Wales
PROW	Public Right of Way
PSV	Public Service Vehicle
SRN	Strategic Road Network
TA	Transport Assessment
TEMPro	Trip End Model Presentation Program
TP	Framework Travel Plan
WAG	Welsh Assembly Government

10.0 Archaeology and Cultural Heritage

10.1 Non-Technical Summary

10.1.1 This ES Chapter has assessed the potential effect of the Proposed Development in terms of archaeology and cultural heritage resources. Potentially significant effects associated with construction activities and the operational phase of the completed proposed development are identified and, where necessary, mitigation and enhancement measures are outlined as summarised in Table 10.4.

10.1.2 With embedded and additional mitigation in place, which includes the delivery of a Conservation Management Plan, the construction phase has identified significant beneficial effects to four designated historic assets, comprising three scheduled monuments and one Grade II listed building.

10.1.3 It will also bring these assets into the wider tapestry of Merthyr's historic landscape which includes Cyfarthfa Castle and the Ironworks to compliment and connect with Merthyr's wider 20-year Cyfarthfa Plan project, thereby realising key National policy goals in respect of Welsh tourism, community, cultural development, sustainability and those embedded (for example) in the Wellbeing of Future Generations Wales Act 2015.

10.1.4 Whilst the proposed development will result in the loss of ten non-designated archaeological assets, archaeological mitigation will take place through recording. The remit for this work will be set out in a Written Scheme of Investigation (WSI) and will include opportunities for community involvement in the archaeological process and, for interpretation of archaeological results within the development's plaza. As such, with mitigation in place only non-significant residual adverse effects to ten non-designated historic assets are assessed. A beneficial effect is assessed to a single non-designated historic asset.

10.1.5 In accordance with Cadw guidelines (Cadw, 2017) the assessment has identified effects from the operational phase of the proposed development on historic assets due to change within their settings. As well as effects related to the presence of the development's buildings, this assessment includes effects related to enhanced public access to some of these assets and opportunities for their interpretation. These comprise significant beneficial effects to three scheduled monuments, significant adverse effects to two scheduled monuments, and non-significant adverse effects to a scheduled monument, a Grade II* Historic Park and Garden and a conservation area.

10.1.6 The chapter also references the results of an Assessment of the Significance of the Impact of Development on Historic Landscape Areas on the Register of Landscapes of Historic Interest in Wales (ASIDOHL2) assessment of effects on the Merthyr Tydfil Landscape of Outstanding Historic Interest (MTLOHI). In this regard, the assessment identifies an overall effect of Minor Adverse and should be considered alongside the benefits delivered to the heritage assets within the MTLOHI through conservation and interpretation which are not directly assessed in the ASIDHOL methodology, but which are nonetheless relevant to the MTLOHI.

10.1.7 The assessment has identified no in-combination cumulative effects with any committed or proposed development in the Application Site's vicinity, however, the potential for future in combination effect with two sites that are allocated within the LDP has been identified.

10.1.8 In accordance with heritage legislation and Planning Policy Wales Edition 11 (PPW 11), effects from the Proposed Development on the historic environment will need to be 'fully considered' in the planning balance, taking account of the range of beneficial effects to nationally important historic assets which will offset adverse effects arising from the loss of non-designated archaeology, change to the settings of historic assets and effects on the MTLOHI's Historic Landscape Character Areas (HLCAs).

10.1.9 The proposals accord well with Future Wales: The National Plan 2040, providing increased interpretation of the historic environment to the public that will serve to promote the distinctive industrial heritage of the Merthyr Tydfil borough and the South-East Welsh region with respect for the Welsh language.

10.1.10 The proposals also accord well with the Welsh Government's objectives as set out in PPW 11, in that they seek to conserve important archaeological sites that are designated as scheduled monuments promoting their role in 'education, leisure and the economy' and allowing them to make an appreciable contribution to the 'character or place' at the Site whereas presently they are hard to access and experience.

10.1.11 A response from Cadw on the PAC submission (dated 27 May 2022) states that they have no objection to the proposed development in respect of historic assets and that they concur with EDP's view that the mitigation and off-setting measures proposed will result in a considerable improvement to the physical condition of the designated historic assets in question that will outweigh any adverse impacts to their setting. As such, in light of the compliance of the proposals with heritage legislation, national and local planning policy and, in light of Cadw's position, it is clear that the historic environment and the historic assets that comprise it, do not represent a constraint to the positive determination of the planning application.

10.2 Introduction

10.2.1 This Archaeology and Cultural Heritage Environmental Statement (ES) Chapter has been prepared by The Environmental Dimension Partnership Ltd (EDP). It identifies and assesses the potentially significant effects from the proposed development in terms of archaeology and cultural heritage resources, to address guidance in Chapter 6 of Planning Policy Wales Edition Eleven (Welsh Government, 2021). Potentially significant effects associated with construction activities and the completed development are identified as appropriate, and, where necessary, mitigation and/or compensation measures are outlined.

10.2.2 The assessment is supplemented by the following reports: Archaeology and Heritage Baseline Assessment (Appendix 10.1; EDP, 2021a); and ASIDOHL2 Assessment (Appendix 10.2; EDP, 2021b). A plan showing historic assets assessed within the chapter is included at Appendix 10.3.



Application Site Description

10.2.3 The Application Site is located within a densely wooded area to the west of the town of Merthyr Tydfil. The town centre is located c1.5km to the north-east of the Application Site boundary.

10.2.4 The Application Site occupies hillsides sloping to the east and north-east towards the valley of the River Taff, with the valley of the Nant Canaid to the south of its boundary. Its topography has been heavily influenced by intensive industrial activity in the form of mining for coal and ironstone, and it contains earthworks and structures related to these and associated activities.

10.2.5 The land at the Application Site is situated at the fringe of the uplands which border the Brecon Beacons National Park, within a transitional landscape that bridges the upland moorland landscapes of the Brecon Beacons National Park and the industrial valleys which cut north-south from its foothills.

10.3 Methodology and Scope

Study Areas

10.3.1 The baseline position is derived from the Archaeology and Heritage Baseline Assessment (Appendix 10.1; EDP, 2021a). This study assessed the cultural heritage resource for a much larger area than the present Application Site. This area encompasses the Application Site as well as, in terms of archaeological remains, surrounding land up to a minimum of 500m from the Application Site boundary. In terms of the assessment of potential indirect effects on the significance of historic assets through change within their settings, the assessment considers historic assets up to 2km from the boundary of the Application Site.

10.3.2 Section 3 of this chapter summarises the Baseline Environment as it relates to the Application Site and its environs up to 500m from the boundary and, in terms of setting impacts, up to 2km from the boundary making reference to a Zone of Theoretical Visibility (ZTV).

10.3.3 The assessment also references the ASIDOHL2 report (Appendix 10.2; EDP, 2021b). This report assesses the potential for impacts upon the MTLOHI, arising from the Proposed Development, in line with Cadw guidance (Cadw, 2007). Given that the subject of this assessment is a historic landscape, this assessment has a much broader study area considering the potential for indirect effects using a ZTV that extends for up to 7km from the highest part of the Proposed Development.

Legislation and Planning Policy Background

10.3.4 The following legislation and planning policy is of relevance to the assessment presented in this report.

Legislation

10.3.5 The Ancient Monuments and Archaeological Areas Act 1979 addresses the designation and management of scheduled monuments.

10.3.6 The 1979 Act does not address the concept of 'setting', just physical remains and, therefore, for scheduled monuments the protection of 'setting' is a matter of policy only.

10.3.7 The Planning (Listed Buildings and Conservation Areas) Act of 1990 is the primary legislative instrument addressing the treatment of listed buildings and conservation areas through the planning process.

10.3.8 Section 66(1) of the Planning (Listed Buildings and Conservation Areas) Act 1990 sets out the statutory duty of Local Planning Authorities, where proposals would affect a listed building or its setting.

10.3.9 Section 72(1) of the 1990 Act addresses development proposals that would affect the character or appearance of a conservation area. However, the 'statutory duty' which is set out in the 1990 Act does not extend to cover the 'setting' of a conservation area and so instead that is a matter addressed through relevant planning policies.

Future Wales: The National Plan 2040

10.3.10 Future Wales sets out the Welsh Government's national development framework and policy, comprising part of the Development Plan to be taken as the starting point for consideration of planning applications in Wales. One of its 'outcomes' is that Wales should be a place where prosperity, innovation and culture are promoted. The document notes that:

"The South East has many outstanding historic and natural resources which are an important part of the local fabric and help to tell the story of its distinctive and unique communities. … They should be protected for the enjoyment of future generations and help to provide economic benefits for the region's communities. The region's distinctive heritage should be preserved and enhanced by high quality development."

Planning Policy Wales (PPW)

10.3.11 National planning guidance, concerning the treatment of the historic environment across Wales, is detailed in Section 6.1 of Chapter 6 Distinctive and Natural Places of Planning Policy Wales Edition 11, published in January 2021 (PPW 2021).

10.3.12 PPW identifies the historic environment as being made up of individual historic features, archaeological sites, historic buildings and historic parks, gardens, townscapes and landscapes, which are collectively known as 'historic assets'.

10.3.13 The Welsh Government's specific objectives for the historic environment are outlined at paragraphs 6.1.6 and 6.1.7. Key paragraphs regarding the treatment of archaeological remains in the planning process are paragraphs 6.1.24 – 6.1.28. The key paragraph regarding listed buildings is paragraph 6.5.10. Historic landscapes are covered by paragraphs 6.1.20 and 6.1.21.

Technical Advice Note 24 (TAN 24)

10.3.14 Additional guidance for the historic environment in Wales is set out in 'Technical Advice Note 24: The Historic Environment' (Welsh Government, 2017).

10.3.15 TAN 24 provides "*guidance on how the planning system considers the historic environment during development plan preparation and decision making on planning applications*." It clarifies the polices and distinctions made in PPW.

10.3.16 Of particular relevance to the current application is Section 4 which deals with archaeological remains and the development management process. Indirect effects through changes within the settings of designated historic assets are covered in TAN 24 at paragraphs 1.23 to 1.29. Section 7 is also relevant as it is concerned with the Register of Historic Landscapes in Wales.

Local Planning Policy

10.3.17 The Merthyr Tydfil Replacement Local Development Plan 2016-2031 (LDP), which was adopted by Merthyr Tydfil County Borough Council (MTCBC) on 29 January 2020, provides the local planning policy framework for the area.

10.3.18 Of relevance are Strategic Objective 9: *Heritage and Cultural Assets and Policy CW1: The Historic Environment* which outlines detailed policy, relevant to historic assets. Also relevant here are Objectives 16 and 18 of the Sustainability Appraisal Report which is part of the LDP (January 2020) and which relate to the historic environment.

10.3.19 The assessment presented within this chapter accords with paragraph 6.1.9 of PPW 11 and paragraphs 1.26 and 4.7 of TAN 24. It is based on the information contained within the Archaeology and Heritage Baseline Assessment which has been commissioned by the Applicant in accordance with these policies to inform the decision maker on the potential for historic environment impacts. The ASIDHOL assessment also conforms with paragraph 6.1.21 of PPW 11 and paragraph 7.4 of TAN 24 in that it presents an assessment of impacts upon an area listed in the Register of Landscapes of Outstanding Historic Interest in Wales.

10.3.20 The development design has been engineered to avoid impacts upon the significance of designated historic assets (scheduled monuments and listed buildings) that would conflict with planning legislation.

Scoping Assessment Stage

10.3.21 In April 2021 both Cadw and the Glamorgan Gwent Archaeological Trust (GGAT) were consulted and asked to comment on the scope of the Archaeology and Heritage Baseline Assessment and the proposed scope of the ASIDOHL report.

10.3.22 The ASIDOHL scope was agreed following a series of meetings and email correspondence with Cadw and GGAT in May 2021 and subsequently set out in a Scoping Note (Appendix EDP 1 of the ASIDOHL report at Appendix 10.2 of the ES).

10.3.23 A Scoping Opinion was received from MTCBC on 16 July 2021. Relevant consultees comprised Cadw and GGAT. A summary of their comments is reproduced below:

Cadw

10.3.24 Cadw acknowledge the production of the Archaeology and Heritage Baseline Assessment and the ASIDOHL Assessment and identify both to be "*appropriate assessments to identify the historic assets that will be affected by the proposed development and provide a current baseline for assessing the impact of the proposed development on them*."

GGAT

10.3.25 GGAT acknowledge the production of the draft Archaeology and Heritage Baseline Assessment. They state that, in response to a planning application, they would require an archaeological assessment to be prepared and that the draft Archaeology and Heritage Baseline Assessment provides a good baseline for this assessment. They comment that this document should be submitted in support of any planning application. They also state that, following submission of an archaeological assessment, further mitigation work may be required as a condition of any permission granted.

Pre-Application Consultation (PAC) response

10.3.26 A PAC application was submitted in April 2022. A response from Cadw on the PAC submission (dated 27 May 2022) states that they have no objection to the proposed development in respect of historic assets and that they concur with EDP's view that the mitigation and off-setting measures proposed will result in a considerable improvement to the physical condition of the designated historic assets in question that will outweigh any adverse impacts to their setting.

Assessment Methodology

10.3.27 The identification and then evaluation of potentially significant effects on historic assets depends on a combination of the sensitivity of the asset and the magnitude of change that is predicted to result from the implementation of the development. The assessment of likely significant effects as a result of the development takes into account both the construction phase and the completed occupation phase.

10.3.28 In the first instance, the assessment attributes 'sensitivity' to archaeological and cultural heritage assets, as shown in Table 10.1. I this respect 'sensitivity' equates to 'significance' as defined by PPW/TAN 24. The criteria in Tables 10.1, 10.2 and the assessment in Table 10.3 are based on guidance issued by the Highways Agency in its Design Manual for Roads and Bridges (HA 2007). This is an industry standard assessment methodology for Environmental Impact Assessment (EIA), and the only one adopted by a government agency.

Table 10.1: Sensitivity of Receptor

Receptor	Sensitivity of Receptor				
	Very High	**High**	**Medium**	**Low**	**Negligible**
World Heritage Site					
Scheduled Monument					
Grade I or II* Listed Building					
Grade I or II* Registered Park or Garden					
Other Nationally Important Archaeological Asset					
Grade II Listed Building					
Grade II Registered Park or Garden					
Conservation Area					
Other Asset of Regional or County Importance					
Locally Important Asset with Cultural or Educational Value					
Heritage Site or Feature with Very Limited Values or Interests					

10.3.29 The classification of the magnitude of change to historic assets is based on consistent criteria and takes account of such factors as the physical scale and type of disturbance, and whether features or evidence would be lost that are fundamental to their historic character, integrity and therefore, significance (sensitivity).

10.3.30 Both physical and non-physical (e.g. visual) changes to historic assets are considered. The magnitude of impact is assessed using the criteria in Table 10.2.

Table 10.2: Magnitude of Change.

Magnitude of Change	Description
Large	Change to the significance of a heritage asset so that it is completely altered, improved or destroyed.
Medium	Change to the significance of a heritage asset so that it is significantly modified.
Small	Change to the significance of a heritage asset so that it is noticeably different.
Negligible	Change to the significance of a heritage asset that hardly affects it.
None	No change to the significance of an asset.

10.3.31 Following the evaluation of the sensitivity of specific cultural heritage receptors, and the magnitude of the impact upon them, the significance of the effect will be assessed using the criteria outlined in Table 10.3 below.

10.3.32 It should be noted that there are no receptors of 'Very High' sensitivity within the scope of the assessment and therefore, this is not included in the matrix in Table 10.3.

Table 10.3: Significance of Effect.

Magnitude of Change	**Sensitivity of Receptor**			
	High	**Medium**	**Low**	**Negligible**
Large	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Small	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

10.3.33 The assessment matrix defined in Table 10.3 is not intended to be 'prescriptive', but rather it allows for the employment of professional judgement to determine the most appropriate level of effect for each historic asset that is identified.

10.3.34 Effects are categorised with regard to their nature (adverse, beneficial or neutral) and their permanence (permanent, temporary or reversible). For all forms of historic asset (receptor); including archaeological sites and remains; historic buildings, places and areas; and historic landscapes; the sensitivity of the receptor is combined with the predicted magnitude of change to arrive at the significance of effect.

10.3.35 The combination of sensitivity and magnitude of change is undertaken with reference to the matrix in Table 10.3, with those effects defined as severe, major or moderate being deemed significant. All other effects are determined to be not significant in EIA terms.

Limitations of the Assessment

10.3.36 With much of the Application Site densely vegetated, Site conditions have restricted any ability to carry out archaeological evaluation fieldwork, such as geophysical survey and trial trenching. As such, an understanding of the Application Site's archaeological resources and their value is based on observations made, where possible, on site and desk-based methods of assessment.

10.3.37 It is anticipated that the significance of archaeological remains within the Application Site will be fully determined during archaeological mitigation works (the scope of which will be agreed in advance with GGAT) and carried out after the Application Site has been cleared of vegetation (where proposed). Archaeological mitigation is set out in section 10.6 below.

10.4 Baseline Environment

Existing Baseline

Designated Historic Assets

10.4.1 The Application Site contains parts of two scheduled monuments and a Grade II listed building. Within a 2km radius of the Application Site are 23 scheduled monuments, as well as three conservation areas, part of a fourth conservation area, part of a Historic Park and Garden and 145 listed buildings.

Assets within the Application Site

10.4.2 The designated assets located within the Application Site comprise:

- Scheduled monument, Cyfarthfa Balance Pond and Leat (GM608);
- Scheduled monument, Cwm Pit and Head of Railway (GM607); and
- Grade II listed building, the Base of Chimney at Cwm Pit (81752).

10.4.3 These historic assets are located on the plan at Appendix 10.3. They are described and their significance defined, including the contribution to their significance made by their setting, in the Archaeology and Heritage Baseline Assessment. All of these heritage receptors are of High sensitivity.

10.4.4 The designated historic assets within the site are assessed for their potential to receive direct effects from the construction phase of the development in Section 5 of this chapter. They also have potential for their settings to be altered by the operational phase of the Proposed Development, such that this change would potentially impact upon their significance. As such, potential effects on these assets are considered under operational phase effects in Section 5 of this chapter in line with Stages 3 of the settings assessment process as defined by Cadw (Cadw, 2017).

Assets located beyond the Application Site boundary

10.4.5 With reference to Stage 1 of the settings assessment process (Cadw, 2017), while setting is not purely a visual concept, changes to the setting of a historic asset as a result of development will most commonly occur as a result of intervisibility or direct views between the asset and the proposed development, or as a result of changes to the view of a feature from a third viewpoint.

10.4.6 Regarding designated historic assets located beyond the Site boundary, Stage 1 of the assessment process utilised a ZTV to identify assets with potential intervisibility with the Site. The ZTV is illustrated on the plan at Appendix 10.3.

10.4.7 Following this process, it was concluded that the following designated assets lie within the ZTV and thus are considered in the assessment at Section 5 of this chapter with regard to operational phase effects:

- Scheduled monument, Black Pins early ironstone workings (GM609; High sensitivity);
- Scheduled monument, Vale of Neath railway cutting and tunnel portal (GM606; High sensitivity);
- Scheduled monument, Cwm Glo Pit and Ironstone Tip (GM611; High sensitivity);
- Scheduled monument, Cyfarthfa Tramroad section at Heolgerrig (GM495; High sensitivity);
- Cyfarthfa Conservation Area (Medium sensitivity);
- Morgantown Conservation Area (Medium sensitivity);
- Thomas Town Conservation Area (Medium sensitivity);
- Town Centre Conservation Area (Medium sensitivity);
- Cyfarthfa Castle Grade II* Historic Park and Garden (High sensitivity);
- Ten grade II listed buildings at Upper Colliers Row (Medium sensitivity); and
- Grade II Listed buildings within the conservation areas (Medium sensitivity).

10.4.8 Although located beyond 2km from the Site, on account of its high value and presence within the ZTV the chapter also considers the Grade I listed buildings Cyfarthfa Castle and School at Cyfarthfa Castle (11396 and 11397; High sensitivity).

10.4.9 On account of the potential for settings changes due to non-visual effects, such as a loss of historical, functional associative relationships between historic assets, the assessment also considers the scheduled monument Cyfarthfa Canal Level (GM467; High sensitivity) which is located outside of the ZTV.

10.4.10 All of these historic assets are located on the plan at Appendix 10.3. They are described and their significance defined, including the contribution to their significance made by their setting, in the Archaeology and Heritage Baseline Assessment (Appendix 10.1).

10.4.11 The Application Site is located within the MTLOHI. The chapter considers the potential for effects on the character of this landscape area and in doing so makes reference to an assessment carried out in accordance with the ASIDHOL 2 process (Cadw, 2007).

Non-designated Historic Assets

10.4.12 The Application Site is located within an area that was subject to intensive coal and ironstone mining activity primarily within the 18th, 19th and 20th centuries. The Archaeology and Heritage Baseline Assessment at Appendix 10.1 sets out in detail the history of the locality and the character and significance of its archaeological resource.

10.4.13 Archaeological features within the Site are identified on Plan EDP 2 within the ASIDOHL Assessment report (Appendix 10.2) in which direct impacts upon the Historic Landscape Character Areas (HLCAs) across which the Application Site lies are assessed. With reference to this plan the following paragraphs describe the assets located within the Application Site that will be considered within this chapter.

Glyn Dyrys Upper Level Mine and Tips to West of A470 Tip (B)

10.4.14 LiDAR data, reproduced on Plans EDP 9 and 11 in the Archaeology and Heritage Baseline Assessment illustrates the presence of spoil tips and mine remains related to past mining activity to the immediate south-west of modern tips associated with the construction of the A470, between them and the Parish Road. These comprise a discrete area of fingertips, which, according to the National Monuments Record of Wales (NMRW; Ref. 261934) were produced by upcast from the Glyn Dyrys Upper Level which is presumed to have operated in the 19th century (being as the tips are shown on an Ordnance Survey map of 1876). Remains of the mine itself are in dense woodland, but on LiDAR data appear to comprise earthworks around the level entrance. The works are located within an area identified in the Baseline Assessment as possibly containing early mining remains accessed from the Parish Road. However, if any such works were present in this area they have been buried by the later tips. The tips and mine remains are considered to represent a heritage receptor of Low sensitivity.

The Parish Road (C)

10.4.15 With reference to the Archaeology and Heritage Baseline Assessment the Parish Road is an old track of probable post-medieval date (possibly 17th century) that connected a mill at Melin Canaid (located to the immediate south-west of the Site) and farmsteads in the hills beyond to the west, with the settlement at Rhydycar located to the north of the Application Site in the Taff valley. Presently, the track is used as a footpath defined by hedgerows and a stone/earth bank, although its original course to the north of the Site has evidently been disrupted by later industrial development and transport corridors, as well as the tip associated with the A470's construction. The Parish Road is considered to represent a heritage receptor of Low sensitivity.

Area of the former Glyn Dyrys Pit and the Glyn Dyrys Tip (D)

10.4.16 The Archaeology and Heritage Baseline Assessment describes how the Glyn Dyrys pit worked ironstone from the early 19th century to the late 19th century when it ceased to function with the decline of the Cyfarthfa works. By 1839 it had an engine house which powered its winding gear by steam rather than water balance. The Historic Environment Record (HER) also records a smithy in its near vicinity (Ref. GGAT 02815m). Presently, remains of the mine comprise a group of earthworks that are described in Paragraph 4.353 in the Baseline Assessment report. The earthworks include several banks as well as curved features that probably represent former track beds. A rectangular feature, defined by banks, may have been the location of the mine's engine house which is illustrated as such on historic maps. A large hole to the immediate south-east of the earthworks is likely to be the remains of the shaft itself. The remains are considered to represent a heritage receptor of Low sensitivity.

Course of the Cyfarthfa Canal

10.4.17 The Cyfarthfa Canal dates from the 18th century and was a key, early element of the transport system that took coal and ironstone from mines that lie to the south and west of Rhydycar north to the Cyfarthfa Ironworks. The canal has, in most locations, been entirely infilled and built over by later industrial works and spoil tips, and by the later Cwm Pit railway of the 19th century which superseded its function. The better-preserved parts of the canal, which lie c.360m to the north of the Application Site, are a scheduled monument (GM467). The southern parts of the canal are now indistinguishable above ground. Within the Application Site, part of the canal's course was over built by the spoil tips associated with the A470. Further south the course of the canal runs through an area that is now waterlogged. As such, only below ground archaeological remains related to the canal are likely to survive within the Application Site. On the basis that the best-preserved extant remains of the canal are a scheduled monument, any below ground remains of the canal could possess a moderate degree of evidential value and are considered to represent a heritage receptor of Medium sensitivity.

Route of the Cwm Pit Railway

10.4.18 The Cwm Pit railway was a narrow-gauge line that was constructed in the mid-19th century and went out of use in the early 20th century. It superseded the Cyfarthfa Canal along a very similar route, taking coal and ironstone from the mines of the south to the ironworks to the north. The best-preserved part of the line is at the northern end where the route follows a modern path and, further south, where embankments are preserved. Like the canal, the railway was over tipped by the spoil from the A470 and its former course ran across the now waterlogged and overgrown area to the south of the spoil tip; it is now not easily distinguished on the ground but slight earthworks defining its route may remain.

10.4.19 Further south the course is discernible as it approaches Cwm Pit and the railway head, although the track bed is now followed by a water course which has scoured much of it away. Any remains of the railway are considered to represent a heritage receptor of Low sensitivity.

Route of the Ynys Fach Railway

10.4.20 The Ynys Fach Railway dates from the late 19th century, going out of use in the early-mid 20th century. It was part of a network of railways that delivered coal from mines located to the south of the Site to the Ynys Fach Ironworks to the north-east. Its former course is only preserved in a fragmentary fashion, with a part (within the Application Site) at the northern end discernible as an informal footpath, and further south as an earthwork running through dense woodland. To the north, the route of the railway has been destroyed by modern development and the A470. Any remains of the railway are considered to represent a heritage receptor of Low sensitivity.

Old Coal Workings south-west of Lower Collier's Row (E)

10.4.21 With reference to the Archaeology and Heritage Baseline Assessment, the NMRW identifies areas of surface mine working located to the south-west of the later mine at Lower Colliers Row (Refs. 261938, 261971, 261988). This wooded area contains numerous pits of various sizes from 1-2m up to large holes of 5-6m in width. It is assessed that the pits could be of varied provenance, with some representing early surface mining, some later collapsed shafts or air shafts, and some the collapse of underground workings in this area. A key observation is that the pits follow the lines of coal seams exposed on the hillside and that many of the pits are located close to the Parish Road. It is logical to assume that the earliest (pre-late 18th century) mine working in the Application Site could have occurred in this location, as the exposed seams closest to the transport route of the road would have been exploited first.

10.4.22 Based on HER, NMRW and LiDAR data, Plan EDP 21 of the Baseline Assessment report delineates an area in which early surface workings are likely to occur. Within the Site, this equates to three lines of pits which, with reference to Plan EDP 20 of the report, follow coal seams (Two Foot Nine, Four Feet, Upper Six Feet and Garw). The pits are probably a mixture of ages, but given their location close to the early transport route of the Parish Road, have potential to include early features of the post-medieval period (i.e. pre-late 18th century). Pre-late 18th century mining remains are considered to represent a heritage receptor of Medium sensitivity, although more typical later remains in this area would be of Low sensitivity.

Lower Collier's Row Drift Mines (F)

10.4.23 The HER and NMRW both record mining works associated with the intensive 19th century industrial activity at Lower Colliers Row within the Application Site. These include a shaft (Refs. GGAT 02811m) associated with tramroads and structures which are no longer extant, and drift mines (levels) Collier's Row No. 1 and No. 2 (GGAT 04434m and 04435m; NMRW 261931). The mine workings are all within woodland and in a denuded/collapsed state. It is most likely that they date from the 19th century. The mining remains are considered to represent a heritage receptor of Low sensitivity.

Glyn Dyrys Upper Level Tramway (G)

10.4.24 The NMRW records a former tramway related to the Glyn Dyrys Upper Level (NMRW 261970). The tramway ran from the mine north to connect with the Cwm Pit railway at Lower Colliers Row. The tramway is no longer extant, but its course can be seen as a footpath through woodland. Any remains of the tramway are considered to represent a heritage receptor of Negligible sensitivity.

Trackway

10.4.25 The HER (Ref. GGAT 02859.0 m) records part of a trackway crossing the Site from north to south. The track is described as following the contour for c.800m running from the Cwm Glo valley in the north down to Cwm Pit and the valley of the Nant Canaid in the south. The HER speculates that the track may have originated as a drove-way or pack horse track and therefore is probably an element of the agricultural landscape of the 16th, 17th or early 18th centuries. Presently the track has been destroyed in places by industrial activity, most notably at its southern end where it was buried by spoil tips associated with the mine at Cwm Pit. Any remains of the trackway are considered to represent a heritage receptor of Low sensitivity.

Route of the Gethin and Vale of Neath Railways

10.4.26 The routes of two interlinked former railways, as well as bridges along their length, are located within the Application Site. The better preserved former railway in the Application Site is the Vale of Neath railway, with the Gethin railway only present as a partial cutting to the south of the Cyfarthfa Crossing junction.

10.4.27 The course of the Vale of Neath railway, heading north-east from the tunnel, is represented by a cutting between spoil tips, and to the north-east of the junction by a low embankment. No remains are noted of railway tracks or sleepers. Two 19th century bridges are extant features of the Vale of Neath railway line within the Application Site. These are described in the Archaeology and Heritage Baseline Assessment (paragraphs 4.486 – 4.490). Remains of the railways and bridges are considered to represent heritage receptors of Low sensitivity.

Non-designated Historic Assets located beyond the Application Site Boundary

10.4.28 As noted above, the Application Site is situated within an area which contains multiple archaeological features related to past mining activity, as well as relict features of the pre-industrial post-medieval farming landscape. Rather than treat this myriad of interrelated historic assets as individual heritage features the indirect effects from the Operational Phase on the development are assessed on the historic environment of neighboring areas via the ASIDOHL2 assessment process. In this respect, the various non-designated assets contribute to the character of the HLCAs against which the indirect effects of the development are assessed.

Future Baseline

10.4.29 Historic assets located within the Application Site are subject to ongoing reduction in their significance due to the uncontrolled growth of invasive vegetation and, in some locations, water erosion and subsidence. It is anticipated that, if conditions at the Application Site remain as they are, these processes will continue and historic assets within its boundary will continue to gradually lose their evidential value potentially resulting in the collapse of parts of the scheduled monuments. Management works do take place at the Application Site and the applicant's wider land holding where the landowners employ a full time site manager who carries out tree surgery, vegetation clearance and maintenance of the site's infrastructure. Specific works have been carried out recently that have alleviated conditions that are detrimental to historic assets, these are described in a separate subsection below.

10.4.30 This process has specifically been documented in relation to the scheduled monuments Cyfarthfa Balance Pond and Leat (GM608), Vale of Neath railway cutting and tunnel portal (GM606), Cwm Pit and Head of Railway (GM607) and the Black Pins early ironstone workings (GM609) by Cadw in a series of Monument Management Plans (Cadw, 2021 a, b and c). These erosive processes are summarised below for each asset, along with Cadw's suggested solutions:

Cyfarthfa Balance Pond and Leat (GM608)

10.4.31 Management issues:

- Invasive trees/vegetation growing on the earthworks of the pond and leat;
- A number of areas of subsidence (possible earlier mining activity) have collapsed within the course of the leat;
- Specific leat features such as the south-eastern masonry sluice are covered in vegetation;
- The top of the earthen pond/leat bank holds standing water which is contributing to bank erosion. This is exacerbated by pedestrian erosion;
- Loose brickwork (spillway) in need of repair; and
- Anti-social behaviour – fire-setting, littering, dumping.

10.4.32 Management works required:

- Tree management – assess and deal with problematic trees growing on the earthworks and sluice areas of the pond/leat;
- Regularly cut back invasive under-storey vegetation such as bramble/bracken/scrub growing on earthworks/masonry and treat with herbicide to prevent re-growth;
- Monitor the erosion on the tops of the leat/pond banks. This appears to be exacerbated by standing water and pedestrian access to the earthworks. If it gets worse, contact Cadw for further advice;
- When earthworks/masonry are cleared of invasive vegetation, employ a suitably qualified and experienced conservation architect to assess the monument and produce a conservation plan for repairs to the pond/leat (including the brick spillway and masonry sluices);
- When earthworks/masonry are cleared of invasive vegetation, employ a suitably qualified geotechnical engineer to assess the area of subsidence within the leat. The area in which the monument is situated is very dynamic with what appear to be old mining shafts/pits opening up within the course of the leat. Getting a baseline survey of the monument will inform future decisions regarding monitoring and dealing with these areas of subsidence;
- A quantity of metal has been dumped on the western banks of the pond – this should be removed carefully; and
- Undertake regular litter picks to prevent the build-up of rubbish.

Vale of Neath Railway Cutting and Tunnel Portal (GM606)

10.4.33 Management issues:

- Lack of tree/vegetation management on the sides of the cutting;
- Trees growing directly above the tunnel;
- Scrambler bike damage to the cutting;
- Water erosion undercutting/scouring the sides of the cutting; and
- Vandalism – fire setting, littering, graffiti, unauthorised tunnel access.

10.4.34 Management works required:

- Tree management – any trees at risk of windthrow/shedding limbs/close to masonry should be removed;
- Remove any invasive species establishing within the scheduled area (e.g. broadleaf regeneration and scrub) whilst maintaining a suitable shading tree canopy. Look to extending the native, non-invasive woodland species understorey already present in certain areas on the cutting to cover any bare patches on the banks of the cutting (this will help with erosion);
- Secure the area to prevent scrambler bike access to the monument;

- Determine the nature of the hydrology surrounding the scheduled area to see if anything can be done (outside of the scheduled area) to prevent water running down the sides of the cutting; and
- Undertake regular litter picks to prevent the build-up of rubbish.

Cwm Pit and Head of Railway (GM607)

10.4.35 Management issues:

- Lack of vegetation management has led to all masonry remains becoming cloaked in scrub and semi-mature trees;
- Loose/collapsing stonework throughout monument;
- Fallen tree resting against chimney stack;
- Invasive trees/vegetation growing on the earthworks of the pond;
- Watercourse through monument scouring away archaeological remains; and
- Anti-social behaviour – scrambler bikes, littering.

10.4.36 Management works required:

- Tree management – assess and deal with problematic trees growing on the masonry remains – particularly the chimney stack and retaining walls;
- Regularly cut back invasive under-storey vegetation such as bramble/bracken/scrub growing on earthworks/masonry and treat with herbicide to prevent re-growth;
- Monitor the erosion being caused by the watercourse running along the former railway track bed. In very dry conditions – undertake a photographic record of this area so that the degree of erosion can be monitored;
- When masonry remains are cleared of invasive vegetation, employ a suitably qualified and experienced conservation architect to assess the monument and produce a conservation plan;
- Secure access points into the monument to prevent scrambler motorbike activity; and
- Undertake regular litter picks to prevent the build-up of rubbish.

Black Pins early ironstone workings (GM609)

10.4.37 Management issues:

- Lack of vegetation management has led to many areas of the monument re-wilding;
- Scrambler bikes using the undulating earthworks creating areas of rutting/erosion;
- No secure fencing around the monument; and
- Littering.

10.4.38 Management works required:

- Tree management – assess and deal with problematic trees;
- Regularly cut back invasive under-storey vegetation such as bramble/bracken/scrub whilst maintaining a suitable shading tree canopy;
- Monitor the erosion being caused by footpaths/scrambler bike activity;
- Secure access points into the monument to prevent scrambler motorbike activity; and
- Undertake regular litter picks to prevent the build-up of rubbish.

Recent site management works

10.4.39 It is noteworthy that management works have taken place recently within the Application Site and its locality. This has included works to remove invasive trees from the Grade II listed Base of Chimney at Cwm Pit (81752). These works were commissioned and paid for by Rhydycar West following on directly from the issue of the Cadw Monument Management Plan for the Cwm Pit scheduled monument. In this respect the works responded as swiftly as possible to one of the most critical issues at the monument. The work was carried out by Pitchford Tree Services in the autumn of 2021. The works removed trees that were growing from the top of the chimney base and leaning against its side thus alleviating risk of damage to the structure's fabric from this vegetation.

10.4.40 Engineering work has also taken place within the Application Site that was designed to stabilise the mining tips present on and near to the site by improving drainage of surface water from around them. This was carried out by Merthyr Tydfil Borough Council's (MTBC) engineers and comprised clearing drainage channels, lining existing ditches and felling trees. For this work MTBC applied for Ordinary Watercourse Consent which was approved by the Lead Local Flood Authority and did not involve any works within any of the designated historic assets such as the scheduled monuments.

10.4.41 Whilst this work will have improved general conditions within the Application Site regarding waterlogging, it is not thought that they will have had any implications for the management issues listed above that were identified by Cadw. Notably the water erosion at the Scheduled Monument Cwm Pit would be unaffected as the works are down stream of the monument. In a general sense, improved drainage across the Application Site will result in a lessening of future erosion on archaeological assets should that be caused by waterlogging. However, the engineering work has not had any direct impact upon any historic asset within the Application Site nor has it changed the setting of any designated historic asset such that it has suffered a loss of significance.

10.5 Enhancement and Mitigation

Enhancement & Mitigation within the Submitted Design

10.5.1 Primary mitigation reflects aspects of the proposed development which are designed to avoid or minimise effects on the historic environment. These forms of mitigation, embedded into the project design, are taken into consideration prior to the assessment of effects outlined below. This includes measures, separate to the main development, which are designed to enhance the current state of the Application Site's scheduled monuments through conservation.

Conservation

10.5.2 As an embedded enhancement measure, conservation works are proposed at three of the scheduled monuments (and a single Grade II listed building located within one of the monuments) in the Application Site or its locality. The works are designed to conserve and enhance the heritage significance of the three monuments and the listed building by eliminating environmental factors that are currently eroding and gradually destroying the monuments and instigating controlled plans for their management which will govern their future conservation and restoration.

10.5.3 The works will be informed and led by a series of Monument Management Plans prepared and issued by Cadw in 2021 (Cadw, 2021a, b and c) which have been summarised in Section 2 above. In this respect, the works will represent a culmination of an ongoing process of consultation and cooperation with Cadw in respect of the monuments which included engagement during the scheduling process resulting in the facilitation of the scheduling of eight new scheduled monument designation in 2017/1018.

10.5.4 The conservation works will be detailed, along with details on heritage interpretation, within a Conservation Management Plan (CMP) that will be developed and agreed after (and only if) planning consent is granted for the Proposed Development. A Heads of Terms document summarising the content of the CMP will be submitted with the planning application (EDP, 2022 edp_r007).

10.5.5 For each monument the proposed works are summarised briefly below:

Cyfarthfa Balance Pond and Leat (GM608)

10.5.6 It is proposed to:

- Cutback and remove problematic trees growing on the earthworks and sluice areas of the pond/leat;
- Cutback invasive understorey and treat with herbicide as part of a regular management regime;
- Set up a regular management regime to monitor the erosion of the earthen banks;
- Employ a conservation specialist to assess the monument's masonry and produce a conservation management plan setting out a scheme of repairs;

- In tandem with wider onsite geotechnical work, assess the causes of and potential for further subsidence at the monument; and
- Remove litter and dumped materials from the monument.

10.5.7 With a programme of monitoring in place, a Conservation Management Plan agreed inclusive of this programme of conservation works, it is assessed that Cadw's list of management objectives would be addressed. The monument's present condition would be greatly improved and ongoing erosive factors that are resulting in a gradual loss of evidential value at the monument would be halted, and damaged areas would be repaired.

Cwm Pit and Head of Railway (GM607) – (inclusive of Grade II listed Base of Chimney at Cwm Pit (81752))

10.5.8 It is proposed to:

- Cutback and remove problematic trees growing on masonry remains such as the revetment wall and listed chimney stack;
- Cutback invasive understorey and treat with herbicide as part of a regular management regime;
- Employ a conservation specialist to assess the monument's masonry and produce a conservation management plan setting out a scheme of repairs;
- Secure access points to the monument in order to prevent motorbike access; and
- Remove litter and dumped materials from the monument.

10.5.9 Additionally, the proposed development includes drainage works that intend to canalise a water course that presently flows directly past the Cwm Pit and Head of Railway Scheduled Monument. This water course is presently eroding the adjacent track bed and threatening to undermine the monument's stone revetment walls. As set out in Section 2 above, it has been highlighted as a management issue at the monument by Cadw (Cadw, 2021b). The drainage proposal will divert water through a new ditch where it flows past the monument, creating a buffer between the water flow and the revetment wall. The drainage proposal is illustrated on a plan – Watercourse Mitigation Measures (Tetra Tech, 2021, 011-P01). This plan gives an outline impression of the ditch in its relation to the wall of the scheduled monument. The ditch will serve to protect the wall by halting water erosion taking place close to it, creating a barrier between the water course and the wall foundations.

10.5.10 The ditch will not be located within the scheduled area and its precise finish and design will be the subject of Reserved Matters approval. In this context a modern, engineered finish would be preferable, especially if the ditch is outside the scheduled area, as it would look clearly distinct from the historic fabric of the monument and thus present as a well-defined modern addition, less likely to be mistaken for a historic feature.

10.5.11 With a Conservation Management Plan agreed inclusive of this programme of conservation works, it is assessed that Cadw's list of management objectives would be addressed. The monument's present condition would be greatly improved and, ongoing erosive factors that are resulting in a gradual loss of evidential value at the monument, including the water erosion, would be halted, and damaged areas would be repaired.

Black Pins Early Ironstone Workings (GM609)

10.5.12 It is proposed to:

- Cutback and remove problematic trees that are damaging the monument's fabric;
- Cutback invasive understorey whilst maintaining a suitable shading tree canopy as part of a regular management regime;
- Monitor erosion caused by motorbike activity;
- Secure access points to the monument in order to prevent motorbike access; and
- Remove litter and dumped materials from the monument.

10.5.13 With a Conservation Management Plan agreed inclusive of this programme of conservation works, it is assessed that the monument's present condition would be noticeably improved and ongoing erosive factors that are resulting in a gradual loss of evidential value at the monument would be halted.

Interpretation

10.5.14 The proposed development includes provision for walking routes that cross parts of the two scheduled monuments that lie within the Application Site which will be part of a wider Heritage Trail. The concept and initial design of the trail was discussed with and advised by Cadw in January 2022.

10.5.15 These routes will allow for controlled and managed public access to these monuments in order to facilitate their interpretation with the aim being to deliver a positive benefit with the development. The routes have been carefully considered and chosen to afford better and more managed access to the monuments in a way that would not result in increased erosion to the fabric of the structures. In this respect the routes will utilise existing informal footpaths with their surfaces built up from the present ground surface with a geo-textile layer to protect the fabric of the monuments and, utilise timber boardwalks to bridge depressions, and timber steps at slopes.

Construction

10.5.16 Measures to protect scheduled monuments located within the Application Site during construction will be set out in a Construction Management Plan (CoMP). Such measures will involve the management of access to the monuments during development.



10.6 Likely Significant Environmental Effects of the Scheme

10.6.1 The following paragraphs assess the likely significant effects of the development on historic assets with the mitigation measures embedded into the proposed design considered. These have been assessed in terms of effects during construction, where direct impacts may be anticipated, and during the occupational phases where impacts, in terms of an asset's setting, are expected.

10.6.2 In each case, the assessment will identify whether the predicted effects on historic assets are adverse or would in fact be beneficial and deliver an enhancement.

Construction Phase Effects

10.6.3 The following section provides an assessment of the likely significant effects on archaeological and cultural heritage receptors during the construction phase with embedded mitigation in place.

10.6.4 It addresses only the direct, physical effects of construction activities contained within the boundary of the Application Site and does not cover potential changes to the wider settings of historic assets. These are addressed under the 'occupation' phase because, even though it is recognised that they will first arise during construction (with the potential installation of cranes, etc.), they will emerge over time and will ultimately reach their fullest extent following the completion of the Proposed Development.

10.6.5 It is expected that effects on setting during construction will either be short-term because of the temporary nature of the activity or represent 'lower magnitude' versions of effects which will be assessed in respect of the completed development.

10.6.6 Therefore, whilst the potential for construction activities at the Application Site to have indirect (setting) effects on both designated and non-designated historic assets is not dismissed, the assessment identifies and assesses them at the 'occupational' phase in order to capture the worst-case scenario; in other words when they have reached their maximum extent.

10.6.7 The magnitude of change is viewed in conjunction with the sensitivity of the heritage assets, to appreciate its overall significance. Assessing the significance of effects uses the matrix illustrated in Table 10.3.

Designated Historic Assets

10.6.8 Three designated historic assets are located within the Application Site however none of these are located within the footprint of any of the proposed buildings and construction phase impacts are on account of works set out in the Conservation Management Plan. In this regard the monuments would be located outside of the main area of construction which will facilitate a considerable degree of physical projection from construction activity.



10.6.9 The assets comprise, Cwm Pit and Head of Railway (GM607), Cyfarthfa Balance Pond and Leat (GM608) and Grade II listed Base of Chimney at Cwm Pit (81752). Additionally, the off-site scheduled monument Black Pins early ironstone workings (GM609) will also be affected due to its inclusion in the conservation programme.

Cyfarthfa Balance Pond and Leat (GM608)

10.6.10 During construction the monument will be fenced to restrict access to it, including provision made to protect it from dust associated with the development. Specific measures will be set out in a Construction Management Plan. With such measures in place the monument will not be subject to any direct impacts resulting from construction elsewhere within the Site.

10.6.11 The monument will be subject to the conservation works set out above, including the provision of a Conservation Management Plan, and including assessment of the causes of, and potential for, further subsidence at the monument. These works will be carried out with relevant Scheduled Monument Consent (SMC) in place in accordance with Cadw's Monument Management Plan.

10.6.12 The Outline Masterplan (HMA, 4170, PL 010) illustrates a walking route across part of the scheduled monument which, as for Cwm Pit, is designed to provide controlled, managed access to the monument for the public and facilitate the interpretation of its history and that of Wales' industrial heritage. The route was designed in consultation with Cadw in January 2022 and will be an element detailed within the Conservation Management Plan.

10.6.13 The route utilises an existing path which runs along the top of the bank on the eastern side of the monument. As indicated previously the pathways will be built up from the ground surface which will be protected using a geotextile membrane and the slopes would be traversed on timber steps also built up from the ground surface. Whilst some specific woodland management will be instigated at the monument (see 'Additional Mitigation' below) the monument's existing woodland cover will be retained including its understorey which will serve to contain public access to the tracks and avoid persons walking across other parts of the monument.

10.6.14 At the northern edge of the pond, a space will be created within the walking route that will include information on the nationally important monument by way of its interpretation. Whilst the detailed design is not established, it is anticipated that this may involve an information display which would be mounted in such a way as to avoid impacts into the ground surface of the monument. It is also anticipated that fencing such as a handrail may be required in certain locations which will also be constructed in such a way to avoid impacts into the fabric of the monument.

10.6.15 In accordance with the objectives of Future Wales: The National Plan 2040 where development should be a positive force in encouraging the Welsh language to develop, the information board would be fully bilingual. It is also proposed that bilingual information on the monument would be incorporated into displays within the proposed welcoming atrium. Detail on the heritage interpretation related to the monument will be outlined in a Conservation Management Plan post-consent, with the Heads of Terms document submitted with the application outlining the content of this document.

10.6.16 Whilst it is anticipated that an application will need to be made for SMC (post-outline consent) with the detail on the works to the monument provided in full and supported by a Heritage Impact Statement, with the non-invasive design proposed and sensitive consideration of the appearance of the structural elements of the route, there is no reason to believe that consent would not be granted given the enhanced interpretation that the works would bring. The walking routes would allow the monument to be experienced and appreciated in a controlled and managed way (which it presently is not), and bilingual information on it and its historic function as a water supply mechanism, and the wider history of the Cyfarthfa works, its mines and their relationship to the industrial history of Wales to be presented to the public.

10.6.17 For the present assessment of impacts at the Outline Application stage, the walking route will provide managed access to the monument that will be designed to avoid direct impacts upon the monument's fabric. As such, the implementation of the walking route and interpretation area would not result in any direct effects upon the fabric of the monument.

10.6.18 In respect of the conservation works, the works proposed will halt ongoing erosive pressure to the monument's fabric and gradual loss of evidential value. With reference to Table 10.2 this effect is assessed as resulting in a Medium Beneficial Magnitude of Change. With reference to Table 10.3, a medium change to a historic asset of High sensitivity would result in a Major Beneficial, permanent significant effect.

Cwm Pit and Head of Railway (GM607) and Grade II listed Base of Chimney at Cwm Pit (81752)

10.6.19 During construction the monument will be fenced to restrict access to it including provision, made to protect it from dust associated with the development. Specific measures will be set out in a CMP. With such measures in place the monument will not be subject to any direct impacts resulting from construction elsewhere within the Site.

10.6.20 For this monument, drainage works detailed in the plan Watercourse Mitigation Measures (Tetra Tech, 2021, 011-P01) will result in water that currently passes the monument to the north canalised into a ditch following the edge of the present course with a buffer built up with upcast material forming a barrier between the water and the edge of the monument. Presently, the water flows along the course of a former track bed related to the monument which has eroded away, and it threatens the stability of the revetment walls on the monument's north-west side. This erosive factor was highlighted by Cadw's Monument Warden as a management issue (Cadw, 2021b).

10.6.21 In order to conform with legislation, an SMC application will be required for this work. However, there is no reason to believe consent would not be forthcoming in view of the widespread agreement that the remedial works which the proposals would bring forward are necessary to safeguard the fabric of the monument and thus beneficial with regard to its significance. The detail on the drainage diversion works would be provided in full and supported by a Heritage Impact Statement. It is anticipated that this application will be post-outline consent.

10.6.22 In addition to the drainage works, the monument and associated listed building will be subject to the conservation works set out above including the provision of a Conservation Management Plan. These works will be carried out with relevant SMC in place in accordance with Cadw's Monument Management Plan.

10.6.23 The Outline Masterplan (HMA, 4170, PL 010) illustrates a walking route across part of the scheduled monument that is designed to provide controlled, managed access to the monument for the public and facilitate the interpretation of its history and that of Wales' industrial heritage. The route was designed in consultation with Cadw and will be an element detailed within the Conservation Management Plan.

10.6.24 The route utilises existing paths that cross the monument which have evolved from previous tram routes associated with the former mine. As indicated previously, the pathways will be built up from the ground surface which will be additionally protected using a geotextile membrane and the slopes will be traversed on timber steps that are also built up from the ground surface. Whilst some specific woodland management will be instigated at the monument (see 'Additional Mitigation' below) the monument's existing woodland cover would be retained including its understorey which will serve to contain public access to the tracks and avoid persons walking across other parts of the monument.

10.6.25 Adjacent to the Grade II listed Base of Chimney at Cwm Pit (81752) a space will be created within the walking route that will include information on the monument by way of its interpretation. Whilst the detailed design is not presently established, it is anticipated that this would involve an information display which would be mounted in such a way as to avoid impacts into the ground surface of the monument.

10.6.26 As for the Cyfarthfa Balance Pond and Leat, in accordance with the objectives of Future Wales The National Plan 2040, where development should be a positive force in encouraging the Welsh language to develop, the information board would be fully bilingual. It is also proposed that bilingual information on the monument would be incorporated into displays within the proposed welcoming atrium. Detail on the heritage interpretation related to the monument will be outlined in a Conservation Management Plan post-consent, with the Heads of Terms document submitted with the planning application outlining the content of this document.

10.6.27 Whilst it is anticipated that an application will need to be made for SMC (post-outline consent) with the detail on the works to the monument provided in full and supported by a Heritage Impact Statement, with the non-invasive design proposed and sensitive consideration of the appearance of the structural elements of the route, there is no reason to believe that consent would not be granted given the enhanced interpretation that the works would bring. The walking routes would allow the monument to be experienced and appreciated in a controlled and managed way (which it presently is not), and bilingual information on it and its historic function, how it operated as a coalmine, and the wider history of the Cyfarthfa works, its mines and their relationship to the industrial history of Wales to be presented to the visiting public.

10.6.28 For the present assessment of impacts at the Outline Application stage, the walking route will provide managed access to the monument that will be designed to avoid direct impacts upon the monument's fabric. As such, the implementation of the walking route and interpretation area would not result in any direct effects upon the fabric of the monument

10.6.29 In respect of the conservation works, including the cessation of the water flow past the monument, these will halt the ongoing erosive pressure to the monument's fabric and gradual loss of evidential value. With reference to Table 10.2 this effect is assessed as resulting in a Medium Beneficial Magnitude of Change. With reference to Table 10.3, a medium change to a historic asset of High sensitivity would result in a Major Beneficial, permanent significant effect.

Black Pins Early Ironstone Workings (GM609)

10.6.30 The Black Pins are located off-site c.60m to the west of the proposed development. As such, they will not be affected by unwanted access during construction or problems with construction derived dust.

10.6.31 The monument will be subject to the conservation works set out above including the provision of a Conservation Management Plan that will set out a management regime of vegetation management, erosion monitoring, litter removal and restriction of motorbike access. These works will be carried out with relevant SMC in place in accordance with Cadw's Monument Management Plan.

10.6.32 In respect of the conservation works, the works proposed will halt ongoing erosive pressure to the monument's fabric and gradual loss of evidential value. With reference to Table 10.2, this is assessed as resulting in a Small Beneficial Magnitude of Change. With reference to Table 10.3, a Small change to a historic asset of High sensitivity such as this would result in a Moderate Beneficial, permanent significant effect.

Non-designated Historic Assets

10.6.33 The following non-designated assets will be affected directly by construction phase impacts.

Glyn Dyrys Upper Level Mine and Tips to West of A470 Tip (B)

10.6.34 The proposed development would result in the spoil tip and mine remains being removed in their entirety. With reference to Table 10.2, this is assessed as resulting in a Large Adverse Magnitude of Change. With reference to Table 10.3, a Large change to a historic asset of Low sensitivity would result in a Moderate Adverse, permanent significant effect.

The Parish Road (C)

10.6.35 The Proposed Development would result in a c.300m section of the Parish Road being removed and this would result in a loss of some of its evidential value, restricting its function as a historic walking route across the landscape.

10.6.36 With reference to Table 10.2, this is assessed as resulting in a Medium Adverse Magnitude of Change. With reference to Table 10.3, a Medium change to a historic asset of Low sensitivity would result in a Minor Adverse, permanent non-significant effect.

Area of the former Glyn Dyrys Pit and the Glyn Dyrys Tip (D)

10.6.37 The proposed development would result in the removal of the earthwork remains related to the former Glyn Dyrys pit and its spoil tip.

10.6.38 With reference to Table 10.2, this is assessed as resulting in a Large Adverse Magnitude of Change. With reference to Table 10.3, a Large change to a historic asset of Low sensitivity would result in a Moderate Adverse, permanent significant effect.

Course of the Cyfarthfa Canal

10.6.39 The proposed development would result in a c.350m section of the former course of the Cyfarthfa Canal being removed. However, the survival of the feature within the Application Site is not fully understood and would only comprise buried remains which have survived later industrial development.

10.6.40 It is likely that most of the canal's remains within the Application Site have already been destroyed by later mining activity and the A470's construction, and the proposed development will have no impact upon any of the parts of the canal known to survive as extant remains, including those that are a scheduled monument. As discussed above, the buried remains of the canal are considered separately to its scheduled parts to the north of the Application Site as an asset of Medium sensitivity.

10.6.41 With reference to Table 10.2, this is assessed as resulting in a Medium Adverse Magnitude of Change. With reference to Table 10.3, a Medium change to a historic asset of Medium sensitivity would result in a Moderate Adverse, permanent significant effect.

Route of the Cwm Pit railway

10.6.42 The proposed development would result in a c.350m section of the former course of the Cwm Pit Railway being removed. As noted above, within the Application Site the railway is not easily distinguished on the ground and now only exists as buried archaeological remains.

10.6.43 With reference to Table 10.2 this impact is assessed as resulting in a Medium Adverse Magnitude of Change. With reference to Table 10.3, a Medium change to a historic asset of Low sensitivity would result in a Minor Adverse, permanent non-significant effect.

Route of the Ynys Fach Railway

10.6.44 The proposed development would result in a c.450m section of the former course of the Ynys Fach Railway being removed, which represents part of the remains of the railway's former route. As noted above, within the Application Site the railway is distinguished on the ground as a footpath, slight earthwork and embankment to the south of the Cyfarthfa Crossing, with the earthwork section to be lost as a result of the Proposed Development.

10.6.45 With reference to Table 10.2, this impact is assessed as resulting in a Medium Adverse Magnitude of Change. With reference to Table 10.3, a Medium change to a historic asset of Low sensitivity would result in a Minor Adverse, permanent non-significant effect.

Old Coal Workings south-west of Lower Collier's Row (E)

10.6.46 The proposed development would result the loss of c.24% of an area that is thought to contain possible old coal workings that date from prior to the late 18th century. At present, without sufficient archaeological data, it is not possible to distinguish which remains are old workings and which are more recent remains of less evidential value. As such, the assessment assumes a worst-case scenario and assesses the whole asset as potentially of Medium sensitivity.

10.6.47 With reference to Table 10.2, this impact is assessed as resulting in a Medium Adverse Magnitude of Change. With reference to Table 10.3, a Medium change to a historic asset of Medium sensitivity would result in a Moderate Adverse, permanent significant effect.

Lower Collier's Row Drift Mines (F)

10.6.48 The proposed development would result in the removal of earthwork remains related to 19th century mining at Lower Colliers Row, which are part of an interrelated group of mining earthworks and building remains that extend to the north and north-west of the Application Site. The loss amounts to c.10% of the group.

10.6.49 With reference to Table 10.2 (see above), this is assessed as resulting in a Small Adverse Magnitude of Change. With reference to Table 10.3, a Small change to a historic asset of Low sensitivity would result in a Minor Adverse, permanent non-significant effect.

Glyn Dyrys Upper Level Tramway (G)

10.6.50 The proposed development would result in a c.100m section of the former course of the Glyn Dyrys tramway being removed, representing c.50% of the remains of the tramway's former route. As noted above, within the Application Site the tramway is distinguished on the ground as an informal footpath.

10.6.51 With reference to Table 10.2, this impact is assessed as resulting in a Medium Adverse Magnitude of Change. With reference to Table 10.3, a Medium change to a historic asset of Negligible sensitivity would result in a Negligible Adverse, permanent non-significant effect.

Trackway

10.6.52 The proposed development would result in the loss of a small part (c.15%) of a north-south pre-industrial trackway which follows the contour.

10.6.53 With reference to Table 10.2, this impact is assessed as resulting in a Small Adverse Magnitude of Change. With reference to Table 10.3, a Small change to a historic asset of Low sensitivity would result in a Minor Adverse, permanent non-significant effect.

Route of the Gethin and Vale of Neath Railways

10.6.54 The proposed development would preserve the former railways within the Application Site as trackways through woodland in the way that they are at present. As such there would be no adverse impact to either of these routes through the Site.



10.6.55 It is anticipated that the use of these routes within the development would involve resurfacing as well as conservation of the stonework and ironwork of the non-designated bridges located across the Neath Railway and adjacent to the Cyfarthfa Crossing. It is anticipated that conservation work to these structures would be set out in a Conservation Management Plan secured by a planning condition.

10.6.56 With reference to Table 10.2, conservation work at the two bridges would result in the cessation of erosive pressures that are presently affecting them adversely and which are gradually reducing their evidential value. Subject to detail on the nature of the works, it is anticipated that this conservation would result in a Medium Beneficial Magnitude of Change. With reference to Table 10.3, a Medium change to a historic asset of Low sensitivity would result in a Minor Beneficial, permanent non-significant effect.

Cyfarthfa Crossing

10.6.57 The proposed development would for the most part preserve the group of trackways and trackside structures that represent the remnants of the Cyfarthfa Crossing railway junction. A new path would be created to the north-west of the junction, winding up the adjacent slope and therefore requiring the removal of the route of the former Ynys Fach railway, which has been described above, and the location where it formerly intersected with the junction.

10.6.58 With reference to Table 10.2, this impact is assessed as resulting in a Negligible Adverse Magnitude of Change. With reference to Table 10.3, a Negligible change to a historic asset of low sensitivity would result in a Negligible Adverse, permanent non significant effect.

Merthyr Tydfil Landscape of Outstanding Historic Interest

10.6.59 The ASIDOHL Assessment identifies the following adverse effects on the MTLOHI from the changes proposed to its contributing HLCA.

- HLCA014 River Taff Canal and Railway Corridor – Moderate;
- HLCA070 Cwm Glo: Tramroad, Plateway and Incline Corridor – Moderate;
- HLCA079 A470 (T) Road – Slight;
- HLCA013 Cyfarthfa Castle and Park – Moderate;
- HLCA022 Clyn-Mil, Pencoedcae and Trebeddau – Slight;
- HLCA023 Clyn-Mil Workings – Slight;
- HLCA024 Graweth and Pen-y-Lan – Slight;
- HLCA025 Nantyrodyn and Bwllfa Workings – Slight;
- HLCA026 Cilfach-yr-Encil – Slight;
- HLCA064 Winch Fawr, Pen-y-Heolgerrig, Cwm Du and Upper Cwm Glo Workings – Moderate; and
- HLCA077 Merthyr Common, South – Slight.

10.6.60 The ASIDOHL2 assessment process does not allow for a single overall concluding impact upon the MTLOHI, rather the guidance states that:

"Scores should not be combined and averaged out for all the Historic Character Areas affected, but they should be shown separately, to allow developers, planning authorities or Public Inquiry Inspectors to guide development into those Historic Character Areas where the least reduction in the value of the historic landscape area on the Register is caused."

10.6.61 The MTLOHI is not a designated historic asset in its own right rather it is non-statutory and advisory only. As such it is not ascribed a degree of sensitivity and the impacts listed above are not applied to it in EIA terms.

10.6.62 Based on the ASIDOHL assessment process, as an advisory conclusion on the impact of the Development on the MTLOHI, it should be noted that of the 79 HLCAs that make up the MTLOHI the Development would only affect 11. With reference to Table EDP 5.1 in the ASIDOHL Assessment, four HLCAs would receive a moderate effect and the rest only a slight effect. Of the HLCAs affected all will retain the majority of their historic, industrial-era assets which contribute specifically to the historic character of the MTLOHI, and none of them would be severely affected such that they lose all or even a large proportion of their former industrial archaeological features. As such, overall, when assessing the planning balance, it is recommended that the Proposed Development should only be considered to result in a Minor Adverse, permanent non-significant effect on the MTLOHI, which will largely retain its historic value and character.

10.6.63 It should also be considered that the ASIDHOL process does not account for enhancement measures or mitigation within its calculations and, as set out in Sections 5 and 6 of the ASIDHOL report the adverse impacts should be considered whilst also giving due regard to the proposed conservation and interpretation works that will serve to protect some of the key historic assets in HLCA 014 and better present the Application Site's archaeology to the public.

Operational Phase Effects

10.6.64 This section assesses the likely significant environmental effects of the proposed development following completion, with embedded design mitigation in place. It defines the sensitivity of historic assets that are receptors to the indirect effect of development, i.e. changes to their setting, such that its contribution to their significance is affected. It then defines the significance of the effect on these receptors.

10.6.65 This part of the assessment represents Steps 3 and 4 of the Settings Assessment Process (HE, 2017) as it relates to the effect of the proposed development on heritage receptors. Steps 1 and 2 of the process have been discussed in the Baseline Conditions section above and described in full in the Archaeological and Heritage Baseline Assessment.

10.6.66 The magnitude of change is viewed in conjunction with the sensitivity of the historic assets, to appreciate and determine the overall significance of effect. Assessing the significance of effects uses the matrix illustrated in Table 10.3.



Scheduled Monument, Vale of Neath Railway Cutting and Tunnel Portal (GM606: High sensitivity)

10.6.67 The Archaeological and Heritage Baseline Assessment describes how the monument's setting, such that it contributes to its significance, comprises the former track route that approaches it, the deeply incised cutting through which it runs and the bridges along its course which are experienced on the approach to the tunnel itself.

10.6.68 The proposed development would bring forward conservation works to some of the bridges along the Neath Railway so as to improve their condition. This work is anticipated to improve the appearance of the bridges and thus improve the quality and appearance of part of the asset's setting.

10.6.69 Subject to detail on the nature of the improvements to the bridges, it is anticipated that the improved condition and appearance of the bridges would result in a Small Beneficial Magnitude of Change. With reference to Table 10.3, a Small change to a historic asset of High sensitivity would result in a Moderate Beneficial, permanent, significant effect.

Scheduled Monument, Cwm Pit and Head of Railway (GM607: High sensitivity)

10.6.70 The Archaeological and Heritage Baseline Assessment describes how closely related remnants of the former industrial landscape represent aspects of the monument's setting that contribute to its heritage significance to a low degree.

10.6.71 These include the route of the former Cwm Pit railway, spoil tips located to the north and the earthwork remains of an inclined railway used to deposit spoil, the earthwork remains of a railway and the Cwmfelin Drift mine to the west, and the Scheduled Monument Cyfarthfa Balance Pond and Leat which had a functional relationship with the mine.

10.6.72 Otherwise, this scheduled monument is located within a densely wooded area. Invasive vegetation currently causes damage to the monument, as well as screening views to it and obscuring its relationship with functionally and historically related features in the landscape, thus representing a negative aspect of its setting that detracts from its significance to a moderate degree.

10.6.73 The proposed development would not change the character of the monument's present setting, which would remain wooded, and most of its related archaeological elements would be unaffected. The Development would cause the loss of part of the former course of the Cwm Pit railway, further to the north. The section leading up to the monument itself has been occupied by a water course and largely eroded which has almost entirely reduced its presence as a former railway. This route would become the location of the drainage ditch described above which would run past the monument on its north-west side outside of the scheduled area. The ditch would be visible adjacent to the monument to the north west and thus would be present in the monument's setting; part of the experience of the monument from the north-west from where its walls are prominent.



10.6.74 The location of the ditch now has little relevance to the monument's historic function and the historic appearance of its setting. This is due to the track bed being eroded by water and the area's dense wooded character. As such, its imposition would not damage or destroy any aspect of the monument's setting that contributes to its significance. Its finished design is not yet established and, as set out previously, would be defined within a Reserved Matters application. As such, at this stage it is not possible to comment on the appearance of the ditch in relation to the north-west side of the monument. However, a plain modern finish would be considered the most appropriate finish as that would indicate that the ditch is a recent addition rather than confusing it with elements of the historic environment.

10.6.75 The proposed walking routes that will run up to and across the monument would add a new element to the monument itself and part of its adjacent surroundings that would change the way in which the monument is experienced. In this respect they would facilitate public access to the monument in a controlled and managed form and allow for presentation of the monument via bilingual interpretation information both at the monument and, along with other information on the Application Site's heritage, within the Development's welcoming atrium, thus highlighting its historic function, its relationship to the wider history of Merthyr and Cyfarthfa and with Wales' industrial heritage.

10.6.76 The footways themselves would cover the existing paths, which as described previously, have developed along the routes of former tramways. On none of these routes are sleepers or rails preserved and so the existing paths reflect little of the appearance of the former mine. As such, masking these features would have little implication for the experience of the monument.

10.6.77 Upstanding elements such as handrails that might be required on slopes, or information boards, would not restrict any appreciation of the monument's aesthetic elements. Indeed, the provision of the new routes would make it easier to experience the more striking parts of the monument, such as the revetment wall which would be visible from a location on the walking route outside of the monument boundary to the north-west. Given that the monument's setting has diverged considerably from the industrial landscape in which it functioned, and that there are few elements in its setting which contribute positively to its significance, the imposition of the walking route and interpretative materials would not adversely affect any aspect of its setting that makes a positive contribution to its significance.

10.6.78 Visitor numbers to the monument would increase and the walking route would add a new, modern layer of development and activity across the monument, with the monument becoming part of a walking route within the development rather than sitting in isolation within woodland. However, the proposed infrastructure would not mask any elements that contribute visually to the monument's significance, affect any features in the wider landscape which contribute positively to the monument's significance or directly screen any features of aesthetic value at the monument. Furthermore, the proposals will allow managed and controlled access to the monument (which is currently not accessible) and thus, whilst numbers of visitors will increase, they will be guided around the monument on walkways that are designed to protect its fabric, rather than just being free to roam. The walkways will also facilitate interpretation of the monument to the public and thus allow for its history and its significance to be presented, bilingually, in a way that it is not currently.

10.6.79 As such, a Small Beneficial Magnitude of Change is assessed from change to the setting of the monument. With reference to Table 10.3, a Small change to a historic asset of High sensitivity would result in a Moderate Beneficial, permanent, significant effect.

Scheduled Monument, Cyfarthfa Balance Pond and Leat (GM608: High sensitivity)

10.6.80 The Archaeological and Heritage Baseline Assessment describes how closely related remnants of the former industrial landscape represent aspects of the monument's setting that contribute to its heritage significance to a low degree.

10.6.81 These include the remains at Cwm Pit, Lower Colliers Row and Glyn-Dyrys mines, as well as buried remains related to the Cyfarthfa Canal. However, due to dense woodland surrounding the monument and where water erosion has destroyed extant archaeology across an area to the east, the historic and functional associations between the scheduled monument and these features cannot be readily experienced through a visual connection. Although waterlogging will be alleviated to a degree by the MTBC engineering works described previously, extent remains in the monument's locality are already damaged.

10.6.82 As such, the surrounding woodland (which also encroaches physically upon the monument's fabric) is considered to be a negative aspect of its setting which detracts from its significance to a moderate degree.

10.6.83 The proposed development would remove problematic woodland to the east and north of the monument. However, it would also result in a loss of archaeological remains at Glyn-Dyrys, as well as any surviving buried remains related to the Cyfarthfa Canal.

10.6.84 Modern structures would also dominate the monument's setting to the north, where the northern end of the monument would be adjacent to the Snow Centre and Indoor Activity Centre. These buildings would occupy the spaces between the monument and the former mine workings at Lower Collier's Row to the north, which would reduce the legibility of the former association, albeit an association that is already of a minimal degree of legibility due to later changes in the landscape and the presence of intervening woodland.

10.6.85 The Outdoor Activity area to the east would retain its woodland character. Whilst not presently fixed, equipment proposed there would most likely be located within the trees and would almost certainly not be visually prominent in views from the edge of the monument and thus have little implication for the experience of the scheduled monument, which at its southern end would continue to be experienced in a wooded environment much as it is presently.

10.6.86 The monument's association with Cwm Pit to the south would however be largely unchanged from its present situation.

10.6.87 As for the Cwm Pit monument, the Balance Pond and Leat would be crossed by a modern footway which would be part of a Heritage Trail designed to provide managed and controlled access to the monument and facilitate its interpretation. This development would add a new element to the monument itself and part of its adjacent surroundings that would change the way in which the monument is experienced. As with Cwm Pit, they would facilitate public access to the monument in a controlled and managed form and allow for presentation of the monument via bilingual interpretation information both at the monument and, along with other information on the Application Site's heritage, within the Development's welcoming atrium, thus highlighting its historic function, its relationship to the wider history of Merthyr and Cyfarthfa, and with Wales' industrial heritage.

10.6.88 The footways themselves would cover the existing paths and would bridge the brick-lined sluices that the path crosses. These bridges are envisaged as timber boardwalks and would be carefully designed so as not to result in damage to the sluices themselves. Their presence would be unlikely to screen any view of the sluices which would still be appreciable.

10.6.89 Upstanding elements such as handrails that might be required on slopes or information boards would not restrict any appreciation of the monument's aesthetic elements. Indeed, the provision of the new routes would make it easier to experience the monument, and a view of the Pond and Leat would be achievable from the walkway in which the monument's historic function can be appreciated. Given that the monument's setting has diverged considerably from the industrial landscape in which it functioned, the imposition of the walking route and interpretative materials would not adversely affect any aspect of its setting that makes a positive contribution to its significance.

10.6.90 Visitor numbers to the monument would increase and the walking route would add a new, modern layer of development and activity across the monument, with the monument becoming part of a walking route within the development rather than siting in isolation within woodland. However, the proposed infrastructure would not mask any elements that contribute visually to the monument's significance, affect any features in the wider landscape which contribute positively to the monument's significance or directly screen any features of aesthetic value at the monument. Furthermore, the proposals will allow managed and controlled access to the monument (which is not currently accessible) and thus, whilst numbers of visitors will increase, they will be guided around the monument on walkways that are designed to protect its fabric, rather than just being free to roam. The walkways will also facilitate bilingual interpretation of the monument to the public and thus allow for its history to be presented in a way that it is not currently.

10.6.91 Whilst the monument would become dominated by modern buildings at its northern end, it should be recognised that the best preserved and most archaeologically interesting part of the monument is at its southern end which would remain open and experienced, as it is now, within woodland, albeit with a formalised and modernised walkway along it. It should also be considered that the present setting, which the development would replace, is of dense woodland that is also unrelated historically and functionally to the monument, as it would have been situated, historically, in a more open landscape with a heavily industrialised character. In this respect, it is primarily the loss of historically associated archaeological remains within the wider landscape that would result in an adverse effect on the monument, rather the change in character of the monument's surroundings.

10.6.92 With reference to Table 10.2, overall, the changes to the monument's setting, considering both the nearby buildings and loss of associated archaeological remains would be considered to result in a Small Adverse Magnitude of Change. However, this impact should be considered in tandem with a Small Beneficial Magnitude of Change (in common with the Cwm Pit monument) brought by the benefit to the monument's heritage value through its managed and controlled access and enhanced interpretation.

10.6.93 In concluding an effect, it is assessed that these changes to the setting of a historic asset of High sensitivity would result in both a Moderate Adverse, permanent, significant effect and a Moderate Beneficial, permanent, significant effect.

Scheduled Monument, Cwm Glo Pit and Ironstone Tip (GM611; High sensitivity)

10.6.94 The setting of the scheduled monument and its contribution to its significance is described in the Archaeology and Heritage Baseline Assessment, which describes how functionally related elements preserved in the surrounding landscape make a contribution in that regard.

10.6.95 These include earthworks and paths representing former tramways, and in particular the earthwork remains of an incline to the east, adjacent spoil tips, remains of the Cwm Glo level to the south-east and the remains of possible early mining works in the deeply incised Cwm Glo valley to the south-west.

10.6.96 Also of relevance to the asset's setting is the degree of openness at its location, where an open, grassland setting allows for the monument's component parts to be experienced in conjunction with each other, and with some, more visible, elements of the wider historic environment which relate to them, such as the surrounding spoil tips and the incline railway. This openness is considered to be a neutral aspect of its setting. Beyond the grassed areas, in particular to the south, is dense woodland which serves to screen views from the monument to related former industrial features located to the south.

10.6.97 The proposed development would be located c.780m south of the monument. It would introduce modern built form into its wider setting and thus change its present woodland setting to a more developed form. The buildings would be prominent when viewed from the monument, which has an elevated location on account of its spoil tips, but they would not affect any of the surrounding historic assets which have a strong functional and historical association with the monument. Furthermore, the view would only be from the vantage point at the southern edge

of the monument, and from its western and northern parts the Development would not be visible, and the monument's setting would be unchanged.

10.6.98 Given the lack of relevance to the monument's significance that the woodland to the south has, and that the Development would have no effect on any of the nearby former industrial features that are closely related to the monument, it is concluded that the Proposed Development would have no effect on the heritage significance of the scheduled monument.

Scheduled Monument, Cyfarthfa Canal Level (GM467: High sensitivity)

10.6.99 The Archaeological and Heritage Baseline Assessment describes how the monument is heavily encroached upon by woodland which is detrimental to its setting and detracts from its significance as a designated historic asset.

10.6.100 The monument is closely associated (functionally and historically) with other remnants of the Cyfarthfa Canal, including some preserved parts to the north, and any buried remains of the canal elsewhere which could include buried remains located within the Application Site if these still exist. As such, remains of the canal represent elements of the monument's setting that contribute to its significance as a historic asset.

10.6.101 More tangible remains, such as those of a former aqueduct and lock (located to the north) would contribute to its significance to a moderate degree, whereas buried remains elsewhere along the canal's former course would only contribute in that respect to a small degree.

10.6.102 As previously noted, the proposed development would lie across part of the former course of the Cyfarthfa Canal and may result in the loss of buried remains related to the canal located between c.350m and 900m south of the monument. The loss of such remains would result in the loss of a small and fairly distant element of the canal level monument's setting and result in an adverse effect on its significance.

10.6.103 With reference to Table 10.2, the changes to the monument's setting are considered to result in a Negligible Adverse Magnitude of Change. With reference to Table 10.3, a Negligible change to a historic asset of High sensitivity would result in a Minor Adverse, permanent, non-significant effect.

Scheduled monument, Cyfarthfa Tramroad section at Heolgerrig (GM495: High sensitivity)

10.6.104 The Archaeological and Heritage baseline Assessment describes how the monument's setting is defined by adjacent agricultural fields which represent an open area across which it can be experienced, as well as nearby related former industrial remains such as extant spoil tips, remains of a reservoir and remains related to mine working which together contribute to its significance as a historic asset. The wider landscape does not make any additional contribution.

10.6.105 The proposed development would be located c.1.8km to the south-east and may be visible as a distant modern feature seen above nearby buildings in Heolgerrig. The change to a distant part of the wider landscape would have no effect on any elements of the monument's setting that contribute to its value. As such, the Proposed Development would have no effect on the

asset's heritage significance.

Scheduled Monument, Black Pins Early Ironstone Workings (GM609: High sensitivity)

10.6.106 The setting of the scheduled monument and its contribution to its significance is described in the Archaeology and Heritage Baseline Assessment.

10.6.107 This describes how the monument is mostly encroached upon by invasive woodland, although open areas are present at the highest points of its spoil tips. This surrounding wooded environment screens views to much of the monument and has little relevance to its historic setting which would have been more open and defined by industrial activity. Hence, in this regard, it detracts from its heritage significance.

10.6.108 The monument has an association with other former industrial remains in the locality, including a former tramway and leat that ran north-east from the mine, as well as a historic link with the Winch Fawr works (scheduled monument GM554) located further across the hillside to the north-west. These related features in the surrounding landscape contribute to the monument's significance to a small degree. Otherwise, the monument's topography also represents a positive element of its setting, with its prominent position on the hillside allowing for views of its spoil tips from a broad area; a topographic situation that is considered to enhance the monument's limited aesthetic value to a moderate degree.

10.6.109 The proposed development would replace a swathe of the woodland visible to the east of the monument with modern buildings. Whilst surrounding woodland is considered to be a negative aspect of the monument's setting and serves to restrict views from the monument, the Proposed Development would not alleviate this effect because it would only remove one specific area to the east, rather than the woodland which directly surrounds and encroaches upon the monument.

10.6.110 The development would introduce modern built form into the wider surroundings of the monument and thus change its present woodland setting to a more developed form. The buildings would be prominent, although only part of the development would be visible, most likely comprising the snow centre and hotels below. The development would not separate the monument from directly related archaeological features, as its related tramroads and leats are located to the north-east and the historically related monument GM554 would be unaffected. Furthermore, the view would only be from the vantage point at the eastern edge of the monument's spoil tips and from its western parts the proposed development would not be visible, and the monument's setting would be unchanged.

10.6.111 Consequently, the proposed development would compete with the prominence of the scheduled monument and thus detract to a small degree from the aesthetic aspect of its heritage value. With reference to Table 10.2, the changes to the monument's setting are considered to result in a Small adverse Magnitude of Change. With reference to Table 10.3, a Small change to a historic asset of High sensitivity would result in a Moderate Adverse, permanent significant effect.



Grade II Historic Park and Garden, Cyfarthfa Castle (High sensitivity)*

10.6.112 The Cyfarthfa Castle Park represents the designed landscape associated with Cyfarthfa Castle, which lies within it, and which was the seat of the Crawshay family of industrialists. There is a close association between the park, castle and elements of the wider landscape which were closely associated historically and functionally with the Crawshays, such as the remains of the Cyfarthfa Ironworks to the west and planned housing at Morgantown. All of these elements have a historic integrity and contribute, to a moderate degree, to the heritage significance of the park.

10.6.113 Views across the park are possible that incorporate historically related parts of the landscape, and thus are relevant to the park's significance, but which are also of a highly modern urban environment. In this respect, views in the general direction of the Application Site would have been to the Crawshay's land holdings and mining areas which were closely associated with the house, park and their industrial empire. Presently, the industrial remains are derelict, the views to them restricted by woodland and areas containing numerous modern buildings. As such, the association is now mainly historical and the industrial remains in and around the Application Site contribute to the value of the park to only a negligible degree.

10.6.114 Views are possible from parts of the park that would include the Proposed Development. The Proposed Development would appear as a group of large modern buildings set across distant wooded slopes on the hillsides visible to the south and south-east of the parkland (between 1.9 and 2.5km away).

10.6.115 Although the proposed development would be eye-catching, views to the hillsides to the south from the park would continue to invoke the historic connection between the estate and the extent of its mining empire, and in that regard the proposed development would have no effect on the more important and more tangible associations in the more immediate landscape between the castle, parkland, iron works to the south-west and industrial era housing in the town.

10.6.116 Nevertheless, the proposed development would be noticeable and appear as a new modern feature across wooded hillsides, which form a backdrop in views across the park that incorporate attractive parkland elements such as mature trees and a lake. In this respect, the proposed development's presence may distract slightly from views across the park in which its aesthetic quality can be experienced and appreciated. Nonetheless, it should be considered that the views out from the park also include many modern buildings and so are not of an unspoilt rural or industrial era landscape.

10.6.117 With reference to Table 10.2, the changes to the park's setting are considered to result in a Negligible adverse Magnitude of Change. With reference to Table 10.3, a Negligible change to a historic asset of High sensitivity would result in a Minor Adverse, permanent non-significant effect.

Grade I Listed Buildings Cyfarthfa Castle and School at Cyfarthfa Castle (11396 and 11397: High sensitivity)

10.6.118 The setting of the Grade I listed buildings at Cyfarthfa Castle primarily comprises the surrounding parkland, which was closely associated with the castle and within which it is experienced. The park contributes highly to the castle's significance.

10.6.119 In common with the assessment for the park, historically and functionally related elements in the wider landscape are key aspects of the house's setting that contribute to its value to a moderate degree, inclusive of the remains of the Cyfarthfa Ironworks to the west and planned housing at Morgantown.

10.6.120 Views out from the front of the castle are to the hillsides to the south that would have represented the Crawshay's land holdings and mines and would probably have been intentional. Although the view is now highly modernised, the industrial remains are derelict, and the views to them restricted by woodland, some historical value is retained and the view to the hillsides and the presence of industrial era remains in the view contributes to a negligible degree to the asset's value.

10.6.121 A view of the proposed development would mostly be screened from the castle by intervening mature trees, however, glimpsed views are likely from certain locations along the castle's frontage. In such views the Proposed Development will be eye-catching but distant, appearing as a new modern structure amongst wooded slopes. Given that an appreciation of the former historic landholding and industrial nature of the hillsides to the south will still be possible from the castle, and given the glimpsed nature of the view to the development and lack of any effect on the castle's more immediate setting, the Proposed Development will have no effect on the heritage value of the listed buildings at Cyfarthfa Castle.

Grade II Listed Buildings: Nos. 1-16 Upper Colliers Row – ten separate listings (11488, 80765, 80766, 80767, 80772, 80773, 80774, 80775, 80776, 80777) (Medium sensitivity)

10.6.122 The Archaeology and Heritage Baseline Assessment describes how the row of cottages, which have a strong association with each other, are set along a lane, with closely associated garden enclosures to the south and industrial tips to the west, both of which represent elements of their setting that contribute positively to their value. The A470 dual carriageway passes to the east representing a negative element of their setting.

10.6.123 The ZTV only lightly interacts with the cottages, and it is doubtful whether the development would actually be visible from any of the cottages themselves due to intervening buildings, walls, hedges and trees. At most, glimpsed views from the adjacent roadside to the east may be possible to the top of the ski centre. If visible it would be seen just above a modern building, modern fencing and trees, and would not impose strongly into the view.

10.6.124 Given the likely lack of views to the proposed development from the cottages, and that there is no direct functional or historical association between the cottages and the land at the Application Site, it is assessed that the Proposed Development will have no effect on the heritage value of the listed buildings.

Cyfarthfa Conservation Area (Medium sensitivity)

10.6.125 The Cyfarthfa Conservation Area correlates closely with Cyfarthfa Park, as well as with historically associated features in the valley to the west, the location of the scheduled monument Cyfarthfa Ironworks. The valley area and scheduled monument have been scoped out of the assessment due to an absolute bare minimal interaction with only a small part of the valley, where the ZTV identifies that there would be no realistic views of the proposed development from this part of the conservation area. The effects of the proposed development on Cyfarthfa Park have been detailed previously and the assessment of effects on the conservation area defers to this assessment.

10.6.126 With reference to Table 10.2, the changes to the conservation area's setting are considered to result in a Negligible adverse Magnitude of Change. With reference to Table 10.3, a Negligible change to a historic asset of Medium sensitivity would result in a Negligible Adverse, permanent non-significant effect.

Morgantown Conservation Area (Medium sensitivity)

10.6.127 The Morgantown Conservation Area represents an area of planned industrial settlement of the 19th century, associated with the adjacent Cyfarthfa Ironworks. It contains four Grade II listed buildings, three of which are historic chapels within the town and the other being a former 19th century blacksmith. The area's architectural interest is the key aspect of its significance, as identified in the relevant character appraisal (Morgantown Conservation Area Appraisal, MTCBC, 2009b).

10.6.128 Whilst views out from the conservation area to the wider townscape are possible, the Council's Appraisal notes that, because of the adjacent urban areas, the "views from vantage points within the conservation area do not offer spectacular viewing". Views out of the town to the more distant hillsides beyond the urban area are not mentioned in the Appraisal and are deemed to be of little relevance to this urban conservation area and the listed buildings located therein.

10.6.129 Only a very small part of the ZTV interacts with the conservation area, suggesting that the Proposed Development (located c.1.37 km to the south) may be visible as a distant area of modern development on the far valley side in glimpsed views between and across adjacent buildings from the southern edge of the conservation area, but not from any of its listed buildings.

10.6.130 As such, views are of little relevance to the character and appearance of the conservation area and the inclusion of further modern development within the view would have no effect on the conservation area, and its character and appearance would be preserved.

Thomas Town Conservation Area (Medium sensitivity)

10.6.131 Thomas Town Conservation Area is located on west facing slopes on the eastern side of the town. The asset's 'special interest' is mostly characterised by its architectural interest, representing an area of Georgian and Victorian planned urban development, which includes key municipal buildings and the course of the historically significant Pen-y-Darren tramroad. It includes 30 Grade II listed buildings.

10.6.132 The conservation area's special interest is defined in an Appraisal (MTCBC, 2009a). This document identifies key views from the higher eastern parts of the conservation area to the west across the centre of the town. As for Morgantown (see above), views in the direction of the Application Site are not noted as being of any particular significance. The ZTV only interacts with a small part of the conservation area on its south-eastern edge and central areas. This mainly avoids its various listed buildings, aside from three villas which occupy enclosed plots within gardens, and for which views out to the distant countryside are of little relevance to their heritage interest.

10.6.133 As such, views of the proposed development as a distant group of modern buildings located on a far hillside to the south (c.920m from the conservation area's southern boundary) are of little relevance to the character and appearance of the conservation area or the heritage value of the listed buildings within its boundary. As such, the inclusion of further modern development within the view would have no effect on the conservation area and therefore its character and appearance would be preserved, as would the heritage significance of its listed buildings.

Town Centre Conservation Area (Medium sensitivity)

10.6.134 The Town Centre Conservation Area is also primarily defined by its built heritage and architectural interest, containing 26 listed buildings, with one at Grade II* and 25 at Grade II. However, it is stated in the Character Appraisal (Town Centre Conservation Area Appraisal, MTCBC, 2009c) that "particularly important" views include a "vista west and south-west from Castle Street and Swan Street to Mynydd Aberdare and Mynydd Gethin including the historic iron and coal extraction landscape above Heolgerrig".

10.6.135 Whilst the ZTV for the proposed development does interact with the conservation area in some locations, it does not fall across either of these streets and, notwithstanding this fact, the Proposed Development would be located due south of the conservation area anyway and not to the west and south-west. As such, it would not be present in this key view.

10.6.136 Aside from a few small locations, the ZTV's main interaction is with part of the southern end of the conservation area, where the proposed Development would be visible as an area of modern development on the far valley side, c.670m from the conservation area to the south. It would probably also be visible from the Grade II listed St Tydfil's Church.

10.6.137 Views from this part of the conservation area to the far side of the valley are of little relevance to its character and appearance and already include considerable amounts of modern development in the foreground. As such, the inclusion of an additional group of modern buildings in the distance in such views would have little relevance to the conservation area's



character and appearance or the heritage significance of any of its listed buildings. Consequently, it is assessed that the proposed development would have no effect on the conservation area or the value of any of the listed buildings within it and its character and appearance would be preserved.

10.7 Additional Mitigation, Compensation and Enhancement Measures

Construction Phase

10.7.1 The following measures are suggested to mitigate impacts upon non-designated historic assets within the Application Site by way of archaeological recording.

10.7.2 Given the nature of the Application Site's archaeological resources as a series of earthworks, following the clearance of vegetation a programme of topographic survey is proposed that will record the surface impressions of features before their loss. It is anticipated that the following non-designated historic assets would be recorded in this way:

- Glyn Dyrys Upper Level tips to west of A470 Tip;
- The Parish Road;
- Lower Collier's Row drift mines;
- Area of the former Glyn Dyrys Pit and the Glyn Dyrys Tip; and
- Old coal workings south-west of Lower Collier's Row.

10.7.3 In accordance with PPW 11 and TAN 24, a phase of intrusive archaeological investigations would follow on following CIfA guidance (i.e. CIfA, 2020). This would comprise trenching and/or excavation at several key historic assets within the Site. Suggested intrusive excavation is suggested for each asset in the sub-sections below.

10.7.4 The works would be secured by an appropriately worded planning condition agreed with MTCBC. The scope and methodology of the proposed works would be set out in a Written Scheme of Investigation (WSI) which would be agreed in advance of submission with GGAT as MTCBC's archaeological advisors.

10.7.5 Given the nature of the archaeology as remains related to features of the local area's recent industrial history, it is proposed that the mitigation works provide a suitable subject for community involvement in the archaeological process. As such, a contractor will be employed who is able to deliver community engagement as part of their remit and the WSI will include scope for engagement with local community heritage interest groups or other community organisations (such as schools). Suggested involvement might include active participation in archaeological recording and/or involvement in the interpretation and presentation of finds and features. However, it is anticipated that the precise remit would be developed by the contractor's community engagement professionals in consultation with MTCBC's archaeological advisors, GGAT.

10.7.6 It is also proposed that the data generated by the mitigation works will be presented as part of a bilingual heritage display, along with other information on the Application Site's heritage including its scheduled monuments within the development's plaza. In this way the archaeological mitigation will tie into the general heritage interpretation as proposed that will be outlined in a Conservation Management Plan post-consent, with the Heads of Terms document submitted with the application outlining the content of this document.

10.7.7 Further, it will also bring these assets into the wider tapestry of Merthyr's historic landscape which includes Cyfarthfa Castle and the Ironworks to compliment and connect with Merthyr's wider 20-year Cyfarthfa Plan project thereby realising key National policy goals in respect of Welsh tourism, community, cultural development, sustainability and those embedded (for example) in the Wellbeing of Future Generations Act.

Area of the former Glyn Dyrys Pit and the Glyn Dyrys Tip

10.7.8 The topographic survey would be followed by targeted trenches based on the survey results; for example, across the possible location of the former engine house.

Course of the Cyfarthfa Canal, Route of the Cwm Pit railway, Glyn Dyrys Upper Level tramway and Route of the Ynys Fach and Gethin Railways

10.7.9 These linear features would be subject to archaeological trenching in an attempt to cut a section through their remains. It is anticipated that a trench would be cut though each feature at an appropriate location where remains are most likely to survive.

Old Coal Workings south-west of Lower Collier's Row

10.7.10 Following topographic survey, the nature and provenance of the pits would be assessed, and specific examples of potentially older date investigated and recorded through excavation or trenching.

Operational Phase

10.7.11 Embedded mitigation includes the design and delivery of a CMP in respect of three scheduled monuments. As detailed above, this will include measures proposed regarding the conservation and restoration of the historic assets in question and well as enhanced interpretation (such as through the establishment of a Heritage Trail) in order to offset adverse effects arising from change within the setting of the assets. No further additional mitigation measures are proposed in relation to Operational Phase effects.

10.8 Assessment Summary and Likely Significant Residual Environmental Effects

10.8.1 The residual effects assessment assumes that the archaeological mitigation described in the section above and embedded mitigation measures proposed as part of the scheme will be implemented in full.

Construction Phase

Non-designated historic assets

Glyn Dyrys Upper Level Mine and Tips to West of A470 Tip (B)

10.8.2 Mitigation would comprise the recording of the tips and mine via topographic survey. As stated above, any WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the development. This mitigation would serve to reduce the magnitude of change by an increment to Medium Adverse resulting in a Minor Adverse, permanent non-significant residual effect.

The Parish Road (C)

10.8.3 Mitigation would comprise the recording of the Parish Road's location via topographic survey. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the development. This mitigation reduces the magnitude of change by an increment to Small Adverse resulting in a Minor Adverse, permanent non-significant residual effect.

Area of the former Glyn Dyrys Pit and the Glyn Dyrys Tip (D)

10.8.4 Mitigation would comprise the recording of the pit and tips via topographic survey and archaeological investigation through trenching and/or excavation. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the Development.

10.8.5 This mitigation would serve to reduce the magnitude of change by an increment to Medium Adverse resulting in a Minor Adverse, permanent non-significant residual effect.

Course of the Cyfarthfa Canal

10.8.6 Mitigation would comprise the recording of the canal in section by digging a trench across part of its known course. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the development.

10.8.7 This mitigation would serve to reduce the magnitude of change by an increment to Small Adverse resulting in a Minor Adverse, permanent non-significant residual effect.

Route of the Cwm Pit Railway

10.8.8 Mitigation would comprise the recording of the railway in section by digging a trench across part of its known course. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the development.

10.8.9 This mitigation would serve to reduce the magnitude of change by an increment to Small Adverse resulting in a Minor Adverse, permanent non-significant residual effect.

Route of the Ynys Fach Railway

10.8.10 Mitigation would comprise the recording of the railway in section by digging a trench across part of its known course. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the Development.

10.8.11 This mitigation would serve to reduce the magnitude of change by an increment to Small Adverse resulting in a Minor Adverse, permanent non-significant residual effect.

Old Coal Workings south-west of Lower Collier's Row (E)

10.8.12 Mitigation would comprise the recording of the coal workings via topographic survey and archaeological investigation through trenching and/or excavation. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the Development.

10.8.13 This mitigation would serve to reduce the magnitude of change by an increment to Small Adverse resulting in a Minor Adverse, permanent non-significant residual effect.

Lower Collier's Row Drift Mines (F)

10.8.14 Mitigation would comprise the recording of the mine remains via topographic survey. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the Development.

10.8.15 This mitigation would serve to reduce the magnitude of change by an increment to Negligible Adverse resulting in a Negligible Adverse, permanent non-significant residual effect.

Glyn Dyrys Upper Level Tramway (G)

10.8.16 Mitigation would comprise the recording of the tramway in section by digging a trench across part of its known course. As stated above, the WSI will include scope for community involvement in the archaeological process and data from this work will feed into other heritage interpretation proposed within the Development.

10.8.17 This mitigation would serve to reduce the magnitude of change by an increment to Small Adverse resulting in a Negligible Adverse, permanent non-significant residual effect.

Trackway

10.8.18 No mitigation is proposed regarding the loss of the trackway. The effect to the asset would remain as a Minor Adverse, permanent non-significant residual effect.

Operational Phase

No mitigation measures additional to the embedded measures set out above are proposed. As such the effects identified previously are unchanged and should be considered as residual effects.

10.9 Cumulative Impacts

10.9.1 This section presents an assessment of cumulative effects arising from the Proposed Development. Cumulative effects are assessed in relation to effect interactions, with environmental effects identified by other disciplines having an impact upon heritage receptors, and in-combination effects arising from other committed and proposed development projects in the locality.

10.9.2 In summary, there are no cumulative or in-combination impacts or effects from the development.

Effect Interactions

10.9.3 With regard to effect interactions, these are restricted to effects related to the Landscape and Visual Assessment, the effects assessed are not analogous with effects identified within the report. However, it is considered that commentary on the Application Site's visibility in the report reflects the nature of views to and from the Application Site to heritage assets, as referenced in the assessment outlined above.

In-combination Effects

10.9.4 In-combination effects are assessed from the proposed development in conjunction with the committed planning permissions and pending planning applications listed below.

Bike Park Wales: P/19/0073

10.9.5 Planning permission was granted in March 2019 for "Provision of 36 camping pods and 5 chalets, erection of shower/toilet block and creation of play and picnic area. Construction of new parking area (150 spaces) with overflow carpark (46 spaces), together with a trail maintenance yard, new highway access routes, ground profile works, drainage, infrastructure and landscape works."

10.9.6 The application was supported by an archaeological desk-based assessment and ASIDOHL2 assessment (Black mountains Archaeology, 2019). These assessments did not identify any effects on specific historic assets. With regard to the MTLOHI, the ASIDHOL2 assessment identified a slight effect on HLCA 072 Waunwyllt, Pen y Lan and Graig Gethin, and a very slight effect on 12 other HLCAs. Overall, the assessment concluded a slight effect on the MTLOHI.

10.9.7 GGAT commented on the ASIDOHL2 assessment, concluding in a letter of 12 November 2019 that the development would result in no overall 'direct adverse impact' upon the MTLOHI.

10.9.8 The ASIDOHL2 assessment that supports this assessment does not conclude any effect on HLCA 072, as such, there would be no in-combination cumulative effect on this HLCA. The very slight effects to other HLCAs assessed for Bike Park Wales are considered to be negligible and would not be sufficient to combine with effects from the proposed development such that they result in a noticeably increased effect on any HLCAs.

LDP Allocated Sites in Proximity to the Site

10.9.9 The Application Site is in close proximity to two areas that are allocated under Policies EcW1 and EcW2 of the LDP, the Rhyd-y-car Business Park (c.50m to the north) and part of the Hoover Strategic Regeneration Area (c.300m to the east). However, these two areas are separated from the Application Site by the A470. Both areas are existing employment areas characterised by modern light industrial buildings. The allocations are designed to protect existing employment areas and all development would be of Use Class B1 or an ancillary service.

10.9.10 In this respect development in these allocations would not change the character of the existing landscape and thus environmental effects on historic assets would be unlikely to occur. As such, in combination effects with the Proposed Development are unlikely.

10.9.11 The wider Hoover Strategic Regeneration Area is allocated under Policy SW6 for a mixed-use development comprising residential development, employment and commercial as well as public open space. The main area of the allocation is to the south and east of the EcW1 allocation and thus further from the Site boundary.

10.9.12 Located entirely within the Taff Valley, and in itself involving the redevelopment of areas of older modern development (such as the Hoover factory), the implementation of the allocation would have little relevance to the settings of historic assets located within the woodland that surrounds the Application Site and which are sensitive to the proposed development. The allocated site would be entirely screened from these assets by woodland.

10.9.13 Neither would it have any effect on the setting of the Cyfarthfa Conservation Area and historic park and garden from which it would be screened, as it is located within the urban valley.

10.9.14 The Rhyd-y-car Business Park is situated within the HLCA 014 which is identified as being subject to a Moderate overall effect in the ASIDHOL2 Assessment. As such, development of that site could potentially, if resulting in an adverse effect on the HLCA, cause an in combination cumulative effect on the HLCA 014 with the proposed development. Any future plan to develop that site would need to take this into consideration in its cumulative assessment.

10.9.15 The Hoover Strategic Regeneration Area is mainly located within HLCAs 015A and 015B, neither of which were identified as affected by the proposed development.

10.9.16 Two areas of land are allocated for housing development at Hoelgerrig, The Upper Georgetown Plateau (Policy SW3-3) and Brondeg (Policy SW3 – 4). Both sites are described in the LDP as having an archaeological element, however, their development would have no effect on any of the archaeological features within the Application Site.

10.9.17 Located on the urban fringe of Hoelgerrig, the development of these sites would have little relevance to the value of historic assets located within and around the Application Site due to the woodland located between them and the allocations. No other historic assets are subject to an effect from the proposed development that might be affected by the development of these allocations.

10.9.18 The Upper Georgetown Plateau site is situated within the HLCA 070 which is identified as being subject to a Moderate overall effect in the ASIDHOL2 Assessment. As such, development of that site could potentially, if resulting in an adverse effect on the HLCA, cause an in-combination cumulative effect on the HLCA 014 with the proposed development. Any future plan to develop that site would need to take this into consideration in its cumulative assessment.

10.9.19 The Brondeg site is located within HLCA 012B which was not identified as affected by the Proposed Development.

10.9.20 Other allocations such as SW3-18, SW3-19, SW3-26 and EcW-1.4 are small sites located within the wider urban area of Methyr Tydfill, but all in excess of 700m from the Application Site boundary.

10.9.21 Due to their distance from the Application Site and occupation of pre-developed urban environments, their development would have no influence on any of the settings of the historic assets located in the vicinity of the Application Site. As they would result in further urban development within existing urban areas it is extremely improbable that they would result in any substantial effect on the HLCAs of the MTLOHI that might also result in an in-combination effect with the proposed development.

10.10 Conclusions

10.10.1 This ES Chapter has assessed the potential effect of the proposed development in terms of archaeology and cultural heritage resources. Potentially significant effects associated with construction activities and the completed proposed development (Operational Phase) are identified and, where necessary, mitigation and enhancement measures are outlined. These effects are summarised below in Table 10.4.

10.10.2 With mitigation, either through the design of the proposed development, through conservation measures and heritage interpretation delivered via a Conservation Management Plan or through archaeological recording, the construction phase has identified significant beneficial effects to four designated historic assets, comprising three scheduled monuments and one Grade II listed building.



10.10.3 Whilst the proposed development will result in the loss of ten non-designated archaeological assets located within its footprint, archaeological mitigation will take place through recording. The remit for this work will be set out in a WSI and will include opportunities for community involvement in the archaeological process and, for interpretation of archaeological results within the development's plaza. As such, with mitigation in place only non-significant residual adverse effects to ten non-designated historic assets are assessed. A beneficial effect is assessed to a single non-designated historic asset.

10.10.4 In accordance with Cadw guidelines (Cadw, 2017) the assessment has identified effects from the Operational Phase of the proposed development on historic assets due to change within their settings, summarised in Table 10.1. As well as effects related to the presence of the Development's buildings, this assessment includes effects related to enhanced public access to some of these assets and opportunities for their interpretation. These comprise significant beneficial effects to three scheduled monuments, significant adverse effects to two scheduled monuments, and non-significant adverse effects to a scheduled monument, a Grade II* Historic Park and Garden and a conservation area.

10.10.5 The chapter also references an ASIDOHL2 assessment of effects on the MTLOHI. In this regard, the assessment identifies Moderate effects for four HLCAs and Slight effects for seven HLCAs. Given that 68 HLCAs will be unaffected and that for the majority of the HLCA affected industrial era heritage will be preserved the overall effect on the MTLOHI is only Minor Adverse and should be considered alongside the benefits delivered to the heritage assets within the MTLOHI through conservation and interpretation which are not directly assessed in the ASIDHOL methodology, but which are nonetheless relevant to the MTLOHI.

10.10.6 The assessment has identified no in-combination cumulative effects with any committed or proposed development in the Application Site's vicinity, however, the potential for future in combination effect with two sites that are allocated within the LDP has been identified.

10.10.7 In conclusion, the highest value historic assets located within the site or in its near vicinity will be subject to considerable benefits from the proposed development's proposals for conservation and interpretation delivered via a Conservation Management Plan, greatly improving their current unmanaged situation and presentation of the Application Site's heritage resource to the public. This outcome results from the applicant's high sensitivity to and positive regard for the historic environment whereby sensitive historic assets have been deliberately avoided in the development footprint and a programme of consultation and cooperation with Cadw has been pursued at all stages. These benefits will need to be considered alongside adverse effects that are from change to the settings of heritage assets and loss of non-designated archaeological remains within the development footprint. However, it is noteworthy that the archaeological remains will be subject to mitigation through recording which will include opportunities for community participation and will feed into the wider interpretation of the historic environment that the development will deliver.

10.10.8 In accordance with heritage legislation and PPW 11, effects from the proposed development on the historic environment will need to be 'fully considered' in the planning balance, taking account of the range of beneficial effects to nationally important historic assets which will offset adverse effects arising from the loss of non-designated archaeology, change to the settings

of historic assets and effects on the MTLOHI's HLCAs.

10.10.9 The proposals accord well with Future Wales: The National Plan 2040, providing increased interpretation of the historic environment to the public that will serve to promote the distinctive industrial heritage of the Merthyr Tydfil borough and the South-East Welsh region with respect for the Welsh language.

10.10.10 The proposals also accord well with the Welsh Government's objectives as set out in PPW 11, notably at Paragraph 6.16 in that they seek to conserve important archaeological sites that are designated as scheduled monuments promoting their role in 'education, leisure and the economy' and allowing them to make an appreciable contribution to the 'character or place' at the Site whereas presently they are hard to access and experience.

10.10.11 A response from Cadw on the PAC submission (dated 27 May 2022) states that they have no objection to the proposed development in respect of historic assets and that they concur with EDP's view that the mitigation and off-setting measures proposed will result in a considerable improvement to the physical condition of the designated historic assets in question that will outweigh any adverse impacts to their setting. As such, in light of the compliance of the proposals with heritage legislation, national and local planning policy and, in light of Cadw's position, it is clear that the historic environment and the historic assets that comprise it, do not represent a constraint to the positive determination of the planning application.

Table EDP 10.4: Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Conservation Works at Scheduled Monument Cyfarthfa Balance Pond and Leat (GM608)	High	Medium	Major Beneficial	-	Medium	Major Beneficial	High
Conservation Works at Scheduled Monument Cwm Pit and Head of Railway (GM607) and Grade II Listed Base of Chimney at Cwm Pit (81752)	High	Medium	Major Beneficial	-	Medium	Major Beneficial	High
Conservation Works at Black Pins Early Ironstone Workings (GM609)	High	Small	Moderate Beneficial	-	Small	Moderate Beneficial	High
Glyn Dyrys Upper Level Mine and Tips to West of A470 Tip (B)	Low	Large	Moderate Adverse	Archaeological recording through topographic survey	Medium	Minor Adverse	High
The Parish Road (C)	Low	Medium	Minor Adverse	Archaeological recording through topographic survey	Small	Minor Adverse	High
Area of the former Glyn Dyrys Pit and the Glyn Dyrys Tip (D)	Low	Large	Moderate Adverse	Archaeological recording through topographic survey and trenching/excavation	Medium	Minor Adverse	High
Course of the Cyfarthfa Canal	Medium	Medium	Moderate Adverse	Archaeological recording through targeted trenching	Small	Minor Adverse	High
Route of the Cwm Pit Railway	Low	Medium	Minor Adverse	Archaeological recording through targeted trenching	Small	Minor Adverse	High
Route of the Ynys Fach Railway	Low	Medium	Minor Adverse	Archaeological recording through targeted trenching	Small	Minor Adverse	High
Old Coal Workings south-west of Lower Collier's Row (E)	Medium	Medium	Moderate Adverse	Archaeological recording through topographic survey and trenching/excavation	Small	Minor Adverse	High
Lower Collier's Row Drift Mines (F)	Low	Small	Minor Adverse	Archaeological recording through topographic survey	Negligible	Negligible Adverse	High
Glyn Dyrys Upper Level Tramway (G)	Negligible	Medium	Minor Adverse	Archaeological recording through topographic survey	Small	Negligible Adverse	High
Trackway	Low	Small	Minor Adverse	None	Small	Minor Adverse	High
Bridges on the former Neath and Gethin railways	Low	Medium	Minor Beneficial	None	Medium	Minor Beneficial	Medium
Operation							
Change within the Setting of the Scheduled Monument, Vale of Neath Railway Cutting and Tunnel Portal	High	Small	Moderate Beneficial	None	Small	Moderate Beneficial	Medium
Change within the Setting of the Scheduled Monument, Cwm Pit and Head of Railway	High	Small	Moderate Beneficial	None	Small	Moderate Beneficial	Medium
Change within the Setting of the Scheduled Monument, Cyfarthfa Balance Pond and Leat resulting from enhanced interpretation	High	Small	Moderate Beneficial	None	Small	Moderate Beneficial	Medium
Change within the Setting of the Scheduled Monument, Cyfarthfa Balance Pond and Leat resulting from the Development's buildings	High	Small	Moderate Adverse	None	Small	Moderate Adverse	Medium
Change within the Setting of the Scheduled Monument, Black Pins Early Ironstone Workings	High	Small	Moderate Adverse	None	Small	Moderate Adverse	Medium
Change within the Setting of the Scheduled Monument, Cyfarthfa Canal Level	High	Negligible	Minor Adverse	None	Negligible	Minor Adverse	Medium

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Change within the Setting of the Grade II* Historic Park and Garden, Cyfarthfa Castle	High	Negligible	Minor Adverse	None	Negligible	Minor Adverse	Medium
Change within the Setting of the Cyfarthfa Conservation Area (Medium sensitivity)	Medium	Negligible	Negligible Adverse	None	Negligible	Negligible Adverse	Medium

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11.0 Hydrology and Hydrogeology

11.1 Introduction

11.1.1 This chapter aims to describe the baseline hydrological and hydrogeological environment for the proposed commercial redevelopment on land to the west of A470, south-west of Merthyr Tydfil.

11.1.2 The chapter presents an assessment of the potential effects on the hydrological and hydrogeological environments associated with the proposed development and outlines appropriate mitigation measures to reduce or eliminate any adverse effects arising from the construction and operational phases of the development. Where effects are predicted, their significance has been assessed and measures incorporated into the proposed development to mitigate or reduce the significance of these effects. Significance has been assigned to any residual effects following the implementation of the proposed mitigation measures.

11.1.3 To aid the assessment process, a Hydrogeological and Hydrological Desktop Assessment (Preliminary Risk Assessment) has been prepared to accompany the chapter and is contained within Appendix 11.1. Further details regarding the land contamination potential and the potential flood risk are provided in the Ground Conditions and Flood Risk chapters of this ES (Chapter 7 and 13 respectively).

11.1.4 For the purpose of this assessment, the following is defined:

- The term “Hydrology” refers to the surface water;
- The term “Hydrogeology” refers to the groundwater.

11.1.5 The proposed development comprises a mixed leisure development comprising indoor snow centre (up to 39,200 sq m), waterpark (up to 7,500 sq m), indoor activity centre (up to 9,000 sq m), external activity areas, hotel accommodation (up to 418 bedrooms), forest lodge accommodation (up to 30 units), car parking (up to 830 spaces) and associated earthworks, access, drainage, servicing and utilities connections/infrastructure. Further detail on the proposed development is presented under Chapter 2 of this Environmental Impact Assessment (EIA).

11.1.6 The proposed development boundary covers circa 30.4 hectares, designated as a Site of Interest for Nature Conservation (SINC) and with parts designated as a Site of Special Scientific Interest (SSSI). The land ownership boundary covers a much larger area (circa 223 hectares). There is a large legacy of mining related features such as open spoil tips, abandoned mine entries, shafts and associated infrastructure still present at and surrounding the proposed development. Two Scheduled Monuments (SM), Cyfarthfa Balance Pond and Leat and Cwm Pit and Head of Railway are located partly within the site and two further SMs, the Vale of Neath Railway Cutting and Tunnel Portal and Blackpins Early Ironstone Workings, are located outside of the site boundary to the south-west and west. Within this chapter, the proposed development boundary is referred to as the ‘site’, and the full extent of the land holding is referred to as ‘land ownership’ boundary.

Executive Summary

11.1.7 The implementation of specific mitigation measures within the construction and operational phases of the proposed development, in conjunction with good environmental controls, will ensure that any impacts and/or effects on hydrology and hydrogeology will be quickly controlled and will have minor to negligible residual risks.

11.1.8 This chapter and the appended Hydrogeological and Hydrological Desktop Assessment (Preliminary Risk Assessment) provides a detailed account of the hydrogeological and hydrological environment at the site which is considered to be sufficient to support the outline planning application and therefore not considered to be a barrier to the proposed development. Accordingly, no objections to the development should be sustained on grounds of Hydrology & Hydrogeology.

11.1.9 Further recommendations for the collection of site-specific data have been made based on consultation with NRW. It is expected that these further works will be discussed and agreed with NRW at the detailed design stage. They include the following;

- Site specific qualitative groundwater data (level and water quality) over a sustained period at targeted locations (and within key geological units/ mine workings) will be required to ascertain the temporal variation in groundwater levels (including the extent of groundwater rebound) and quality beneath the site.
- A network of groundwater monitoring boreholes will be required to confirm and ascertain the groundwater levels and quality beneath the site. A Groundwater Monitoring Strategy and Plan will be prepared at the detailed design stage which will present a strategy for drilling groundwater monitoring boreholes at the site and proposals for groundwater monitoring.
- Interactions between spoil tips, superficial deposits, coal measures aquifer and key hydrological features within the SINC and SSSI to be further investigated through ground investigation and monitoring.
- Site specific surface water quality data at targeted locations and key features. Based on the review of available information, there is no evidence to suggest that water quality is significantly impacted. However, given the history of the site and the number of potential contaminative sources, this will need to be confirmed through surface water sampling and analysis.
- The recently installed drainage network at the site is incomplete and its effectiveness is yet to be tested in the absence of any significant rainfall / storm events at the time of the site visit. As such, further investigations and assessment should be carried out to conclude whether elements should be incorporated into the proposed development/ drainage design.

11.2 Methodology and Scope

Legislative and Policy Framework

11.2.1 The assessment has been undertaken in accordance with the relevant legislation, policy and guidance documents which are summarised below:

European Policy & Legislation

11.2.2 The Water Framework Directive (2000/60/EC), which was transposed into Welsh law in The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 establishes a framework for community action in the field of water policy. The main objective of the Directive is for all groundwater, surface water and coastal water bodies to achieve 'good' status by 2015 (and now by 2027). The Directive introduced new broader ecological objectives as well as aims to prevent deterioration of all water bodies. The Directive must be considered in any scheme that has the potential to impact on any part of the water environment.

11.2.3 The Groundwater Directive (2006/118/EC), a daughter of the WFD, came into force in 2006 and aims to protect groundwater against pollution and deterioration. The directive is transposed into Welsh law by the Groundwater (England and Wales) Regulations 2009.

National Policy & Legislation

11.2.4 Part 2A of the Environmental Protection Act 1990 ("Part 2A") establishes a legal framework for dealing with contaminated land in England and Wales.

11.2.5 Part 2A defines contaminated land in Section 78A(2): "contaminated land" as any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that – (a) significant harm is being caused or there is a significant possibility of such harm being caused; or (b) significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.

11.2.6 The Contaminated Land (Wales) Regulations 2006, The Contaminated Land (Wales) (Amendment) Regulations 2012, also govern contaminated land assessment in Wales.

11.2.7 Under section 78A(9) of Part 2A the term "pollution of controlled waters" means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term "controlled waters" in relation to England and Wales has the same meaning as in Part 3 of the Water Resources Act 1991, except that "ground waters" does not include waters contained in underground strata but above the saturation zone.

11.2.8 The Water Resources Act 1991 applies to both England and Wales aims to prevent and minimise the pollution of controlled waters and under the act, it is an offence to cause or knowingly permit any poisonous, noxious, or polluting material, or any solid waste to enter any controlled water. The 1991 act gives Natural Resources Wales (NRW) powers to remediate the pollution of controlled waters or take steps to prevent pollution by serving 'works notices' requiring the necessary remediation to be carried out.

11.2.9 The Environmental Damage (Prevention and Regulation) Regulations 2009 are a 'backstop' and only apply when there is an imminent threat or actual 'environmental damage' within the

scope of the Regulations. An operator can be required to take immediate steps to prevent damage or further damage. The regulations apply to damage to protected species and natural habitats or to a site of special scientific interest, surface water or groundwater, and land. Other key pieces of legislation which are relevant to this chapter are presented below:

- The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (the EIA Regulations);
- The Water Resources Act 1991;
- The Water Act 2014;
- The Private Water Supplies (Wales) Regulations 2017;
- The Water Supply (Water Quality) Regulations 2018;
- The Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016;
- The Control of Pollution Act 1974;
- Environmental Permitting (England and Wales) Regulations 2016 and as amended.

11.2.10 National Planning Policy relevant to potential hydrogeological effects is summarised as follows:

- Planning Policy Wales (PPW) (Edition 11: published in February 2021) sets out the general planning framework within Wales and is supported by a series of Technical Advice Notes (TANs).
    - PPW specifies that “new development is not undertaken without an understanding of the risks, including those associated with the previous land use, pollution, groundwater, flood risk, subsidence, landslips, rock falls, mine and landfill gas emissions and rising groundwater from abandoned mines.”
    - Geological features are a key part of our natural environment, and protecting geodiversity underpins the wider protection and management of our natural resources, including land availability, renewable energy potential, groundwater supply and flood risk.
    - Water resources and quality must be considered from an early stage in the process of identifying land for development and redevelopment.
    - New development should be located and implemented with sustainable provision of water services in mind, using design approaches and techniques which improve water efficiency and minimise adverse impacts on water resources, including the ecology of rivers, wetlands and groundwater and thereby contributing towards ecological resilience.
    - Development should not cause additional run-off, which can be achieved by controlling surface water as near to the source as possible by the use of SuDS. Care should be taken in places of shallow groundwater or where flooding is caused by combined surface and groundwater processes. In such situations

direct infiltration SuDS may not be appropriate. Consultation with drainage bodies and NRW should be undertaken, and relevant evidence and information drawn from Area Statements taken into account.

- Future Wales, the National Plan 2040:
    - This document, which is part of the statutory development plan, places emphasis on management of water quality within all new developments. It also places a focus on new developments being within existing built -up areas to reduce the likelihood of a need for significant new sources of water.
- Contaminated Land Statutory Guidance for Wales 2012 (Welsh Government, 2012) and the Defra Circular 01/2006 (Defra 2006) also govern contaminated land assessment in Wales.

Local Policy

11.2.11 The relevant local planning policies in relation to hydrology and hydrogeology are:

11.2.12 Merthyr Tydfil Replacement Local Development Plan 2016-2031

11.2.13 Policy BW8: Development and the Water Environment – Proposals for development will only be permitted where:

- They avoid identified river flood plains in order that these areas continue to fulfil their flood flow and water storage functions;
- They do not have an adverse effect on the quality and/or quantity of surface waters or groundwater resources, and where opportunities exist, they incorporate measures to improve existing water quality;
- Development proposals will be required to avoid exacerbating flood risk locally and elsewhere within the river catchment by incorporating sustainable drainage systems (SuDS) for the disposal of surface water. Alternative methods of surface water disposal will only be considered where a developer demonstrates that the incorporation of SuDS is inappropriate for practical or environmental reasons.

11.2.14 Policy EnW4: Environmental Protection – Development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and / or the natural environment from the pollution of land, surface water, groundwater and the air.

11.2.15 Where impacts are identified the Council will require applicants to demonstrate that appropriate measures have been incorporated to reduce, or minimise the impact identified to the lowest possible acceptable level. Planning conditions may be imposed or legal obligation entered into, to secure any necessary mitigation and monitoring processes.

11.2.16 In respect of the water environment, development proposals will be required to incorporate measures to improve water quality where opportunities exist. With regard to flood risk, new

developments will be expected to avoid unnecessary flood risk and meet the requirements of TAN 15.

11.2.17 Policy EnW4 follows the precautionary approach and the Council encourages developers to assess any impact at the earliest stage so that development proposals reduce any impact present to the lowest possible acceptable level, wherever it is practical and feasible to do so, in order to safeguard the environment, amenity, public health and well-being. Where development is permitted conditions will be attached to the approval to minimise any potential pollution levels and where appropriate, to monitor the effects of the development.

11.2.18 The Council recognise the role the planning system can play in helping realise the objective of the Water Framework Directive to improve water quality. New development will be expected to incorporate measures to improve ground and surface water quality wherever opportunities exist. In addition to the provision of Sustainable Drainage Systems (SuDS) to reduce diffuse pollution.

11.2.19 While many elements of pollution control are outside the remit of the planning system it is important that new development does not lead to unacceptable levels of pollution.

Guidance Documents

11.2.20 The following guidance documents are considered relevant to this chapter:

- Risk Assessment for your Environmental Permit, published online by the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA), published 1st February 2016 and last updated 21st March 2021 and relevant guidance provided by Natural Resources Wales (NRW) - https://naturalresources.wales/permits-and-permissions [checked October 2021];
- The Environment Agency's approach to groundwater protection dated February 2018 (version 1.2) which has been adopted by NRW;
- Groundwater source protection zones (SPZs), published online by the EA on 1st August 2019 - https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs [checked October 2021];
- Environment Agency Land contamination risk management (LCRM), published online, dated 8 October 2020. (Last updated 19th April 2021);
- Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Impact Assessment (IEMA, 2004 as amended 2006);
- CIRIA 552 "Contaminated Land Risk Assessment: A Guide to Good Practice" (Ref. 14.11);
- Environment Agency Pollution Prevention Guidance (PPG) notes, including "PPG1: General guide to the prevention of pollution" (Ref. 14.13), "PPG2: Above ground oil storage tanks" (Ref. 14.14), "PPG6: Working at construction and demolition sites" (Ref. 14.15) and "PPG26: Drums and intermediate bulk containers" (Ref. 14.16). Please note, these have been superseded by the Pollution Prevention Guidelines (PPG's);

- BS EN 10175:2011+A1:2013 Investigation of potentially contaminated sites. Code of practice (Ref. 15.9).
- BS EN 5930:2015 Code of practice for ground investigations; Department for the Communities and Local Government, Amended Circular on EIA consultation paper 'Environmental Impact Assessment: A Guide to Good Practice and Procedures' (June 2006);

Scoping Assessment Stage

11.2.21 Consultation has taken place with the relevant statutory bodies via the submission of a Scoping Report. A Scoping opinion on hydrological and hydrogeological elements of the proposed development was received, with relevant comments presented below in Table 11-1.

Table 11-1 – Consultation Responses

Statutory Body	Scoping Opinion	Comments
Merthyr Tydfil County Borough Council (MTCBC)	The topography and mining history of the area present a unique challenge to future development. Future proposals are to comply with new legislation in place since January 2019." "Baseline information from a previous report of January 2018, this is to be updated. Works effecting watercourses will require relevant approval. Contact with MTCBC SAB Officer is advised at earliest opportunity.	From the 7th January 2019, the Welsh Government introduced Schedule 3 of the Flood and Water Management Act 2010. All new developments of more than one building and/ or where construction is 100m^2 or greater, will require sustainable drainage systems (SuDS) for water. The SuDS must be designed and built-in accordance with Statutory SuDS Standards published by Welsh Ministers and SuDS schemes must be approved by the SuDS Approving Body (SAB), before construction work begins. A Flood Consequence Assessment (FCA) has been prepared by Tetra Tech to assess the potential flood risk and to support the SAB application for the site. Details on this can be found at Chapter 13. The previous 2018 WYG (now Tetra Tech) Desktop Hydrology and Hydrogeology Assessment has been updated (2022) and is attached at Appendix 11.1.
Merthyr Tydfil County	Formal ordinary watercourse applications would need to be submitted to the Lead	A meeting with Huw Williams of MTCBC on 23rd November 2021

Statutory Body	Scoping Opinion	Comments
Borough Council (MTCBC)	Local Flood Authority (LLFA) for approval where discharge rates, flood mitigation measures and risk assessment measures are agreed. A hydrology assessment would be required for downstream waterbodies to ensure the LLFA is satisfied that flood risk doesn't increase as result of additional flows from the development. It is possible that improvement work to these watercourses may be required, pending the results of the hydrology assessment. The proposal indicates that a watercourse within the development area needs to be diverted to facilitate the development. An ordinary watercourse application will be required for this work. Discharge rates must be limited to "greenfield" rates up to a 1 in 100+40% storm event.	confirmed that these applications and assessments are not required at this stage and that these could be deferred to a formal application after Outline Planning Permission has been granted. Additionally, Chapter 13 – Water, Drainage and Flooding and the Flood Consequences Assessment confirms that discharges will be restricted to Greenfield Runoff Rates as required. Detailed designs will be undertaken in the next stages of the planning process.
Natural Resources Wales (NRW)	Due to the proximity of the Cwm Glo a SSSI and Rhydycar West SINC we have concerns to the degree to which these sensitive areas are hydrologically and hydrogeologically dependent as areas defined as wet woodlands. The EIA should therefore include a baseline assessment of these sensitive areas with respect to the local hydrodynamics and assess whether or not the proposed scheme could interact with/ disrupt these hydrodynamics." The assessment should form part of a wider Groundwater Monitoring Strategy which should focus on: • The hydrogeology of the Made Ground, Superficial Deposits and the bedrock of the Middle Coal Measures which underlie parts or	A desktop hydrological and hydrogeological assessment has been prepared (Appendix 11.1) which considers the interaction between the hydrogeology and key hydrological features both within the development boundary and within the wider area. The preliminary environmental risk assessment outlined within this chapter includes potential impacts on designated / water dependent features, such as those located within the SINC and nearby SSSI area. The assessment outlined mitigation measures to reduced potential impacts to an acceptable level. A Groundwater Strategy Plan will be prepared as part of the Reserved

Statutory Body	Scoping Opinion	Comments
	all of the site respectively. • Assess if any degree of groundwater rebound is occurring notably as shafts, adits, discussed workings and coal seams are present at the site, • Assess groundwater interactions/ baseflow associated with the streams that cross the site. A Groundwater Monitoring Strategy and Plan should be developed that shows the proposed locations for groundwater monitoring boreholes and a summary rational for why these locations have been chose. Groundwater monitoring should ideally occur through the use of data loggers as these provide 'real time' and 'complete data sets' and ideally across one year so that the seasonal variation can be assessed. It would be useful to have a designated rain gauge on site.	Matters stage. This will be based upon the data gathered from work that are currently ongoing. Including a ground investigation, drilling of groundwater monitoring boreholes to facilitate long term groundwater monitoring, surface water flow monitoring and quality sampling.

Assessment Methodology

11.2.22 The assessment has been undertaken primarily using a qualitative assessment which is based on professional judgement and statutory and general guidance. It includes the following:

- A review of the relevant legislation, guidance documents and local policy;
- Update to the Hydrological and Hydrogeological Desktop Assessment (Appendix 11.1);
- Site visits to confirm and augment information obtained through the completion of the desktop assessment;
- Consultation with relevant statutory authorities and published information to help establish baseline conditions and identify any significant concerns in the area;
- Consideration of potential interactions and identification of possible impacts;
- Assessment of impacts, within the context of the receiving environment including cumulative effects; Identification of measures and solutions to avoid, minimise and mitigate potential impacts; and,

- Assessment of residual impacts, taking account of mitigation measures.
- Identification of measures and solutions to avoid, minimise and mitigate potential impacts; and,
- Highlight and assess any residual impacts that would exist following mitigation.

11.2.23 At the impact assessment stage, any potentially beneficial or adverse impacts associated with the development are identified and assessed with reference to the baseline environment. This requires consideration of:

- Sensitivity/value of the receptor;
- Magnitude of the impact;
- Impact duration;
- Whether impact occurs in isolation is cumulative or interactive; and
- Performance against environmental quality standards or other relevant thresholds.

Sensitivity and Value of Receptor

11.2.24 The value or sensitivity of a receptor is largely determined by its quality, rarity and scale. The determination of value or sensitivity considers the scale at which the attribute is important.

11.2.25 For the purpose of assessing the significance of environmental impacts predicted as part of the impact assessment, the value that receptors are scaled at will be based on the relative importance of the receptor defined as follows:

- Local Level: On the proposed development Site or immediately adjacent to it;
- District Level: Beyond the Site boundary but within the district;
- County Level: County Level e.g., Merthyr Tydfil/ Mid Glamorgan;
- Regional Level: Wales;
- National Level: United Kingdom;
- International Level: European Community

11.2.26 A receptors value and sensitivity is defined using available guidance and professional knowledge and considering the site sensitivities. In some cases, the inherent value of the receptor has been recognised and been afforded a statutory designation (e.g. Special Areas of Conservation (SAC's)), which makes the value assignment more simplistic. The judgement of receptor significance is made on a case-by-case basis for each receptor or resource identified as having the potential to be subject to impacts associated with the proposed development.

11.2.27 Irrespective of its recognised value, all receptors / features would exhibit a degree of sensitivity to the changes imposed by new development. The 'sensitivity' element of the criterion ensures that this characteristic of each receptor is assessed. The classification for determining sensitivity of receptors is detailed in Table 11-2.

Table 11-2 – Sensitivity Criteria

Sensitivity Level	Description
High	A receptor with a high quality and rarity, regional or national level and limited potential for substitution. Sites of Special Scientific Interest (SSSI's). Public or Private drinking water supply abstraction (surface water or groundwater) used for human consumption. Surface water classified under the WFD as 'high' (or equivalent older chemical or biological monitoring designation). Groundwater classified under the WFD as 'good'. Watercourse designated under the Freshwater Fish Directive or known to have fish spawning grounds. Watercourse widely used for recreation, directly related to watercourse quality (e.g. swimming, salmon fishery etc.) Groundwater Source Protection Zone I.
Medium	Receptor with a high quality and rarity, local scale and limited potential for substitution/ replacement or receptor with a medium quality and rarity, regional or national scale and limited potential for substitution/replacement. Groundwater not used for human or stock consumption (surface water or groundwater). Public or Private non-drinking water supply abstraction (surface water or groundwater). Surface water classified under the WFD as 'good' (or equivalent older chemical or biological monitoring designation). Watercourse known to support important fishery population. Principal Aquifer in areas of low aquifer vulnerability. Groundwater Source Protection Zone II.

Sensitivity Level	Description
Low	Receptor with a medium quality and rarity, local scale and limited potential for substitution/ replacement or receptor with a low quality and rarity, regional or national scale and limited potential for substitution/replacement. Surface water classified under the WFD as 'moderate' (or equivalent older chemical or biological monitoring designation). Watercourse not widely used for recreation, or recreation use not directly related to watercourse quality. Groundwater that displays generally poor qualitative and quantitative status under WFD. Secondary A Aquifer. Groundwater Source Protection Zone III.
Negligible	Receptor with a low quality and rarity, local scale and limited potential for substitution/replacement. Surface water classified under the WFD as 'poor or bad' (or equivalent older chemical or biological monitoring designation). Groundwater classified under the WFD as 'poor'. No designated fisheries. Un-productive strata. Not situated within a groundwater Source Protection Zone.

11.2.28 For the purpose of the assessment, the following receptors have been designated as follows:

Coal Measures Aquifer

11.2.29 This receptor is considered to be of Low sensitivity as it is an aquifer which is generally of poor quality The aquifer is classified under the WFD as 'poor'.

Surface Water features including ponds, springs, and watercourses On-Site

11.2.30 Surface water features on site are not used for recreational purposes and water is not abstracted for drinking water purposes. The surface water features ultimately discharge to the River Taff (off-site) which is classified under the WFD as 'moderate'. Therefore, the features are of Low sensitivity.

Off-Site Private Water Supplies

11.2.31 These off-site receptors are considered to be of Medium sensitivity. Both supplies are located more than 500m from the proposed development and the abstracted water is not believed to be used for human consumption.

Off-Site Surface Water Features e.g., River Taff

11.2.32 Surface water features on site discharge via culverts beneath the A470 and ultimately discharge into the River Taff (approximately 450m to the east from the sites eastern boundary). The River Taff is classified under the WFD as 'moderate' and as such, is considered to be of Low sensitivity.

Cwm Glo a Glyndyrys SSSI & Rhydycar West SINC

11.2.33 Cwm Glo a Glyndyrys SSSI largely abuts the western, northern, and eastern red line boundary although, the proposed access road into site and part of the proposed snow centre are within the SSSI. This is a statutory designation and as such, this receptor is considered to be of High sensitivity.

Scheduled Monuments

11.2.34 Nearby SM's have no hydrological or hydrogeological significance or designation but have been considered with respect to potential damage from rising groundwater levels or increased flow impacts from surface water features as a result of the proposed development e.g., erosion of the feature. The SMs are considered to be of Medium to Low sensitivity from a water perspective.

Magnitude of Potential Impact

11.2.35 The Magnitude of Potential Impact (or potential effect) refers to the 'scale' or 'amount' of an impact. Key sources/ hazards have been identified and the potential magnitude of potential impact has been determined through the predicted change from the baseline conditions throughout the various phases of development.

11.2.36 In order to define level of impact magnitude the following guidance has been adopted for the purpose of providing a transparent assessment. The professional judgement of the technical author is used in the decision-making process when characterising impacts in accordance with the criteria set out Table 11-3.

Table 11-3 – Magnitude of Potential Impact Criteria

Magnitude	Description
No Change	No loss or alteration of characteristics, features, or elements; No observable impact on receptors/features.
Negligible	Noticeable, temporary (for part of the development duration) change; or Barely discernible change for any length of time, over a small area, to any key characteristics or features; Results in effects on attribute of insufficient magnitude to affect the use/integrity.
Minor	Noticeable, temporary (during the project duration) change, over a partial area, to key characteristics or features. Impact predicted to extend over a small area; Impact predicted to affect small numbers of people; Impact predicted to affect a small number of other receptors (ecological, businesses, facilities); Impact not predicted to have trans-boundary effects, but possibility remains; Slight but discernible change in environmental conditions predicted; Impact not predicted to entail unusual/complex effects for receptors; Impact not predicted to affect particularly scarce features/resources; Impact not predicted to result in breaches of legislation or statutory Environmental Quality Standard or Objectives; Impact not predicted to result in loss of attribute; Impact will continue for a short period of time only; Impact will be temporary; Impact will be intermittent and/or rare; Impact will be reversible; Impact will be possible to avoid, reduce, repair, or compensate for; or

Magnitude	Description
	Slight positive change in environmental conditions resulting in minor improvements in quality or value of a receptor.
Moderate	Significant, permanent / irreversible changes, over the majority of the development area and potentially beyond, to key characteristics or features. Impact predicted to extend over a moderate area; Impact predicted to affect moderate numbers of people; Impact predicted to affect some other receptors (ecological, businesses, facilities); Impact unlikely to have trans-boundary effects, but possibility remains; Moderate change in environmental conditions predicted; Impact unlikely to entail unusual/complex effects for receptors but possibility remains; Impact unlikely to affect particularly scarce features/resources but possibility remains; Impact entails a low probability that breaches of legislation or statutory Environmental Quality Standard or Objectives will occur; Impact unlikely to result in loss of attribute but possibility remains; Impact will continue for a moderate period of time; Impact will be semi-permanent; Impact will be intermittent; Impact will be possible to avoid, reduce, repair, or compensate for; or Notable positive change in environmental conditions resulting in measurable improvements in quality or value of a receptor
Major	Very significant, permanent / irreversible changes, over the whole development area and beyond (i.e. off-site), to key characteristics or features of character or distinctiveness. Impact certain or likely to occur; Impact predicted to extend over a large or very large area; Impact predicted to affect considerable numbers of people;

Magnitude	Description
	Impact predicted to affect considerable numbers of other receptors (ecological, businesses, facilities); Impact predicted to have trans-boundary effects; Significant change in environmental conditions predicted; Impact will entail unusual/complex effects for receptors; Impact will affect particularly scarce features/resources; Impact entails a high probability that breaches of legislation or statutory Environmental Quality Standard or Objectives will occur; Impact will result in total loss of attribute; Impact will continue for extended periods of time; Impact will be permanent rather than temporary; Impact will be continuous rather than intermittent, or where intermittent, frequent rather than rare; Impact will be irreversible; Impact will be very difficult to avoid, reduce, repair, or compensate for; or Significant positive change in environmental conditions resulting in major improvements in quality or value of a receptor.

Significance of Impact

11.2.37 The EIA Regulations (2017) are concerned with 'significance' and the identification of 'significant environmental effects'. Therefore, an assessment of significance is necessary in order to identify the main environmental effects of the proposed development..

11.2.38 The 'significance' of any impacts of the proposed development is assessed as part of the impact assessment outlined within this chapter. There are no published guidelines or criteria for assessing and evaluating effects on hydrology and hydrogeology within the context of EIA in Wales. The assessment is based on guidance outlined in EA guidance 'Land Contamination Risk Management (LCRM) and Development of Land Affected by Contamination: A Guide for Developers; as well as other generic EIA regulation guidance within the Environmental Impact Assessment Handbook Version 5 April 2018.

11.2.39 The sensitivity of the receiving environment together with the magnitude of the effect defines the significance of the effect prior to application of mitigation measures as outlined in Table 11-4.

Table 11-4 – Impact Significance Matrix

	Receptor Sensitivity			
Magnitude of Impact	**Very Low**	**Low**	**Medium**	**High**
No Change	Negligible	Negligible	Negligible	Minor
Negligible	Negligible	Minor	Minor	Moderate
Minor	Minor	Minor	Moderate	Major
Moderate	Minor	Moderate	Moderate	Major
Major	Moderate	Major	Major	Major

11.2.40 The probability of the magnitude of impact occurring is defined in Table 11-5 and applied to the impact significance determined in Table 11-6, to provide an overall Impact of Significance/ Risk Level (Table 11-7).

11.2.41 Broad definitions which determine the probability or likelihood of an event occurring are provided in Table 11-5 and have been applied to this assessment.

Table 11-5 – Definitions of Impact Probability or Likelihood

Descriptor	Description
Certain	Very likely to occur
Likely	Will probably occur
Possible	May occur
Unlikely	Not expected to occur

Table 11-6 – Overall Impact Significance/ Risk Level

	Impact Probability			
Impact Significance	**Certain**	**Likely**	**Possible**	**Unlikely**
Major	Major	Major	Moderate	Minor
Moderate	Major	Moderate	Minor	Negligible
Minor	Moderate	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

11.2.42 Features to which legally derived designations apply have automatically been determined to be of very high value (or of a higher value than non-designated features), and any impact tends to be of a greater significance than an impact of features to which no designation applies. Hence, for designated features, the use of the value criteria leads to an initial presumption that impacts will be of a very high significance. Information on sensitivity can then be used to modify or maintain this initial assessment.

11.2.43 Given the use of professional judgement in the assessment process, there may be some variation between subject areas (i.e. different environmental parameters) in the significance rating process. This may be as a result of for example the complexity of interactions that require assessment in determining the magnitude of change. However, the ratings derived through the impact assessment process, can also be described in a generic fashion as given in Table 11-7. The following definitions are proposed in relation to the significance of environmental impacts predicted through this ES.

Table 11-7 – Impact Significance Definitions

Level of Significance	Description
Negligible	No discernible effect. An impact that is likely to have imperceptible or insignificant impact
Minor	Slight, very short or highly localised impact of no significant consequence. These effects may be raised as local issues but on their own are unlikely to be of importance in the decision-making process. When combined with other effects these could have a more material influence.
Moderate	Intermediate limited (extent / duration / magnitude) impact that may be considered as significant. These effects are likely to be important considerations at a local level. These could have influence on decision making especially when combined with other similar effects
Major	Very large or considerable impact (extent/duration/magnitude); Effects, both adverse and beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation. In isolation, these could have a material influence on the decision-making process.

Limitations of the Assessment

11.2.44 The assessment is based on a desk-based assessment only and intrusive investigation has not been carried out on the site to support the assessment.

11.2.45 As such the ground conditions are based on the information presented within the Desk Study and the professional experience of the authors. With the absence of site-specific information, the assessment process is undertaken based on a conservative approach and actual ground conditions will be confirmed in due course to support the proposed development.

11.2.46 In addition, drainage works undertaken by the Council is incomplete and the effectiveness of the works has not been tested.

11.3 Baseline Environment

Site Description

11.3.1 The proposed development is situated to the southwest of Merthyr Tydfil town centre, on the eastern slopes of Mynydd Aberdâr south of the village of Heolgerrig and is located at National Grid Reference (NGR) 304591, 204873. The site covers an area of approximately 30.4 hectares with the wider land ownership covering an area of circa 223 hectares.



11.3.2 The site is bounded by land designated as Site Specific Scientific Interest (SSSI) to the east, west and north. Two Scheduled Monuments (SM), Cyfarthfa Balance Pond and Leat and Cwm Pit and Head of Railway are located partly within the site and two further SMs, the Vale of Neath Railway Cutting and Tunnel Portal and Blackpins Early Ironstone Workings, are located outside of the site boundary to the south-west and west.

11.3.3 Spoil tips, associated with the Glyndyrys Colliery and construction of the A470 trunk road, are located within the central and northern area of the site. An unnamed spoil tip, comprising of mostly slag material, encroaches onto the south-western area of the site and is included within the SM for Cwm Pit and Head of Railway. A basin area, known as the 'Marshy Area', is located within the central, western extent of the site, and situated between the Glyndyrys Tip and the Cyfarthfa Balance Pond and Leat.

Wider Context

11.3.4 The land ownership at Rhydycar West covers an area of approximately of 223 ha. This area covers undeveloped land consisting of natural mature woodland and marshland combined with anthropogenic derived spoil tips and mining features relating to the long history of coal and ironstone extraction works.

11.3.5 The north-western extent of the land ownership is characterised by less mature woodland and wide-open spaces, with coniferous forestry on its western edge. The land initially slopes steeply to the east but flattens off along the eastern boundary to a gentler slope. Numerous streams flow across this area from south-west to north-east, and numerous ponds and small reservoirs dot the landscape. There are several farm buildings towards the western boundary that are used for the keeping of horses, and a road bisects the central portion of this site in a north-south orientation. There is also a Scheduled Ancient Monument (Cwm Du Shaft and Air Fan) in this area.

11.3.6 In the northern area of the land ownership area, south of Heolgerrig village, there are more mature trees present, but is also given over to wide open spaces located largely on areas of previous tips. Streams in this area are generally shown to flow west to east.

11.3.7 Directly north of the site boundary, within the central area of the land ownership, is an area of young to mature woodland and open spaces. Some streams flow through the area, mostly west to east. There are a small number of ponds shown to be present.

11.3.8 To the west and south-west of the site, there is an old ruin associated with the Cwm Pit Colliery, and the entrance of the old Cwmbâch-Abercanaid Tunnel. It is also the location of three SMs; Abercanaid-Cwmbach rail tunnel, the former Cwm Pit Colliery and the remains of the Cyfarthfa Tub Boat canal and pond which is located along the western boundary of the site.

11.3.9 Several water features are shown to be located in this area, largely orientated west to east with some trending north-south with discharge of water collecting into an unnamed stream which flows through Cwm Pit and into the site, with discharge into a basin area between the A470 tip and the Cyfarthfa Pond and Leat.

11.3.10 The eastern and south-eastern extent of the site largely comprises of dense woodland in its south-western corner, although the remainder of the site is given over to thinner woodland, open space and a large area of reeds and marsh. This is the area of the former 'Glyndyrys Pond'. Several streams are shown to flow through the site mostly with a west-east orientation, although some are shown to flow north-south. Beyond the land ownership to the east the A470 dual carriage way with River Taff and southern extent of Merthyr Tydfil beyond with Merthyr Leisure Centre located 150m north-east of the site.

11.3.11 To the south, beyond the site boundary, is the undeveloped extension of Mynydd Aberdâr with Bike Park Wales located 1km to the south.

Site Walkover

11.3.12 Site walkovers were carried out over two separate occasions in May and June 2017. These visits covered the entire land ownership boundary. As part of the revised development boundary,a further two site walkovers were carried out in May and September 2021, with the focus on surveying hydrological features within the development area. An additional site walkover was completed on Friday 10 June 2022 to survey the tip drainage works that were constructed by Merthyr Tydfil County Borough Council. The observations made during these five visits are detailed within the desktop assessment (Appendix 11.1), with a summary of key observations outlined below:

- The water conditions observed at the site during the first site walkover (30th-31st May 2017) are considered to be representative of 'low flow' conditions. An increase in the amount of water at the site following a brief (one week) period of heavy rain was evident during the second site visit (15th June 2017), both in terms of the water levels observed in the surface water features, and the increased flow rates observed to be emerging from the base of tips and mine features;

- Mine water discharge has been observed to arise from numerous mine entrances across the land ownership boundary, largely within the western area (outside of the site boundary). The water quality was generally found to be clear and transparent except for some orange staining noted at the entrance to a former drift mine located at Locality 6. Water emerging from mine entrances are typically drained by several streams and ephemeral channels which largely flow across the site in a west to east orientation;

- Springs have been observed to emerge from the base of several tips particularly within the proposed development area and southern area of the landownership. These springs which are then drained by streams crossing the site in a general west to east orientation. The water quality of the emerging spring water was observed to be clear and transparent;

- A large area of ponding water has been observed within an area of the site known as the 'hollow' which is situated within a basin area between the Cyfarthfa Pond and Leat and the Glyndyrys Tip. Water in this hollow area is sourced from a diverted stream of the Nant Canaid which is known as the 'Nant Melin Canaid'. This stream flows through Cwm Pit and Head of Railway SM and discharges into the hollow which acts as a natural soakaway. Drainage works which were started in April 2022 by the Council

attempted to divert water away from this area as outlined in the Tetra Tech Site Visit Report, June 2022 (Appendix 11.1). However, the works were put on hold and water from this stream continues to discharge into the 'hollow' area behind the A470/Glyndyrys tip, with water flowing through and re-emerging at the base of the tip to the east. At the base of the tip, drains have been installed by the Council to capture water which emerges as spring water and from surface water run-off. Water is then channeled to a discharge point at the former Cyfartha Junction which comprises a large stone lined channel which cascades down towards the former Aberdare to Merthyr railway line/ widened track. Like much of the network, this stone lined channel remains unfinished. It should be noted that the weather preceding the visit in June 2022 had been dry, with limited to no rainfall for several days. As a result, low flow conditions of key water features were observed, and no water was found to be flowing in the newly constructed drainage ditches at the base of tip. Water within the hollow is therefore likely being lost to ground/ providing recharge to mine workings at depth. Evidence of erosion of the masonry wall of the SM has been observed;

- Water flowing through cwm pit was previously diverted through culverts/ area of sink, with discharge into the Nant Cannaid to the south of Cwm Pit. Two culverts have been observed by Tetra Tech within the northern bank of the Nant Cannaid;

- Stagnant water present in the leat of the former Cyfarthfa Pond and Tub Boat Canal has been observed to be seeping through the wall of the former canal wall, and draining into the northern area of the hollow. Water within the Cyfarthfa Pond has been observed to overtop in the north-western corner of the pond, with water flowing along the former canal feature and ultimately discharging into the hollow area;

- Spring water collecting within the Abernant tunnel in the south-eastern corner of the site is being drained via a pipe with water found to be emerging from a manhole chamber at the entrance of tunnel. Water discharging from this point then flows along the former railway track (Aberdare to Merthyr Line) before discharging into the original Nant Canaid stream at the site boundary;

- Several crown holes and areas of subsidence have been identified across the site and land ownership boundary which were often filled with stagnant water. These areas are likely providing localised groundwater recharge;

- Surface water at the site is discharged from site via several culverts at the site boundary, beneath the A470, before discharging into the Glamorgan Canal at the site boundary or directly into the River Taff (via the Nant Rhyd y Car stream – outside the development boundary) to the east;

- The main discharge point for groundwater within the former workings beneath the site is from a stone building (former Engine House) located at Upper Abercanaid in the south-eastern corner of the land ownership boundary. Discharged water enters into the Glamorgan Canal to the east of this locality. Groundwater was estimated to be discharging at 50L/sec at this point and was noted to be generally clear and transparent.

Geology

Regional Overview

11.3.13 The geological strata in the South Wales region is largely characterised by the Coal Measures Group, Millstone Grit Group and Carboniferous Limestone Formations of the Carboniferous Period. The Carboniferous strata of South Wales are folded into a broad east – west trending, asymmetrical synclinorium, with subsidiary fold structures. The overall structure of the synclinal structure is rather complex due to extensive faulting and the presence of minor folds associated with compressional fold structures. The Coal Measures occupy the central area of outcrop in the South Wales Coalfield, with narrower Millstone Grit and Carboniferous Limestone outcropping on the peripheral northern, eastern and southern margins.

Made Ground

11.3.14 A review of BGS Geological Mapping for the site (Sheet 231) indicates that extensive deposits of Made Ground (spoil tip materials from mining activities) are present across the site. These are identified as being an “Artificial Deposits”. The Made Ground is described as being of a variable composition, man-made, and varying with depth across the site. Most the Made Ground is considered likely to comprise spoil from the ironstone and coal mine workings at the site.

Superficial Deposits

11.3.15 A review of the Drift Geological Mapping for the site (Sheet 231) indicates that the entire site area is underlain by Glacial Till, Devensian – Diamicton Deposits. The Glacial Till Deposits formed approximately up to 2 million years ago in the Quaternary Period. Glacial Till is at it’s thickest (circa 12m) along the eastern extent of the landownership, thinning towards the west.

Solid Geology

11.3.16 The underlying solid geology shown to be present beneath the site is the Middle and Lower Coal Measures Formations of the South Wales Coal Group. The Lower Coal Measures Formation of the Langsettian (Westphalian A) is shown on the Solid Geological Mapping of the site to outcrop along the eastern boundary of the site, and the South Wales Lower Coal Measures of the Duckmantian (Westphalian B) across the remainder of the site area.

11.3.17 The South Wales Lower and Middle Coal Measures formed approximately 309 to 313 million years ago in the Carboniferous Period. Both are composed of deltaic cyclothems of mudstone, siltstone, sandstone, with frequent seatearths and coals with Marine Bands that record periodic transgressions, alternating in cycles. The major rock unit beneath the site is mudstone, interbedded with some silty sandstone horizons, siltstones, coal seams and ironstone veins.

11.3.18 The Lynfi Member and Rhonda Member, thick sandstone horizons of the Upper Coal Measures Formation are shown to outcrop to the south-west of the site along the ridge of the Mynydd Aberdâr hillside. The Upper Coal Measures Formation, also known as the Pennant Sandstone Formation, is stratigraphically above the Middle and Lower Coal Measures Formations. The dip direction of the Coal Measures strata within the vicinity of the site is shown to be towards the south, south-east with a dip angle of between 6 and 13 degrees. Based on the recorded dip

direction of the geological strata, sandstone members of the Upper Coal Measures Formation will not be present beneath the site.

Coal Seams & Ironstone Bands

11.3.19 There are thirteen named coal seams, twelve named ironstone veins and one Marine Band which are known to outcrop across the land ownership boundary. The stratigraphic order of this seams and ironstone veins are presented in Insert 3 and depicted on Figure 4 of the desktop assessment (Appendix 11.1).

Faults

11.3.20 No faults are shown to be present beneath the proposed development site. The Arup (2008) report states that a fault trending north-west to south-east was proven in workings within the Seven Feet Seam to the east of Glyndyrys Tip and had a downthrow of 4.6m; but could be as much as 10m in places.

11.3.21 The Merthyr fault is shown to be located off-site to the east, and generally follows the direction of the River Taff, with a downthrow inferred to be towards the west and a horizontal off-set of approximately 260m. The Merthyr fault intersects the Gellideg Coal Seam and other seams east of the site on the opposite (eastern) side of the River Taff.

Previous Site Investigations

11.3.22 The site was subject to four separate ground investigations between 1980 and 1986, which are summarised in the 'Borehole Investigation and Monitoring Report 1980-1988' which has been reviewed in the desktop assessment (Appendix 11.1). The borehole and trial pit logs provide details on the encountered geology, depth to encountered mine workings, groundwater strikes and standing water levels recorded upon completion of the boreholes. Investigations largely targeted known tip areas at the site, with a good coverage within the eastern extent of the land holding and within the western levels (off-site to the north-west); although the majority of boreholes with groundwater monitoring pipe installed area within the central and southern extent of the land ownership area.

11.3.23 During May and June of 2017 a survey of the accessible monitoring boreholes was completed within the wider land ownership boundary la . All boreholes were found to be blocked at depth, except for monitoring borehole CZ9A, although this was found to be dry (June 2017).

11.3.24 Between the 17th and 29th October 2021, ninety-nine trial pits were advanced across the land holding to depths between 2 and 6m depth. The ground conditions and groundwater strikes encountered are summarised within the Exploration Associates Factual report on Ground Investigation (ref 151233) dated November 2001. Further information on previous ground investigations at the site is presented in the Ground Conditions Chapter 7.

Hydrogeology

Hydrogeological Overview

11.3.25 The Coal Measures Group generally comprises low permeability hydrogeological units composed of interbedded carbonaceous mudstones and sandstones with subordinate siltstones and coal seams. The Upper Coal Measures is largely dominated by thick, sandstones horizons whereas the Lower and Middle Measures are dominated by argillaceous mudstones and siltstones.

11.3.26 Coal Measures sandstones are often very well cemented, extremely hard and dense, and in consequence possess very little primary porosity or intergranular permeability. The permeability of the sandstones directly relates to the distribution and size of the fractures (secondary porosity) present in the sandstone horizons.

11.3.27 The Coal Measures therefore constitutes a complex multi-layered aquifer system rather than one continuous groundwater body. Under natural (pre-mining) conditions, the sandstone horizons act as individual aquifers, separated by the intervening lower permeability mudstones/siltstones layers. This condition however has largely been disrupted by large scale mining across the South Wales Coalfield which has largely disrupted the hydrogeological environment and created hydraulic continuity between water bearing sandstone layers and historic mine workings; even those present in the Middle and Lower Coal Measures Formations.

Aquifer Designations

11.3.28 The superficial deposits beneath the site comprise Glacial Till deposits which are categorised by Natural Resource Wales (NRW) as Secondary Undifferentiated Aquifer. This has been assigned in cases where it has not been possible to attribute either a Secondary A or B aquifer to the soil type due to the variable characteristics.

11.3.29 The solid geology beneath the site comprises the Middle and Lower Coal Measures Formation of the Coal Measures Group which are categorised by NRW as ‘Secondary A’ Aquifers.

Made Ground/ Coal Tips Hydrogeology

11.3.30 Several coal and ironstone derived spoil tips are shown to be present across the site. These mine tips are shown to largely overly Glacial Till deposits beneath the site. These tips will act as separate, individual aquifer systems and can be referred to as “anthropogenic aquifers”. These Made Ground ‘aquifers’ will be recharged directly by rainfall infiltration and inflows of streams and surface water run-off. Several springs have been observed to emerge from this tip features, providing a source of water for a number of drainage channels across the land holding, such as the Western Levels (off-site to the north-west).

Glacial Till Hydrogeology

11.3.31 Groundwater flow within the deposits is anticipated to be minimal given the low permeability nature of boulder clay. The presence of boulder clay across the site will largely promote surface runoff across and limit vertical flow to (and recharge of) the underlying Coal measures beneath the site.

11.3.32 There is a potential for some groundwater flow to occur within secondary pathways created from collapsed disused mines located at a shallow depth beneath the site. These areas would provide localised areas of recharge to groundwater present in the disused mine working's should a hydraulic connection exist, although such pathways are likely to be limited in extent to the areas of subsidence.

Coal Measures Hydrogeology

11.3.33 The Middle and Lower Coal Measures Formation are considered to be one geological unit, which constitutes a complex multi-layered aquifer system, rather than one continuous groundwater body.

11.3.34 Argillaceous strata (mudstone) predominate at the site, acting as aquitards (low permeability strata) and often isolating the thin and impersistent subordinate sandstone horizons. Coal measures sandstones are fine grained and often very well cemented. As a result, groundwater storage and flow primarily occurs within and through fractures and joint sets in the sandstone horizons which is a type of secondary permeability. The permeability of the sandstones is therefore controlled by the natural joints and fractures and, more recently, due to the presence of tension zones (subsidence) caused by mining.

11.3.35 The mining of numerous coal seams and iron veins at the site and in the surrounding area has largely disrupted the natural hydrogeological conditions in the Coal Measures by the creation of open shafts and disused workings. Many mine drainage adits continue to drain the coal seam and ironstone veins long after the cessation abandonment of mines and the rebound of groundwater levels. These mine features have created hydraulic continuity between layers which were previously isolated and, in some cases, between aquifer horizons and flooded disused workings.

11.3.36 A detailed account of the hydrogeological Conceptual Site Model (CSM) is outlined within this ES Chapter and depicted graphically within Figure 8 and 9 of the desktop assessment (Appendix 11.1).

Groundwater Recharge

11.3.37 Lower permeability, clay rich Glacial Till deposits are shown to be present across the majority site area confining the Coal Measures. The presence of till material overlying the coal measures will restrict rainfall recharge to the water bearing sandstones beneath the site, largely resulting in rainfall runoff. The low permeability mudstone layers will also retard vertical groundwater flow through the Coal Measures, limiting groundwater recharge to the underlying water bearing sandstone horizons and therefore confining groundwater flow to the shallow interface. However, some recharge to the shallow sandstone horizons is likely to take place through fractures and joints present in the mudstone in the absence of the overlying Glacial Till.

11.3.38 The predominant recharge zone to the underlying sandstone horizons will be where they outcrop to the west at a higher elevation to the site. These areas are generally where the Glacial Till deposits are absent or thin and the sandstone is exposed as escarpments given the resistant nature of the rock.

11.3.39 Recharge to the sandstone units is also anticipated to occur via mine features (mine shafts or crown holes) or areas of subsidence, as a result of mine collapse. Recharge is also likely to occur via rainwater infiltrating through spoil tips at the site, where a hydraulic connect exists i.e., where the Glacial Till is thin or absent or where pathways (fractures and joints) are present owing to weathering or underlying subsidence.

11.3.40 Mine workings, which are dry as a result of the underlying ironstone workings, could be recharged as result of rising groundwater levels through natural rebound in levels (cessation of pumping) or blocking up/ restricting of the ironstone workings.

Groundwater Source Protection Zones

11.3.41 The site is not located within a groundwater source protection zone.

Groundwater Levels and Flow

11.3.42 Within the sandstone units, there will also be an element of intergranular flow, although this is anticipated to be minimal due to the cementation of Coal Measures sandstone. Sandstone horizons in the Middle and Lower Coal Measures Formations are often thinner and comprise less water in comparison with those in the Upper Coal Measures which are shown to outcrop to the south-west of the site.

11.3.43 Groundwater flow within the Coal Measures is anticipated to be down geological dip of the strata towards the to the south, south-east of the site. Although, intergranular flow is expected to be limited, with flow strongly controlled by the former mine workings beneath the site.

11.3.44 Groundwater will also emerge as springs at the junction between the base of water bearing sandstones and underlying mudstones layers; at rock head via fractures in the rock as a result of subsidence or from mining adits/ shafts.

Hydraulic Properties

11.3.45 Due to the solid geology largely comprising of very low permeability mudstone across most of the site area the unit is not generally the target of many hydrogeological investigations or abstraction boreholes, and as such there is very little available hydrogeological data relating to the Coal Measures in South Wales.

11.3.46 Transmissivity for the Coal Measures ranged from 0.15 to 225m2/day. The lower values were associated with small diameter observation boreholes monitored in pump tests. The larger values are likely to be unrealistically high as they were derived from non-steady state data from the pumping of abandoned mine workings and therefore reflect the large volumes of storage present in the workings; rather than within the sandstone units.

11.3.47 The only transmissivity and storage values specifically for the Lower Coal Measures Formation are from a test on a production borehole at Pengarnddu, Merthyr Tydfil (SO 0810,0860). The transmissivity values obtained were within a narrow range of 3 to 15m2/d. Storage coefficients calculated from the surrounding observation boreholes indicated confined conditions with 1x10-4 to 4x10-5 (dimensionless). Similarly, the only transmissivity for the Middle Coal Measures Formation is from a test carried out at Aberdare Golf Club which provided a value of 11m2/day.

Groundwater Quality

11.3.48 The chemistry of groundwater in the Coal Measures varies widely from good quality with low total dissolved solids to highly mineralised groundwater in South Wales. Higher quality groundwater is normally obtained from springs and shallow abstraction boreholes, whereas groundwater often becomes sulphate rich with increasing depth

11.3.49 Groundwater present within disused coal mine workings beneath the site has the potential to be of poor quality with possible high levels of dissolved inorganic ions, low levels of dissolved oxygen, iron and sulphate. Mine water discharge has not been observed within the development area. Water emerging from springs within the development boundary has been observed to be clear, with no obvious signs of iron & manganese precipitate.

11.3.50 The chemical status of the South-Eastern Valleys 'Carboniferous Coal Measures', which underlie the proposed development area, is classified as 'poor' and have an overall status of 'Poor'.

Licensed Groundwater Abstractions

11.3.51 No licensed groundwater abstractions have been identified at the site or within 250m of the site boundary.

Private Water Supplies (PWS)

11.3.52 No PWS are present at the site or within 500m of the site boundary.

11.3.53 Two PWS are known to be present within 500m of the land ownership boundary at Blaencanaid Farm (303511,204690) and at Bike Park Wales.

11.3.54 Limited details were held by the Council regarding Blaencanaid Farm such as date of drilling, construction details, depth of borehole and recorded water levels. No water quality information for the supply has been collected/submitted to the council for the last 17 years.

11.3.55 The supply located at Bike Park Wales was installed to 100m depth in April 2013. The water quality for the borehole is "satisfactory" and the resting water level is 15.5m below ground level. Given that the supply is drawing from the coal measures aquifer and potentially former mine workings, the water is not thought to be used for human consumption.

Hydrology

11.3.56 The land at the site generally slopes downwards from the west to the east towards the A470 which bounds the eastern area of the land ownership boundary; although, the presence of spoil tips has modified the natural landscape and topography of the site.

11.3.57 There are several streams which are shown to be crossing the site area, generally flowing in an east to west orientation towards the River Taff which is located approximately 600m to the west of the A470 at an approximate elevation of 165m to 155m AOD past the site. Several large ponds and emerging springs from the base of tips marked on Ordnance Survey (OS) plans for the site, but these do not capture all hydrological features at the site (see Appendix G of the desktop assessment (Appendix 11.1)).



11.3.58 The site and the surrounding area is situated within the 'River Taff – Conf Taf Fechan to Conf R Cynon' catchment of the Severn Basin according to the EA Catchment Data Explorer . The catchment covers an area of approximately 4,828ha with the River Taff spanning a length of 17.6km within the catchment. The River Taff has an overall water body classification (both chemical and ecological) of moderate in 2009 (Cycle 1) and 2015 (Cycle 2) under the WFD water body classification assessment.

Catchments

11.3.59 There are five main hydrological catchment areas across the land ownership boundary. These are depicted on Figure 5 within the desktop assessment (Appendix 11.1) and described below. The proposed development is located within Catchment 3, 4 and 5;

- Catchment Area 1 – The Nant Cwm Pant Bach drains land within the north-western area of the site (Zone 1) and the land located beyond off-site;
- Catchment Area 2 - The principal stream in this catchment is the Nant Rhyd y Car which is fed by the Nant Cwm Glo and the Nant Llwyn Yr Eos streams which drain the central area of Zone 1;
- Catchment Area 3 – Characterised by a series of small channels and ephemeral streams which drain emerging springs from the base of tips and drifts within the southern area of Zone 1 and central part of Zone 4;
- Catchment Area 4 – The diverted channel of the Nant Canaid stream flows close to the southern boundary of the site, through the Cwm Pit and discharges into a large marshy ponded area adjacent to the former Tub Boat Canal; and,
- Catchment Area 5 – Comprises the original Nant Canaid stream which flows close to the southern site boundary before discharging into the River Taff to the east of the site.

11.3.60 The northern extent of the proposed development is located within Catchment Area 3.

11.3.61 Catchment Area 3 is largely characterised by a series of small streams and ephemeral channels which are shown to drain issuing streams from the base of spoils tips and water emerging from former mine entrances, transmitting water to ponds within the eastern area of the site prior to being discharged off-site via a series of culverts beneath the A470.

11.3.62 The central and southern extent of the proposed development is located within Catchment Area 4.

11.3.63 A tributary of the Nant Cannaid, referred to as the 'Nant Melin Cannaid', is sourced from emerging springs to the west and north-west of the site. Contemporary OS mapping shows the Nant Melin Cannaid stream to 'sink' (infiltrate into the ground) close to the former Cwm Pit Colliery at grid reference SO065863. There is no evidence to suggest that this is still occurring and instead, the flows past the Cyfarthfa Pond (at a lower level) and discharge into a ponded, marshy area which is referred to as the 'hollow' (area of proposed Outdoor Activity Centre). Water collects in this basin, behind the Glyndyrys Tip and acts as a natural soakaway.

11.3.64 Water collecting in this soakaway area is thought to drain slowly through the base of this basin, providing potential recharge to the underlying groundwater (present in flooded disused workings) and emerging as springs at the base of tips (overlying the boulder clay) to the east of this position (eastern extent of the proposed development). Drainage works which were started in April 2022 by the Council attempted to divert water away from this area as outlined in the Tetra Tech Site Visit Report, June 2022 (Appendix 11.1). However, the works were put on hold and water from this stream continues to discharge into the 'hollow' area behind the A470/Glyndyrys tip, with water flowing through and re-emerging at the base of the tip to the east. At the base of the tip, drains have been installed by the Council to capture water which emerges as spring water and from surface water run-off. Water is then channelled to a discharge point at the former Cyfartha Junction which comprises a large stone lined channel which cascades down towards the former Aberdare to Merthyr railway line/ widened track. Like much of the network, this stone lined channel remains unfinished.

11.3.65 Catchment Area 5 is the smallest catchment area in terms of land area. The Nant Canaid stream flows close to the southern boundary of the site, adjacent to former Aberdare to Merthyr railway track before flowing from the to the east beneath the A470. Water flowing within the Nant Canaid is sourced from springs and surface runoff from land situated offsite to the west. Water is also shown to flow along the former Aberdare to Merthyr railway track which is sourced from spring water emerging from within the Abernant Tunnel. A cut off drain has been installed by the Council to divert water to the former Cyfartha Junction however, the drainage channel was not completed.

Licensed Surface Water Abstractions

11.3.66 There are no licensed surface water abstractions within the proposed development or 250m from the boundary of the site.

Discharge Consents

11.3.67 There are no discharge consents within the proposed development or 250m from the boundary of the site.

Pollution Incidents

11.3.68 There are no known pollution incidents that have occurred within the proposed development. A Category 3 (minor) incident occurred on 4th May 2016 approximately 240m east of development boundary, which involved an 'unidentified oil' spill.

Surface Water Quality

11.3.69 NRW hold no surface water quality data for watercourses within the proposed development and the wider land ownership boundary.

Flood Risk

11.3.70 A Flood Consequence Assessment has been prepared with details on flood risk presented within Chapter 13.

Protected Areas

Site of Special Scientific Interest (SSSI)

11.3.71 The site is bound to the north, east and west by the 'Cwm Glo a Glyndrys SSSI'. This 203ha area is protected for its extensive areas of marshy grassland, species-rich neutral grassland and acid grassland, and for the association of these habitats with other including woodland and heath. It is also of special interest for its diverse assemblage of grassland fungi.

Site of Importance for Nature Conservation

11.3.72 The majority of the proposed development is situated within a SINC.

Scheduled Monuments (SMs)

11.3.73 There are two SMs within or partly within the proposed development boundary but seven other SMs across the land ownership boundary. Cyfarthfa Balance Pond and Leat, which is partly within the site adjacent to the western boundary of the proposed development area and Cwm Pit and Head of Railway is partly within the site to the south. Also, Black Pins Early Ironstone workings and the Vale of Neath Railway Cutting and Tunnel Portal are close to the proposed development area, to the west and south.

Hydrogeological Conceptual Site Model Summary

11.3.74 The CSM is described in detail for the site in its current setting (post-mining), to assess the effects that mining has had on the hydrogeological system at the site. The CSM for the site has therefore been split into pre-mining and post-mining phases.

Hydrogeological CSM (Pre-Mining)

- Glacial Till soils, comprising predominantly of clay and silt, are present across much if the site, thickening from west to east. These low permeability soils overly thick mudstone layers interbedded with thinner sandstone horizons and coal seams of the Middle and Lower Coal Measure Formations;
- Groundwater within the interbedded sandstone units beneath the site would be recharged where these units outcrop at or close to the surface at higher elevations to the west of the site where the Glacial Till deposits would be thin or absent. Recharge would also take place where fractures and jointing is present in the mudstone units;
- The Glacial Till soils and interbedded mudstone units would have acted as confining layers with groundwater within the sandstone units likely confined and under pressure;
- Groundwater flow within the main water bearing sandstone horizons would have likely been down geological dip towards the south-west of the site, with a groundwater flow direction towards the base of the Merthyr Valley most likely providing baseflow to the River Taff and other hydraulically connected watercourses;

- Inter porosity flow within the sandstone units is expected to have been limited given that these units are often cemented. Instead, flow would have likely predominated via fractures / fissures / faults in these units;

- Springs emerge at the junction between the base of the sandstone and the underlying mudstone at outcrop or where the overlying Glacial Till deposits are thin or absent. Several springs are marked on OS Mapping off-site to the west of the site and have been observed within the development boundary;

- Water emerging from springs and surface water run-off over the Glacial Till soils would have been drained by a series of defined watercourses crossing the site in a general west to east orientation, and ultimately discharging into the River Taff (off-site) to the east;

- Erosion and downcutting of the River Taff has helped shape (along with glaciation) the Merthyr Valley along the Merthyr Fault, a major fault line. The River Taff at the base of the valley would represent the major discharge zone and most significant area for surface water/groundwater interaction.

Hydrogeological CSM (Post-Mining)

11.3.75 The site and the surrounding area has been extensively worked for the extraction of both coal and ironstone since the mid-18th Century, with mining at the site ceasing in the 1960's. Mining beneath the site has disrupted the 'normal' hydrogeological environment and has created hydraulic continuity between water bearing sandstone layers and the historic mine workings. Consequently, the hydrological and hydrogeological environment that exists at the site is now more complex as a result of this extensive mining with numerous preferential groundwater flow pathways, recharge, and discharge zones.

11.3.76 Both the site and wider area is underlain by ironstone workings which progressed down dip (towards the south) from the most northern outcrop of the ironstone (outside of the site and land ownership boundary to the north-west, west of Heolgerrig) to beneath the proposed development area and beyond. Mine abandonment plans for the site detail an extensive network of interconnected tunnel ways and shafts which previously targeted the productive coal seams and ironstone veins of the Coal Measures Group. Workings are shown to have been sunk to the north-west of the site (west of Heolgerrig), targeting the ironstone at outcrop and extending deep beneath the site down geological dip towards the south and south-east of the site, with workings shown extend beyond the River Taff to the east of the site.

11.3.77 As these works progressed, adits and cross drivages were constructed to permit water to drain downwards to the lowest seam whilst the overlying seams could be worked. Based on a review of the available previous site reports (Section 2.4.), the lowest level from which all mine water was discharged from was the Parliament Level. This level is situated off-site to the north and east of the site, with the seam closely following the former route of the Glamorgan Canal.

11.3.78 Drainage from the Parliament Level was later intercepted by an engine shaft that was drilled at Rhyd-y-Car in c.1801. The Rhyd-y-Car engine shaft is located off-site, approximately 900 to the north of the site at the former Ynysfach Ironworks. In order to permit further exploitation of the ironstone further south (i.e. beneath the proposed development area), a further cross measure was constructed between Rhyd-y-Car and an engine shaft which was sunk at the

Glyndyrys Pit, which is located on site. Later again, the Glyndyrys shaft was connected to the Upper Abercanaid Engine Shaft which is located outside of the development boundary to the south-east of the site. Upon abandonment of the workings, all mine water across the entirety of the ironstone workings now discharges from the Upper Abercanaid Engine Shaft. This engine shaft is the main discharge point for groundwater beneath the site. Groundwater was observed to be discharging from this shaft in c.2017 at approximately 40 to 60 litres/second with water discharging in the former Glamorganshire Canal and ultimately, to the River Taff. The invert level of the water discharge is at approximately 163m AOD.

11.3.79 The Five Feet/ Gellideg to the Yard coal seams, which have been extensively worked across much of the land holding and the northern and eastern extents of the proposed development boundary, are understood to drain to the lower ironstone workings. The workings (and drainage pattern) for the overlying Bute and Nine Feat coal seems are drained separately, with drainage patterns differing across the land ownership boundary. Unlike the coal seams beneath, the Nine Feet Seam was worked from several adits along the strike of the seam in order to allow drainage via gravity direct to outcrop. An example of this can be seen at the Coed Cae Level (Zone 2 – outside of the development area) which has been observed to be discharging mine water from this adit. The entrance of the mine is at an approximate level of 222m AOD with water estimated to be flowing out at a rate of 10L/min.

11.3.80 Working of the Bute and Nine Feet coal seams within the southern portion of the land ownership boundary (and beneath the proposed development) are thought to connect to the underlying ironstone drainage system; although localised discharges to rock head and upwelling from mine working's between 190 to 225m AOD is also taking place in this part of the site.

11.3.81 Drainage within to overlying coal seams largely occurs from levels/ adits at outcrop further up elevation to the west of the proposed development, providing a source of water for a number of watercourses which and discharge into the Nant Melin Cannaid and Nant Cannaid streams. However, there is also the potential for connections to exist to the underlying ironstone drainage network. Several mine entrances and adits located in Zone 1 were observed to be discharging mine water during the site walkover in c.2017.

11.3.82 The abandoned tunnel ways and drainage pits beneath the site and the wider land ownership boundary now represent the dominant pathway for groundwater flow beneath the site. The abandoned mine shafts (those which are not backfilled/ capped) are areas of groundwater recharge to the flooded workings below. These shafts represent vertical recharge zones to groundwater present in deeper disused workings beneath the site. Recharge to both the sandstone units of the coal measures and flooded mine workings will also occur via areas of subsidence or open crown holes due to collapse in the below workings.

11.3.83 Former shafts and areas of subsidence (e.g., collapsed mine workings and crown holes) will also act as areas of groundwater discharge, particularly during periods of prolonged rainfall which will result in rising groundwater levels. Previous site reports, such as Arup (2008) have stated that groundwater levels within the underlying ironstone drainage system and seams below the Nine Feet coal seam have risen over the years; and are circa 10m above the level at which groundwater is discharging from the Upper Abercanaid Engine Shaft. The rise in groundwater levels is thought to be attributed to deterioration of the underlying ironstone drainage network as a result of mine collapse. In addition, the grouting of the A470 has also likely disrupted the natural flow groundwater within the system, limiting discharge from the

Parliament Level off-site, resulting in an increased discharge to rock head further to the west of the site. Typically, following the cessation of mining and dewatering, levels are expected to rebound overtime. It should be noted that there is no recent groundwater level information at the site.

11.3.84 Perched groundwater levels within the numerous spoil tips at the site will be recharged via direct rainfall and indirectly via emerging springs and surface water run-off. A basin area which is referred to as the 'hollow', located on site between the Cyfarthfa Pond and the Glyndyrys Tip, is receiving water from the Nant Melin Cannaid stream and is acting as a natural soakaway. There is no outfall for this stream and as a result, water infiltrates to ground and flows through the tipped materials of the Glyndyrys Tip, and discharges at the base of the tip to the east. It is not clear whether all water which is discharging from these springs on the eastern side of the tip is solely sourced from water the soakaway area or whether a component is the result of water upwelling from underlying mine workings. In addition, this area may also be acting as a localised groundwater recharge zone to the underlying ironstone drainage network.

11.3.85 Springs emerging at the base of spoil tips are drained by several small streams and drainage channels which cross the site. The Cyfarthfa Pond, which is located just outside of the proposed development boundary, is thought to receive water from springs emerging at the base of the adjacent tip.

Hydrological Conceptual Site Model Summary

11.3.86 Similar to the hydrogeological system, the hydrology environment has been shaped and modified by the extensive mining works at the site. A detailed description of the hydrological catchment areas at the site is presented in the Desk Top Study report (Appendix 11.1). Based on the site visits to the site in c. 2017 2021 and 2022, an updated Hydrological Map has been constructed and is attached at Appendix 11.1 within the desk top study report. As such, only a brief summary is presented herein, with the reader referred to the updated Hydrological Map and site visit report completed in June 2022 for detailed account of the current hydrological system within the proposed development area of the site.

11.3.87 The proposed development is situated between the Nant Rhydycar to the north and the Nant Cannaid to the south and is located within three of the five hydrological catchments across the ownership boundary. The site is largely drained via a series of small streams and drainage channels, a combination of natural and artificial; with several following routes of former railway lines; prior to discharge via a series of culverts beneath the A470.

11.3.88 The Nant Cannaid flows along the southern boundary of the land ownership boundary. Water flowing within the Nant Canaid is sourced from several springs and surface runoff from land situated off-site to the west as well as several small tributaries to the Nant Cannaid.

11.3.89 A diverted channel of the Nant Cannaid, known as the Nant Melin Cannaid, flows through Cwm pit and discharges into a basin area known as the 'hollow'. This area also receives water from the Cyfarthfa Pond, with water flowing along the former route of the tub boat canal and into the basin during periods of heavy rainfall and the overtopping of the pond in the north-eastern corner. The pond likely receives groundwater baseflow from upwelling of former mine workings (e.g., Nine Feet seam) and from springs emerging at the base of the adjacent tip.

11.3.90 Water collecting in 'hollow' area is thought to drain slowly through the base of this basin, providing potential recharge to the underlying groundwater (present in flooded disused workings) and emerging as springs at the base of tips (overlying the boulder clay) to the east of this position (eastern extent of the proposed development). Water collecting in this area is then channelled via ephemeral streams, including dismantled railway tracks, towards the former 'Glyndyrus Pond' before eventually discharging to culverts under the A470 at the south-eastern boundary of the landholding.

Updated Baseline – MTCBC Tip Works

11.3.91 During spring 2022, tip drainage works were undertaken by the Council. A site visit was completed on Friday 10 June 2022 to survey the works. It is understood that the works were undertaken to enhance pre-existing drainage provisions and improve stability of tips across the site. The works present a new baseline for the site; however they are currently on hold.

11.3.92 The recent drainage works have been implemented to mitigate against known drainage issues at the site, namely;

- Water discharge from the Nant Meline Canaid Stream which ponds behind the A470/ Glyndyrus Tip,
- Spring emergence of this ponded water at the base of A470/ Glyndyrus Tip,
- Discharge of water from the railway tunnel entrance and areas of flooding.

11.3.93 Although the works completed thus far are likely to have a beneficial impact on the site drainage, the network is incomplete, and its effectiveness is yet to be tested in the absence of any significant rainfall / storm events at the time of the site visit.

11.3.94 Water from the Nant Melin Canaid is still collecting within the 'Hollow' area behind the A470 / Glyndyrys tip. This area continues to act as a natural soakaway, with water flowing through and re-emerging at the base of the tip to the east; although no water was found to be discharging within the newly installed constructed capture drain which could suggest that water from the 'Hollow' is lost to ground / below mine-workings.

11.3.95 Water was not largely found to be flowing within the new drainage network other than from water emerging from the cast iron pipe at the former Abernant tunnel entrance.

Sensitive Hydrological and Hydrogeological Features

The hydrological and hydrogeological features with greatest sensitivity to the development are those in areas of the site which are immediately adjacent to surface watercourses. This is because, changes to the surface water (or land adjacent) could have a direct impact upon water features present within the SINC or SSSI area. Groundwater levels, both within the underlying mine workings, sandstone units of the Coal measures and spoil tips/ heaps, have the potential to be impacted as a result of the development.

11.3.96 Other sensitive features include the underlying ironstone drainage system, which controls the hydrogeology beneath the site and the surrounding area and two off-site private water supplies

which are abstracting groundwater from the Coal Measures aquifer; and nearby SMs (e.g. Cyfartha Pond and Leat and Cwm Pit Head of Railway).

11.4 Mitigation

11.4.1 The purpose of mitigation is to reduce the significance of the residual impact to a minor adverse or negligible level. Individual impacts assessed as being of minor adverse or negligible significance have not automatically been considered to require mitigation. However, where appropriate and possible, and taking into account views and comments received through consultation, consideration has been given to the implementation of mitigation measures designed to reduce minor adverse impacts to a negligible level.

11.4.2 Mitigation measures can be incorporated at various stages in the proposed development. The preferred hierarchy of mitigation is as follows:

- Prevention: At the design stage: avoid, relocate, modify the design and / or do not process with the development;
- Reduction: introduce design modification or additional structures, reduce size and scale of development etc.; and
- Compensation or remediation: compensation to provide like-for-like replacement for any lost environmental elements. When adverse impacts are unavoidable, it may also be possible to limit the duration of an impact by undertaking remedial works. For example, the impact on the landscape of mineral extraction is largely unavoidable, but the land can be progressively restored following the completion of extraction to complement or enhance the character of the landscape.

11.4.3 Effects on the hydrological and hydrogeological receptors associated with the construction and operation of the proposed development are outlined below in Section 11.5, with proposed Mitigation Measures presented in Section 11.6.

11.5 Impact Assessment

11.5.1 The following section outlines the parameters on water quality; hydrogeology, soils and geology that have been assessed.

11.5.2 The likely significant effects possible from the construction and operational phase (i.e., Sources/ Hazards) have been risk assessed within the desktop assessment which is attached at Appendix 11.1. As summary of these significant effects on the water environment is present below in Table 11-8.

Table 11-8 – Summary of Likely Significant Effects on Water Environment

Activity	Likely Significant Effects
Construction Phase	
Accidental spillages	Circumstantial release of fuels and/ or chemicals to groundwater or surface water features
Construction works including stockpiling of materials and construction of haul roads	Mobilisation of elevated contaminants during construction and excavation activities Alteration of existing drainage features both surface water and groundwater. Potential to disrupt or remove natural infiltration/ groundwater recharge zones of spoil tips, the Coal Measures and mine workings. Also, potential to create new potential pathways for contaminant migration. Sediment loading of watercourses. The sealing up or damaging of mine shafts and areas of groundwater recharge, resulting in the rise of groundwater levels in the underlying ironstone drainage system or reduction in groundwater recharge.
Dewatering	Lowering of groundwater levels within the spoil tips, the Coal Measures and mine workings.
Operational Phase	
Site operations	Circumstantial release of fuel and/or chemicals. Anthropogenic contamination such as use of road salt or leaking sewer mains. Disturbing of the natural subsurface water flows and altering of the water balance of the local hydrogeology. Blocking up or sealing of mine shafts or groundwater recharge areas.

11.5.3 The pathways a route by which the contaminant can reach the receptor/understanding of the hydrogeological flow paths/connectivity resulting in an effect; have been outlined in detail within the desktop assessment (Appendix 11.1).

11.5.4 The main receptors identified at the site are as follows:

- Groundwater within the underlying Coal Measures Aquifer (Secondary A Aquifer);
- Off-site Private Water Supplies (Blaencanid Farm and Bike Park Wales);
- On site surface water features including ponds, springs, and watercourses;
- Off-site surface water features e.g., River Taff;
- Off-site Scheduled Ancient Monuments e.g., Cyfarthfa Pond and/ or Cwm Pit;
- Cwm Glo a Glyndyrys SSSI and Rhydycar West SINC.

11.5.5 The impact assessment scenarios for the Construction and the Operational Phase are outlined in the following Tables.



Table 11-9 – Assessment of Significant Effect (Construction Phase) Without Mitigation

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
Accidental spillages – circumstantial release of fuels and/ or chemical	Secondary A / Undifferentiated Aquifer (**Low**)	Direct and indirect pathways that exist to groundwater present in the Coal Measures and disused mineworking's via fractures, joint sets, and mine features such as shafts, crown holes, bell pits or areas of subsidence	Moderate	Moderate	Possible	Minor
	Off-site Private Water Supplies (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)	Direct spillage to receptor; surface water run-off and diffuse overland flow; groundwater baseflow; contaminant migration via on-site surface water features e.g., springs, drainage channels and streams	Major	Major	Possible	Moderate
	Off-site Surface Water Features e.g. River Taff (**Low**)		Major	Major	Possible	Moderate
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Possible	Minor

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
	SSSI (**High**)		Major	Major	Possible	Moderate
Historical contamination - mobilisation of elevated contaminants during construction and excavation activities.	Secondary A / Undifferentiated Aquifer (**Low**)	In addition to pre-existing pathways, excavation and general earthworks for the proposed development could create potential pathways for contaminant migration; vertical infiltration via the unsaturated zone of spoil tips.	Moderate	Moderate	Possible	Minor
	Off-site Private Water Supplies (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)	Diffuse overland flow; infiltration through groundwater baseflow; direct deposition of contaminated spoil into surface water features; surface water features including emerging springs at base of tips and drainage channels; ponds	Moderate	Moderate	Possible	Minor
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
	Scheduled Monuments (**Medium**)	and natural areas of soakaway (i.e., the 'hollow'); historical mine features e.g., tram and railway lines.	Moderate	Moderate	Possible	Minor
	SSSI (**High**)		Moderate	Major	Possible	Moderate
Alteration of drainage / infiltration / recharge to groundwater	Secondary A / Undifferentiated Aquifer (**Low**)	Reduced unsaturated zone within superficial deposits / spoil tips; removal of aquifer protection to the underlying aquifer/ mine workings; reduction in recharge to underlying spoils tips/ aquifer; creation of new pathways for contaminant migration & recharge zones	Moderate	Moderate	Likely	Moderate
	Off-site Private Water Supplies (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)	Alteration of natural recharge pattern due to the introduction of new engineered drainage	Moderate	Moderate	Likely	Moderate

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
	Off-site Surface Water Features e.g. River Taff (**Low**)	systems at the site and introduction of hard standing; reduction in flows/ spring discharge	Moderate	Moderate	Likely	Moderate
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	SSSI (**High**)		Moderate	Major	Possible	Moderate
Mine water discharge	Secondary A / Undifferentiated Aquifer (**Low**)	Direct and indirect pathways that exist to groundwater present in the Coal Measures and disused mineworking's via fractures, joint sets, and mine features such as shafts, crown holes, bell pits or areas of subsidence. Release of mine water either already occurring at the site or the result of alteration to the drainage through redevelopment of the site.	Moderate	Moderate	Possible	Minor
	Off-site Private Water Supplies (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)		Moderate	Moderate	Possible	Minor

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	SSSI (**High**)		Moderate	Major	Possible	Moderate
Blocking up or destruction of underlying ironstone drainage system / preferential pathways beneath the site as result of the planned	Secondary A / Undifferentiated Aquifer (**Low**)	Reduction in permeability and flow through mine workings resulting in increased groundwater levels, increased spring emergence and increased watercourse flows/ flood risk.	Major	Moderate	Possible	Moderate
	Off-site Private Water Supplies (**Medium**)		Moderate		Unlikely	Negligible

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
development works.	On-site Surface Water Features (**Low**)		Major	Moderate	Possible	Moderate
	Off-site Surface Water Features e.g. River Taff (**Low**)		Major	Moderate	Possible	Moderate
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Possible	Minor
	SSSI (**High**)		Major	Major	Possible	Moderate
Dewatering of excavations (only where required)	Secondary A / Undifferentiated Aquifer (**Low**)	Lowering of groundwater levels in the underlying aquifer and mine workings; reduction of recharge to the	Moderate	Minor	Likely	Moderate

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
	Off-site Private Water Supplies (**Medium**)	underlying aquifer or below to hydraulically connected surface water features	Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)		Moderate	Moderate	Possible	Minor
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	SSSI (**High**)		Moderate	Major	Possible	Moderate

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
Sediment laden water resulting increased turbidity in existing drainage features and underlying groundwater	Secondary A / Undifferentiated Aquifer (**Low**)	Vertical infiltration through unsaturated zone/ preferential pathways	Moderate	Moderate	Possible	Minor
	Off-site Private Water Supplies (**Medium**)	Diffuse overland flow; infiltration through groundwater baseflow; surface water features including emerging springs at base of tips and drainage channels; ponds and natural areas of soakaway (i.e., the 'hollow'); historical mine features e.g., tram and railway lines.	Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)		Moderate	Moderate	Possible	Minor
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Possible	Minor

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
	SSSI (**High**)		Moderate	Major	Possible	Moderate
Stockpiling of construction materials and the construction of haul roads	Secondary A / Undifferentiated Aquifer (**Low**)	Vertical infiltration of contaminants through the preferential pathways and/ or unsaturated zone to the groundwater table/ mine workings.	Moderate	Moderate	Possible	Minor
	Off-site Private Water Supplies (**Medium**)	Groundwater flow through the sandstone horizons both by intergranular flow or via preferential pathways	Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)	Diffuse overland flow; infiltration through groundwater baseflow; surface water features including emerging springs at base of tips and drainage channels; ponds and natural areas of soakaway (i.e., the 'hollow'); historical mine	Moderate	Moderate	Possible	Minor
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Significance of Impact	Event Probability	Assessment of Significant Effect (Without Mitigation)
	Scheduled Monuments (**Medium**)	features e.g., tram and railway lines.	Moderate	Moderate	Possible	Minor
	SSSI (**High**)		Moderate	Major	Possible	Moderate

Table 11-10 – Assessment of Significant Effect (Operational Phase) Without Mitigation

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Level of Potential Effect	Event Probability	Assessment of Significant Effect (Without Mitigation)
Accidental spillages – circumstantial release of fuels and/ or chemical	Secondary A / Undifferentiated Aquifer (**Low**)	Direct and indirect pathways including site drainage provisions, direct infiltration, diffuse run-off.	Moderate	Minor	Possible	Minor
	Off-site Private Water Supplies (**Medium**)		Moderate	Moderate	Unlikely	Negligible

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Level of Potential Effect	Event Probability	Assessment of Significant Effect (Without Mitigation)
	On-site Surface Water Features (**Low**)	Direct spillage to receptor; surface water run-off and diffuse overland flow; groundwater baseflow; contaminant migration via on-site surface water features e.g., springs, drainage channels and streams	Moderate	Minor	Possible	Minor
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Possible	Minor
	SSSI (**High**)		Moderate	Major	Possible	Moderate
Potential contamination (E.g., anthropogenic contamination such as leaking sewer pipes or use of road salts);	Secondary A / Undifferentiated Aquifer (**Low**)	Indirect pathway to underlying groundwater via surface run-off and infiltration through preferential pathways that exist such as via anthropogenic drainage systems	Moderate	Moderate	Possible	Minor
	Off-site Private Water Supplies (**Medium**)		Moderate	Moderate	Unlikely	Negligible

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Level of Potential Effect	Event Probability	Assessment of Significant Effect (Without Mitigation)
	On-site Surface Water Features (**Low**)	Diffuse overland flow; infiltration through groundwater baseflow; surface water features including emerging springs at base of tips and drainage channels; ponds and natural areas of soakaway (i.e., the 'hollow'); historical mine features e.g., tram and railway lines.	Moderate	Moderate	Possible	Minor
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Possible	Minor
	SSSI (**High**)		Moderate	Major	Possible	Moderate
Alteration of drainage / infiltration /	Secondary A / Undifferentiated Aquifer (**Low**)	Reduced unsaturated zone within superficial deposits / spoil tips; removal of aquifer protection to the underlying	Moderate	Moderate	Possible	Minor

Source	Receptor (Sensitivity)	Pathway	Magnitude of Potential Impact	Level of Potential Effect	Event Probability	Assessment of Significant Effect (Without Mitigation)
recharge to groundwater	Off-site Private Water Supplies (**Medium**)	aquifer/ mine workings; reduction in recharge to underlying spoils tips/ aquifer; creation of new pathways for contaminant migration & recharge zones.	Moderate	Moderate	Unlikely	Negligible
	On-site Surface Water Features (**Low**)	Alteration of natural recharge pattern due to the introduction of new engineered drainage systems at the site and introduction of hard standing; reduction in flows/ spring discharge.	Moderate	Moderate	Possible	Minor
	Off-site Surface Water Features e.g. River Taff (**Low**)		Moderate	Moderate	Possible	Minor
	Scheduled Monuments (**Medium**)		Moderate	Moderate	Unlikely	Negligible
	SSSI (**High**)		Moderate	Major	Unlikely	Minor

11.6 Additional Mitigation, Compensation and Enhancement Measures

11.6.1 Mitigation measures are implemented so that potential impacts can be identified, avoided, or reduced. Only those impacts which are assessed as being of moderate and major adverse significance are generally considered to require mitigation. The components presented in outline proposed mitigation measures which, when implemented, should reduce any identified unacceptable risks to the hydrological and hydrogeological environments at the site to a manageable, acceptable level during the construction and operational phase where necessary.

Table 11-11 – Proposed Mitigation, Compensation and Enhancement Measures

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
Construction Phase					
Accidental Spillages (including fuel oil) – release of fuel and lubricants during refuelling / maintenance of plant or the use of chemicals during the construction works and operation phase	Secondary A / Undifferentiated Aquifer (Low)	Minor	Operations onsite including maintenance, refuelling and storage of fuels will be kept to the minimum that is required. A Construction Environment Management Plan (CEMP) will be developed for the site and will be provided to NRW. The CEMP will detail measures to minimise the potential for spills and other accidents. Measures are to include best practice pollution measures such as use of bunding and storage of potentially hazardous materials. An emergency plan for the site will also be developed and implemented if required. This plan will outline the provision of on-site equipment for containment of spillages such as emergency booms and chemicals to soak up spillages. Where fueling of large machinery is required, drip trays and absorbent mats and pellets will be used to contain or absorb	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Negligible		Negligible	Negligible
	On-site Surface Water Features (Low)	Moderate		Minor	Minor to Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Moderate		Minor	Minor to Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
	Scheduled Monuments (Medium)	Minor	accidental spillages. Plant maintenance will also be undertaken in a designated area and similar contamination prevention measures will be adopted. If mitigation measures are adhered to, the likelihood of occurrence would be reduced from 'possible' to 'unlikely' and as such the overall risk is reduced to 'Minor'. To offer further surety that the mitigation measures outlined in the CEMP are implemented in full, a Groundwater Protection Plan (GWPP) will be produced for the construction phase of the proposed development. The GWPP will identify the perceived risks to the sensitive environmental receptors, identify pollution pathways, and provide recommended mitigation measures against this risk in accordance with relevant Environment Agency guidance. A site audit will be carried out by a Hydrogeological Clerk of Works (HCoW) who will oversee the construction phase of the works and carry out routine monitoring.	Minor	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible
Historical contamination - mobilisation of elevated contaminants during construction and excavation activities.	Secondary A / Undifferentiated Aquifer (Low)	Minor	During the reserved matters stage, as part of the detailed design stage, ground investigation works will be carried out to update the existing risk assessment and to inform a Groundwater Monitoring Strategy and Plan. Areas of contamination will be identified, and risk management procedures identified within a Remediation Strategy. An Earthworks and Remediation strategy will be developed for the site. Excavation works will be undertaken in accordance with the	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Minor		No Change	Negligible
	On-site Surface Water Features (Low)	Minor		Negligible	Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
	Off-site Surface Water Features e.g. River Taff (Low)	Negligible	agreed CEMP and Remediation Strategy. Active excavation works will be limited to periods of dry weather (where possible) to restrict pooling / surface runoff into open excavations on site. A CEMP will be developed for the site and adhered to. The CEMP will detail measures to minimise the potential for contamination of the underlying aquifer as a result of construction activities relating to physical disturbance of the ground. Excavations for this type of development are, by their very nature, are transient and occur over relatively small timeframes (i.e. weeks). During construction , strict adherence to the CEMP and PPG's will be followed.	Negligible	Negligible
	ScheduledMonuments (Medium)	Minor		Negligible	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible
Alteration of drainage / infiltration / recharge to groundwater	Secondary A / Undifferentiated Aquifer (Low)	Moderate	A full list of mitigation measures associated with water, drainage and flooding which are to be employed during the Construction Phase are discussed in the Tetra Tech Drainage Strategy report. Works to gather site specific qualitative groundwater data (level and water quality) over a sustained period at targeted locations (and within key geological units/ mine workings) has begun and will help ascertain the degree of groundwater rebound beneath the site. A network of groundwater monitoring boreholes will be installed across the development site and within key hydrological features located nearby (i.e., within the SINC and SSSI outside the development) in order to confirm and ascertain the interaction	Minor	Minor to Negligible
	Off-site Private Water Supplies (Medium)	Negligible		No Change	Negligible
	On-site Surface Water Features (Low)	Moderate		Minor	Minor to Negligible
	Off-site Surface Water Features e.g. River Taff	Minor		Negligible	Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
	(Low)		between spoil tips, superficial deposits, coal measures aquifer and key hydrological features within the SINC and SSSI. The findings of the groundwater and surface water monitoring will be used to inform the Groundwater and Surface Water Management and CEMP documents. Construction works will be carried out in such a way as to avoid damage to watercourses and the underlying drainage systems; both within the spoil tips on site and coal measures aquifer/ mine workings. This will be achieved by: • Strict supervision on site and careful programming of works; • Drainage – new drainage infrastructure will be bunged at the end of each working day to prevent water ingress and accidental contamination. Final connections will be made post-completion of road construction; • Drainage – wheel washes will be used by the contractor, and a road brush will be employed, to avoid pollution of existing drainage systems; • Excavation and Stockpiling – the contractor will use silt-traps, cut off trenches and vegetated corridors to prevent silty water from entering adjacent watercourses; • Oil Storage and Refuelling – the contractor will dedicate specific areas for oil storage and refuelling, separated a minimum of 10m from adjacent watercourses and comply		
	ScheduledMonuments (Medium)	Negligible		Negligible	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
			with legislation, including providing bunds sized 10 contain 110% of fuel storage capacity; • Oil Storage and Refuelling – the contractor will use fill point drip trays, bunded pallets and secondary containment units; • Oil Storage and Refuelling – the site will be enclosed and secured and fuel storage areas will be secondarily secured; • Waste Management – the contractor will develop a Site Waste Management Plan (SWMP) in accordance with PPG 6, including the retention of packaging by suppliers and the use of covered skips for any site waste; and • Incident Response – the contractor will develop a site-specific Incident Response Plan in accordance with PPG6, appoint a responsible person and train operatives in implementation and testing of the Plan periodically throughout construction of the works. • Ensure that drainage within areas outside of the development area (i.e., within the SSSI) would not be interrupted or destroyed as a result of the construction works; • Prevent damage by erosion, silting, pollution or flooding by incorporating appropriate mitigation measures which would be documented within a Surface Water Management Plan. Drainage works will be completed in accordance with an appropriate specification, e.g. the National Building Specification		

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
			for other works, with cross-reference to the Specification For Highway Works and Pollution Prevention Guidance Notes, or PPGs, and particularly PPG 5: Works And Maintenance In Or Near Water.		
Mine water discharge	Secondary A / Undifferentiated Aquifer (Low)	Minor	Reduced quality mine water discharge is not expected to be a significant issue at the site. Groundwater and surface water quality will be determined through ground investigation and surface water monitoring to support drainage design and incorporation of relevant SuDS features.	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Negligible		No Change	Negligible
	On-site Surface Water Features (Low)	Minor		Negligible	Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Minor		Negligible	Negligible
	Scheduled Monuments (Medium)	Negligible		Negligible	Negligible
	SSSI (High)	Moderate		Negligible	Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
Blocking up or destruction of underlying ironstone drainage system / preferential pathways beneath the site as result of the planned development works.	Secondary A / Undifferentiated Aquifer (Low)	Moderate	There is the potential that the development could impact upon or disrupt the underlying ironstone drainage system. Damage or blocking up to this system could cause a rise in groundwater levels and could potentially result in groundwater flooding or increased surface water flow elsewhere in the system. Shafts, such as the Glyndyrys Shaft within the proposed development, and other mine workings will be thoroughly investigated and will be adequately protected during the construction phase. These key hydrogeological areas will be investigated as part of the reserved matters stage through ground investigation and monitoring of groundwater levels. Should grouting of mine shafts be a requirement, then a comprehensive localised hydrogeology study and investigation will be undertaken to ensure the grouting does not impede upon the hydrogeological regime.	Minor	Minor to Negligible
	Off-site Private Water Supplies (Medium)	Negligible		No Change	Negligible
	On-site Surface Water Features (Low)	Moderate		Minor	Minor to Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Moderate		Minor	Minor to Negligible
	Scheduled Monuments (Medium)	Minor		Minor	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible
Dewatering of excavations	Secondary A / Undifferentiated Aquifer (Low)	Moderate	Dewatering of excavations are likely to be required, particularly where excavations intersect the groundwater table or groundwater present within the underlying spoil tips.	Minor	Minor to Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
	Off-site Private Water Supplies (Medium)	Negligible	Prior to works, a dewatering risk assessment and method statement will be completed detailing measures to be put in place to ensure protection of the groundwater and surface water environment. In-situ hydrogeological testing will be undertaken as needed to allow a quantitative assessment of dewatering requirements during the construction phase.	Negligible	Negligible
	On-site Surface Water Features (Low)	Minor		Negligible	Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Minor		Negligible	Negligible
	Scheduled Monuments (Medium)	Negligible		Negligible	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible
Sediment laden water resulting increased turbidity in existing drainage	Secondary A / Undifferentiated Aquifer (Low)	Minor	A CEMP will be developed for the site and adhered to. Good site working practices utilising silt traps where required. Works restricted during periods of high rainfall. Changes to drainage regime to be kept to a minimum. Surface water run-off is to be controlled.	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Negligible		No Change	Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
features and underlying groundwater	On-site Surface Water Features (Low)	Minor		Negligible	Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Minor		Negligible	Negligible
	Scheduled Monuments (Medium)	Minor		Minor	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible
Stockpiling of construction materials and the construction of haul roads	Secondary A / Undifferentiated Aquifer (Low)	Minor	A CEMP will be developed for the site and adhered to. Measures will include the early establishment of drainage facilities such as bunds, ditches, and silt traps to reduce the risk of problems during construction; siting of materials and stockpiles which are considerate of their proximity to surface water features; limiting excavation activities and site works during heavy rainfall events.	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Negligible		Negligible	Negligible
	On-site Surface Water Features (Low)	Minor		Negligible	Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
	Off-site Surface Water Features e.g. River Taff (Low)	Minor		Negligible	Negligible
	Scheduled Monuments (Medium)	Minor		Minor	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible
Operational Phase					
Accidental spillages – circumstantial release of fuels and/ or chemical	Secondary A / Undifferentiated Aquifer (Low)	Minor	Mitigation measures associated with water, drainage and flooding at the site are outlined within the Tetra Tech Drainage Strategy Report. Potential impacts associated with the surface water drainage at the site will be addressed by the design features outlined within the aforementioned report. The effectiveness of the formal drainage network that has been partially installed at the site by the Council will be considered and incorporated into the design where proven to be effective and in line with the approved design.	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Negligible		Negligible	Negligible
	On-site Surface Water Features (Low)	Minor		Negligible	Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Minor		Negligible	Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
	Scheduled Monuments (Medium)	Minor		Minor	Negligible
	SSSI (High)	Moderate		Minor	Minor to Negligible
Potential contamination (E.g., anthropogenic contamination such as leaking sewer pipes or use of road salts);	Secondary A / Undifferentiated Aquifer (Low)	Minor	During the operational phase, any leakage from sewage pipes will be minimised by ensuring the pipework design is rigorous in terms in leakage and deterioration. For example, installing welded pipe work as opposed to conventional push fit pipes that are prone to deterioration or, installing pipe work within trenches lined with low permeability material. The UKWIR Guidance will be followed for the installation of water supply pipes at the site. This guidance outlines the methodology by which appropriate water supply pipes should be selected on Brownfield sites.	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Minor		Negligible	Negligible
	On-site Surface Water Features (Low)	Minor		Negligible	Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Minor		Negligible	Negligible
	Scheduled Monuments (Medium)	Minor		Minor	Negligible

Potential Environmental Effect	Receptor (Sensitivity)	Impact Significance Without Mitigation	Proposed Mitigation	Residual Magnitude of Impact	Impact Significance With Mitigation
	SSSI (High)	Moderate		Minor	Minor to Negligible
Alteration of drainage / infiltration / recharge to groundwater	Secondary A / Undifferentiated Aquifer (Low)	Minor	The Tetra Tech Flood Consequence Assessment Report outlines the proposed mitigation measures associated with the flood risk and drainage designs. Three watercourses are proposed which will decrease pluvial flood risk significantly. Re-alignment of the Nant Melin Canaid within the Cwm Pit SM will prevent ongoing erosion of the masonry stone wall.	Negligible	Negligible
	Off-site Private Water Supplies (Medium)	Negligible		Negligible	Negligible
	On-site Surface Water Features (Low)	Minor		Negligible	Negligible
	Off-site Surface Water Features e.g. River Taff (Low)	Minor		Negligible	Negligible
	Scheduled Monuments (Medium)	Negligible		Negligible	Negligible
	SSSI (High)	Minor		Negligible	Negligible

11.7 Description of Residual Effects and their Significance Taking Mitigation into Account (Construction)

11.7.1 The development does not have any significant residual effects on the water environment during construction if all mitigation measures are implemented.

11.8 Description of Residual Effects and their Significance Taking Mitigation into Account (Operation)

11.8.1 The development does not have any significant residual effects on the water environment during operation if all mitigation measures are implemented.

11.9 Cumulative Impacts

11.9.1 With regards to the water environment, no cumulative impacts have been identified in the surrounding area.

11.10 Summary

11.10.1 This ES Chapter presents an assessment of the potential impacts regarding the water environment from the proposed development at the site. It provides a detailed account of the hydrogeological and hydrological environments both at the site and the surroundings area and includes a qualitative impact assessment following the development of a Conceptual Site Model which provides an initial characterisation of the water environment. Mitigation measures have been proposed which reduce potentially significant risks associated with the construction and operational phases of the proposed development to acceptable levels.

11.10.2 The implementation of specific mitigation measures within the construction and operational phases in conjunction with good environmental controls, can ensure that any impacts and/or effects on the hydrology and hydrogeology will be quickly controlled and will have a minor to negligible residual risk level. In addition, the incorporation of SuDS features or the proposed re-alignment of the Nant Melin Cannaid will bring beneficial impacts by preventing continued erosion of the Cwm Pit and Head of Railway stone masonry wall.

11.10.3 This ES Chapter and the appended Hydrogeological and Hydrological Desktop Assessment (Preliminary Risk Assessment) provides a detailed account of the hydrogeological and hydrological environment at the site which is considered to be sufficient to support the outline planning application and therefore not considered to be a barrier to the proposed development. Accordingly, no objections to the development should be sustained on grounds of Hydrology & Hydrogeology.



11.11 Glossary

Term	Definition
AOD	above Ordnance Datum
bgl	below ground level
BGS	British Geological Survey
CLEA	Contaminated Land Exposure Assessment
WFD	Water Framework Directive
CSM	Conceptual Site Model
DEFRA	Department of Environment, food and Rural Affairs
DQRA	Detailed Quantitative Risk Assessment
DTS	Desktop Study
DWS	Drinking Water Standard
EA	Environment Agency
NRW	Natural Resources Wales
EQS	Environmental Quality Standards
OS	Ordnance Survey
SGV	Soil Guideline Values
TSV	Tier 1 Screening Values
AOD	above Ordnance Datum

12.0 Landscape and Visual Impact Assessment

12.1 Introduction

12.1.1 Purpose

12.1.1.1 This Landscape and Visual Impact Assessment relates to an Outline Planning Application for a destination sports, leisure and tourism led, mixed-use development proposal comprising indoor snow centre (up to 39,200 sq. m), waterpark (up to 7,500 sq. m), indoor activity centre (up to 9,000 sq. m), external activity areas, hotel accommodation (up to 418 bedrooms), forest lodge accommodation (up to 30 units), car parking (up to 830 spaces) and associated earthworks, access, drainage, servicing and utilities connections/infrastructure on land to the Southwest of the Rhydycar roundabout on the A470, South of Merthyr Tydfil.

12.1.1.2 The site extends to 30.4 hectares. It is located west of Rhydycar and to the southwest of Merthyr Tydfil, between the A470 to its east, Gethin Woodland Park to the south and west, and Heolgerrig to the north, as shown on **Figure LA.12.1**.

12.1.2 Executive Summary

12.1.2.1 This Landscape and Visual Impact Assessment has examined the landscape and visual impacts in relation to the development proposals. All impact assessments are based on the proposed design approach, which incorporates mitigation measures. The potential impacts have been thoroughly assessed through a combination of desk study research and walk-over surveys of the site and the surrounding context.

12.1.2.2 The sensitive integration of development at the site represents a significant challenge due to the combination of former mining features, disused railway infrastructure, tips and the distinctive character of the site and its context. The vision of the proposed development is centred around what will be the longest indoor snow centre in the UK (incorporating the national training headquarters and facility for Snowsports Cymru Wales and GB Snowsport). The master plan is for a new destination sports, leisure and tourism resort. Central to this is the creation of a high-quality holiday resort destination that focuses on indoor and outdoor activities, wildlife and reinforces the special character of the local environment. The masterplan and landscape strategy respond sensitively to its landscape setting and contribute positively to the local area.

12.1.2.3 The proposals for the site have been formulated through an iterative process with the design evolution responding to the findings of baseline surveys to avoid or moderate adverse effects. The proposals have been informed by comprehensive survey and assessment work. As a result, the potential landscape and visual impacts have been moderated. The proposals therefore satisfy policy requirements relating to the site. Adverse landscape effects are largely constrained to the direct impacts on the site itself and reflect the scale of the built form and earthworks proposed. The effectiveness of mitigation measures is demonstrated by the reduction in the significance of effects which is assessed following the completion of construction, and particularly at 15 years after construction.

12.1.2.4 Similarly, the indirect effects beyond the site boundary are also reduced following the completion of the construction work as the proposed development becomes integrated into its context.

12.1.2.5 The visual impacts of the development proposals have been assessed through a process of identifying assessment viewpoints, using computer-generated Zone of Theoretical Visibility (ZTV) and accurate visual representation to illustrate the proposed development from a significant proportion of the identified assessment viewpoints. The visual assessment has identified adverse impacts for areas with open views towards the site from the east within the urban area. Built development within the urban area reduces the extent of areas where uninterrupted views are available. Effects for other visual receptors are generally moderate adverse and there is a reduction in significance of effects for several receptors following construction and after 15 years.

12.1.2.6 The Landscape and Visual Impact Assessment has identified that the site could accommodate the proposed development without resulting in an unacceptable adverse impact on landscape character and visual amenity experienced within the surrounding landscape/townscape.

12.1.3 Scope of the Assessment

12.1.3.1 The proposed development at the site is centred around what will be the longest indoor snow centre in the UK (incorporating the national headquarters and training facility for Snow Sports Wales and Team GB). The master plan is for a new destination sports, leisure and tourism resort, which will include:

- An International Ski Federation (FIS) standard indoor snow centre capable of hosting National and International Indoor ski competitions
- A water park;
- Space for indoor adventure activities;
- Space for outdoor adventure activities;
- A variety of resort accommodation, including up to 420 hotel/ hostel keys and 30 forest lodges;
- Associated retail outlets;
- Associated Food and Beverage offers;
- Conference facilities
- New public spaces and extensive external landscaped areas, including the provision of public access to existing Heritage Assets; and

- Ancillary accommodation in support of the above, including parking, public transport drop-off, active travel infrastructure, energy centre, snow management infrastructure and back-of-house areas.

12.1.3.2 This Landscape and Visual Impact Assessment (LVIA) provides an assessment of the effects of the proposed development, on the landscape of the site and its context. The design of the proposed development and the identification of mitigation measures incorporated within the design to minimise adverse effects, is informed by the findings of the assessment process as it progressed. In this LVIA, effects on features identified as important to the scenic quality, or effects on the landscape character of the site and its setting are assessed. Effects on peoples' views of the site and its setting, or visual amenity, are also assessed.

12.1.3.3 For the purposes of assessing the landscape and visual effects of this proposal, study areas have been defined:

- The site extends to the redline boundary as shown on **Figure LA.12.1**.
- The immediate landscape context extends to approximately 0.5km to the north, west and south from the site with the A470 reducing the immediate context to circa 0.1km to the east of the site.
- The wider landscape context extends between 1 and 2km from the site boundary, which is influenced by vegetation, built form and/or topography.
- The visual study area, which is defined by the surrounding valleys topography, extends 3km to the west and south of the site, 5km to the southeast of the site, 4km to the east of the site, and 6km to the north, see **Figure LA.12.1**.

12.1.3.4 The objectives of the assessment are to:

- Describe and evaluate the landscape of the site and surrounding landscape context and the visual amenity of people in the surrounding area, which might be affected by the proposed development;
- Examine the development proposals and analyse the potential effects on the landscape and visual amenity associated with the scheme's design, and whether they are likely to be significant;
- Set out mitigation measures which could be implemented in order to avoid, reduce or offset adverse effects, especially those identified as significant, and, where possible, incorporate these in the scheme design;
- Describe any enhancements of the landscape or visual amenity incorporated in the development proposals, and
- Provide an assessment of the significance of the landscape and visual effects of the proposed development with integral mitigation measures in place.

12.1.3.5 The LVIA is presented with separate sections dealing with effects on landscape, and effects on visual amenity. The LVIA is illustrated by plans and photographs (see **Appendix 12.1**), as follows:

- Figure LA.12.1 Site Location
- Figures LA.12.2 Designations
- Figure LA. 12.3 Public Access
- Figures LA. 12.4 LANDMAP
- Figures LA. 12.5 Site Context
- Figures LA. 12.6 Site Photographs
- Figure LA. 12.7 Zone of Theoretical Visibility
- Figures LA. 12.8 Context Photographs
- Figures LA. 12.9 Viewpoint Photographs

12.1.3.6 Detailed information is presented in Appendices as follows:

- Appendix 12.2 Assessment Methodology
- Appendix 12.3 Assessment of effects
- Appendix 12.4 Viewpoint Selections
- Appendix 12.5 Accurate Visual Representations
- Appendix 12.6 Public Rights of Way within the site

12.2 Assessment Methodology

12.2.1 The methodology used for assessing the landscape and visual effects is based on the recommendations in Guidelines for Landscape and Visual Impact Assessment 3rd Edition, published by The Landscape Institute and the Institute of Environmental Management & Assessment in 2013 (GLVIA3), as set out in **Appendix 12.2**.

12.2.2 The assessment process comprises a combination of desk studies and field surveys, with subsequent analyses, and involved:

- A review of landscape designations and planning policies for the landscape, and of other landscape studies relevant to the area, including LANDMAP assessment information and local landscape character assessments;
- A survey of the site and landscape context study areas and inspection of views of the site from publicly accessible viewpoints, including a photographic survey. The surveys



were carried out on the 30th of March, 1st of April, and 22nd of April 2021 during dry weather with good visibility. A revisit of the site was also undertaken on 14th June 2022 following some engineering works carried out on the site by Merthyr Tydfil County Borough Council (MTCBC) as part of improving the drainage of the site and to secure the stability of the tips. The works included constructing boulder lined channels and steps for water to cascade down, drainage ditches, and the widening of some existing tracks. Additional views were also photographed on 26th October 2022 following comments received from MTCBC;

- The selected viewpoints followed discussions in writing with the Landscape Officer at MTCBC[1];
- Evaluation of the features and elements of the landscape and their contribution to the landscape character, context and setting, based on these studies;
- Analysis of the development proposals and consideration of potential landscape and visual effects of the proposed development;
- Assessment of the susceptibility and sensitivity of the landscape to the changes likely to arise from the development;
- Identification of the extent of theoretic visibility of the proposed development and viewers, their susceptibility and sensitivity, and view locations, supported by a viewpoint analysis; and
- Consideration of the proposals and the mitigation measures to avoid, reduce or offset adverse effects.

[1] Emails between Emma Hayes (formerly Tetra Tech but now Tir Collective) and the Landscape Officer at MTCBC dated between 4th March and 23rd March 2021.

12.2.3 Assessment of magnitude of change arising from the proposal, the degree and nature of effects on the landscape and on visual amenity and their significance, with the mitigation proposals in place.

Assessment and Mitigation

12.2.4 The effects of the development, whether beneficial or adverse, may vary in nature and degree through its lifecycle and, where feasible, mitigation measures are proposed to be incorporated in the design of the development. Where design measures cannot address identified likely adverse effects, measures such as management of the construction and operational processes or of the use of public rights of way may be proposed. The purpose of mitigation measures is first, to prevent or avoid the potentially adverse effects identified, and if that is not possible, to reduce the potential adverse effect. Where adverse effects are unavoidable, the purpose is to offset or compensate for the effect.

12.2.5 Details of the criteria for assessing landscape effects and visual effects are set out in those respective sections.

Guidance

12.2.6 In addition to GLVIA3, the following sources of guidance were referred to:

- Landscape Institute's Technical Guidance Note 02/21 Assessing landscape value outside national designations[2]
- Landscape Institute's Technical Guidance Note 06/19, Visual Representation of Development Proposals, September 2019[3]

12.2.7 Relevant policy, landscape character assessments, and other contextual information sources were also referred to, including:

- LANDMAP assessment information and Guidance Note 46 (GN46)[4].
- Policies relevant to the landscape and visual amenity in national, regional, and local policy including Merthyr Tydfil Local Development Plan 2016-2031, Management Plan for the Brecon Beacons National Park 2015-2020, and the Brecon Beacons National Park Landscape Character Assessment (2012).
- Order Decisions 24.01.2023 in relation to Order A: ROW/ 3214070, Order B: ROW/ 3214077, and Order C: ROW/ 3214138.

[2] https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2021/05/tgn-02-21-assessing-landscape-value-outside-national-designations.pdf
[3] The Landscape Institute Guidance Note, Visualisation of development, September 2019, on LI website: https://www.landscapeinstitute.org/visualisation/
[4] https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/evidence-to-inform-development-planning/using-landmap-in-landscape-and-visual-impact-assessments-gn46/?lang=en

Photography

12.2.8 Photographs have a special role in describing landscape character and illustrating key views. In order for photographs to be representative and to create an image that is as similar as possible to that which is seen with the human eye, the Landscape Institute (LI) advises using a lens with a focal length equivalent to 50mm for a 35mm Single Lens Reflex (SLR) camera, and a horizontal field of view of a little under 40 degrees. The equipment used for the viewpoint photography includes:

- A Canon EOS 5D Mark iii digital SLR camera with a full frame sensor;
- Canon 50mm EF 1:1.8 II lens; and
- Manfrotto tripod and panoramic head.

12.2.9 Photographs were taken with a focal length of 50mm.

12.2.10 Landscape photography includes wide angle or panoramic views requiring a sequence of photographs to be taken across the view. Where this approach is taken, a series of overlapping photographs are digitally spliced together in PTGui Pro or Adobe Photoshop CC using a cylindrical projection to provide a panorama approximating to the normal field of view in a landscape context. Where necessary, the contrast and brightness of individual photographs is slightly manipulated in order to create a consistent panorama without visible joins.

12.2.11 The viewpoint locations were established using a camera mounted GPS device and verified against Ordnance Survey grid reference and height above Ordnance Datum.

Wireline visualisations

For each viewpoint the camera was mounted on a tripod and 360° photographs were taken. The viewpoint locations were recorded using an on-camera GPS unit. The GPS readings were plotted in GIS and fine-tuned with reference to aerial photography and LiDAR data to match accurately each photograph location. A 3d Sketchup model of the proposed development was imported into 3ds Max software and georeferenced, with the base level of the proposed development blocks located at existing ground levels. The viewpoint locations were set up in this model and the wireline views were generated for each selected viewpoint. Each existing view and Type 3 visualisation view are presented in a cylindrical projection with a horizontal field of view of 90° to show the proposed development in its context, with the images presented as per the latest Landscape Institute guidance [5].

[5] The Landscape Institute Guidance Note, Visualisation of development, September 2019, on LI website: https://www.landscapeinstitute.org/visualisation/

Weather

12.2.12 The weather is a factor affecting the assessment of, especially, visual impacts. The Met Office[6] publish average statistics for weather patterns for the region, monthly and annual, for maximum and minimum temperatures, days of air frost, hours of sunshine, amount of rainfall - both generally and the number of days when rainfall is above 1mm. For Tredegar, at about 10km to the east, the nearest Climate station to where the site is located:

- Rainfall above 1mm per day, which limits visibility, occurs on an average of 165.5 days in the year, about 45.5% of the year
- There are on average 58.7 days when air frost occurs, which can produce hazy conditions limiting visibility, about 16.0% of the year
- There is an average of 1381.2 hours of sunshine per annum for the station, less than the England SW & Wales S district average of 1519.7 hours.

12.3 Landscape Policies and Designations

12.3.1 National Planning policy

Future Wales: The National Plan 2040

12.3.1.1 Future Wales sets out the development plan for Wales, influencing "all levels of the planning system in Wales and will help shape Strategic and Local Development Plans."[7] The plan promotes development that enhances our wellbeing and our quality of life"[8] and embeds the principles of the Well-being of Future Generations (Wales) Act 2015. The plan sets out development policies for Wales, dividing it into 4 regions: The North, Mid Wales, The Southwest, and The Southeast, the site is located in the southeast region.

12.3.1.2 The key policies that are of relevance to the proposed development include:

- **Policy 1 –** Where Wales will grow states "The Welsh Government supports sustainable growth in all parts of Wales. In three National Growth Areas there will be growth in employment and… investment in infrastructure. The National Growth Areas are:

Cardiff, Newport and the Valleys
[…]"

- **Policy 2 –** Shaping Urban growth and Regeneration – Strategic Placemaking states "The growth and regeneration of towns and cities should positively contribute towards building sustainable places… and integrated with green infrastructure."

[6] The data quoted are those for Tredegar, England SW & Wales S, obtained from The Met Office website: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcjww0udy] [accessed February 2021]
[7] https://gov.wales/future-wales-national-plan-2040-0
[8] Page 4, Future Wales The National Plan 2040

- **Policy 9 –** Resilient Ecological Networks and Green Infrastructure aims "To ensure the… provision of green infrastructure, the Welsh Government will work with key partners to:

[…]
… identify opportunities where existing and potential green infrastructure could be maximised as part of placemaking, requiring the use of nature□based solutions as a key mechanism for securing sustainable growth, ecological connectivity, social equality and well□being.
… In all cases, action towards securing the maintenance and enhancement of… green infrastructure assets must be demonstrated as part of development proposals through innovative, nature□based approaches to site planning and the design of the built environment."

- **Policy 33 –** National Growth Area – Cardiff, Newport and the Valleys states "Cardiff, Newport and the Valleys will be the main focus for growth and investment in the South East region…The Welsh Government supports co-ordinated regeneration and investment in the Valleys area to improve well□being, increase prosperity and address social inequalities".

Planning Policy Wales

12.3.1.3 Planning Policy Wales (PPW) Edition 11 published 24 February 2021 sets out the land use planning policies of the Welsh Government. Its primary objective is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation and resultant duties such as the Socio□economic Duty.

12.3.1.4 PPW translates The Welsh Government's commitment to sustainable development into the planning system, to be taken into account when preparing development plans, so that it can play an appropriate role in moving towards sustainability. The key policies that are of relevance to the development include:

- **Chapter 2** People and Places, paragraph 2.1 states that "Everyone engaged with or operating within the planning system in Wales must embrace the concept of placemaking… in order to achieve the creation of sustainable places and improve the well-being of communities."

12.3.1.5 Paragraph 2.17 states … the creation of sustainable places and in recognition of the need to contribute to the well□being of future generations in Wales through placemaking, development plans and development proposals must seek to deliver developments that address the national sustainable placemaking outcomes."

12.3.1.6 Paragraph 2.27 states "Planning authorities should ensure that social, economic, environmental and cultural benefits are considered in the decision-making process… to implement the Well-being of Future Generations Act and the Sustainable Development Principle." A key factor is environmental considerations, with relevant questions listed as:

- "will important features of the natural and built environment be protected and enhanced;
- are the environmental impacts of development on… amenity limited to acceptable levels…;
- is environmental protection for people and natural resources, property and infrastructure maximised and environmental risks prevented or appropriately managed;
  […]
- will the causes and impacts of climate change be fully taken into account through location, design, build, operation…
  […]"

- **Chapter 3** Strategic and Spatial Choices paragraph 3.9 states "The special characteristics of an area should be central to the design of a development. The layout, form, scale and visual appearance of a proposed development and its relationship to its surroundings are important planning considerations."

12.3.1.7 Paragraph 3.10 goes on to state "In areas recognised for their particular landscape… or historic character and value, it can be appropriate to seek to promote or reinforce local distinctiveness. In those areas, the impact of development on the existing character, the scale and siting of new development… will be particularly important."

12.3.1.8 In relation to healthier places, paragraph 3.23 states "Green infrastructure can be an effective means of enhancing health and well□being, through linking dwellings, workplaces and community facilities and providing high quality, accessible green spaces."

- **Chapter 4** Active and Social Places, section 4.5 recreational spaces, paragraph 4.5.1 states "Recreational spaces are vital for our health, well-being and amenity, and can contribute to an area's green infrastructure… Networks of high quality, accessible green spaces and recreation spaces will also promote nature conservation, biodiversity and provide enjoyable opportunities for residents and visitors…"

- **Chapter 6** Distinctive & Natural Places, paragraph 6.0.2 states "The special and unique characteristics and intrinsic qualities of the natural and built environment must be protected in their own right, for historic, scenic, aesthetic and nature conservation reasons."

12.3.1.9 Paragraph 6.1.18 states "Planning authorities should value, protect, conserve and enhance the special interest of parks and gardens and their settings included on the register of historic parks and gardens in Wales. The register should be taken into account in planning authority decision making."

12.3.1.10 Paragraph 6.1.19 goes on to state "The effect of a proposed development on a registered park or garden, or its setting, is a material consideration in the determination of planning applications."

- **Section 6.2** Green infrastructure, paragraph 6.2.5 states "The quality of the built environment should be enhanced by integrating green infrastructure into development through appropriate site selection and use of creative design."



- **Section 6.3** Landscape, paragraph 6.3.3 states "All the landscapes of Wales are valued for their intrinsic contribution to a sense of place, and local authorities should protect and enhance their special characteristics, whilst paying due regard to the social, economic, environmental and cultural benefits they provide, and to their role in creating valued places." Paragraph 6.3.4 goes on to state "Where adverse effects on landscape character cannot be avoided, it will be necessary to refuse planning permission. "**Section 6.6** Water and flood risk, paragraph 6.6.18 states "The provision of SuDS must be considered as an integral part of the design of new development and considered at the earliest possible stage when formulating proposals for new development." Paragraph 6.6.19 goes on to state "Design for multiple benefits and green infrastructure should be secured wherever possible…"

12.3.1.11 Planning Policy Wales is supplemented by 21 topic based Technical Advice Notes (TANs), of which the key elements of relevance to the landscape and visual aspects of the development are set out below:

TAN 5 Nature Conservation and Planning

12.3.1.12 In preparing planning applications, "all relevant information" should be included and "all material considerations addressed in the layout, design and related access, drainage and infrastructure. Landscaping proposals should be included together with any measures designed to avoid, mitigate or compensate for potential adverse effects on nature conservation. Any proposals for enhancement of nature conservation interests should also be included".

12.3.1.13 "The conservation and enhancement of locally designated sites is an important contribution to the implementation of Biodiversity Action Plans and to the management of features of the landscape of major importance for wild flora and fauna.

TAN 12 Design

12.3.1.14 TAN 12 advocates a holistic approach to design, to meet the objectives of good design, set out in Figure 12.1, which include:

- Access: Ensuring ease of access for all;
- Character: Sustaining or enhancing local character; Promoting a successful relationship between public and private space; Promoting innovative design; Promoting legible development; Promoting quality, choice and variety;
- Community Safety: Ensuring attractive, safe public spaces; Security through natural surveillance;
- Environmental Sustainability: Achieving efficient use and protection of natural resources; Enhancing biodiversity; Designing for change;
- Movement: Promoting sustainable means of travel.

12.3.1.15 "Understanding the site and its immediate and wider context is the basis for a meaningful and sustainable design response", including appraising "character", including landscape character, skylines and vistas, prevailing uses, natural and cultural resources and locally distinctive features (4.3 - 4.8). The TAN makes reference to the information available in LANDMAP and the Register of Landscapes of Historic Interest in Wales, in addition to detailed site appraisals. In relation to legibility and of relevance to this site, it advises concentrating on landmarks such as key buildings or landscape features, views and vistas, the coherence and connectivity of the footpath network (4.14).

12.3.1.16 At 5.5.2, the TAN recognises that "good design will almost always be dependent on working within the natural constraints and the historic character of the landscape … The aim should be to achieve good design solutions which maximise the natural landscape assets and minimise environmental impact on the landscape. It is particularly important that proposals to amend or create new landscape are not considered as an afterthought and that the long-term impact of development on the landscape is fully understood. The quality of implementation and the long- term management of changes implicit in planting schemes are fundamental to a scheme's success".

12.3.1.17 The contribution of "high quality public realm" to a stimulating environment and as a focus for community activity is addressed in 5.14 and of public art in 5.15.

12.3.2 Local Planning Policy

12.3.2.1 The site lies within the boundaries of Merthyr Tydfil County Borough Council (MTCBC). Planning policy for the area is provided by the Merthyr Tydfil Local Development Plan 2016-2031, adopted in January 2020. Relevant policies relating to site and the proposed development are outlined below.

Merthyr Tydfil Local Development Plan 2016-2031

- **Policy SW10:** Protecting and Improving Open Spaces: Development proposals that improve the quality, quantity or access to open space will generally be supported.
- **Policy SW11:** Sustainable Design and Placemaking: Development must contribute to the creation of attractive and sustainable places through high quality, sustainable and inclusive design.
- **Policy CW1:** The Historic Environment: The integrity of our historic environment assets will be conserved and enhanced.
- **Policy EnW1:** Nature Conservation and Ecosystem Resilience: Development proposals will be required to promote the resilience of ecosystems. In particular, proposals will be required to maintain and enhance biodiversity interests.
- **Policy EnW5:** Landscape Protection: Development proposals will be permitted where it can be satisfactorily demonstrated that:

  a) It would not cause unacceptable harm to the character and quality of the landscape setting of the County Borough;

b) Development within Special Landscape Areas is sensitive to their special characteristics;
c) Development respects the local distinctiveness and historic character of the landscape;
d) Development will safeguard local landscape character and landscape features, including views, which make a significant contribution to the character, history and setting of the locality;
e) Development secures the enhancement of the character, appearance and quality of the landscape, through restoration, management or enhancement where possible;
f) There is no satisfactory alternative and the benefits associated with the development can be demonstrated to outweigh the harm; and
g) Where damage to local landscape character cannot be avoided appropriate mitigation has been secured.

12.3.2.2 "These designations are not intended to prevent development but to ensure that, where development is acceptable, careful consideration is given to the design and scale of the development including siting, orientation, layout and landscaping and the special qualities and characteristics for which the SLAs have been designated are protected."

12.3.3 Designations

12.3.3.1 Designations provide an indication of landscape value. They are areas that have been recognised for the scenic beauty and recreational potential of the landscape. Designations are shown on **Figures LA 12.2**.

National Parks

12.3.3.2 The Brecon Beacons National Park (BBNP) covers part of the north and northwest of the study area. At its nearest point, the BBNP is circa 2.9km to the northwest of the application site, see **Figure LA.12.2-1**.

12.3.3.3 The current Management Plan for the Brecon Beacons National Park 2015-2020 lists special qualities of the BBNP, which were identified during the preparation of 'Managing Change Together'. Relevant special qualities are as follows:

- A feeling of vitality and healthfulness that comes from enjoying the Park's fresh air… rural setting, open land...
- A sense of place and cultural identity - "Welshness" - characterised by… relatively unspoilt historic towns, villages and family farms.
- A sense of discovery where people are able to explore… prehistoric ritual sites, medieval rural settlements, early industrial sites, local myths, legends and geological treasures.
- The Park's sweeping grandeur and outstanding natural beauty observed across a variety of harmoniously connected landscapes, including marvellous gorges and waterfalls, classic karst geology with caves and sink holes, contrasting glacial

landforms such as cliffs and broad valleys carved from old red sandstone and prominent hilltops with extensive views in all directions.

- A working, living "patchwork" of contrasting patterns, colours, and textures comprising of well-maintained farmed landscapes, open uplands, lakes and meandering rivers punctuated by small-scale woodlands, country lanes, hedgerows, stone walls and scattered settlements.

- Extensive and widespread access to the Park's diversity of wildlife and richness of semi-natural habitats…

- In the context of the UK, geographically rugged, remote and challenging landscapes.

- Enjoyable and accessible countryside…

Special Landscape Areas

12.3.3.4 Special Landscape Areas (SLAs) are a non-statutory landscape designation applied by the local planning authority to define areas of high landscape importance within their administrative boundary.

12.3.3.5 In June 2017 MTCBC published the Local Development Plan (2016 – 2031) Background Paper: Special Landscape Areas[9]. It identified five SLAs, based on the preferred methodology LANDMAP Guidance Note 1: LANDMAP and Special Landscape Areas, NRW 2016.

12.3.3.6 The site is located within SLA 3: Merthyr West Flank, see Figure LA.12.2-1. Relevant landscape value and contributions are identified as:

- The rarity value of this area is significantly enhanced by its specific historic associations with the Crawshay family of Cyfarthfa and the substantial density of features across this landscape, including particularly significant concentrations of early extractive features a number of priority habitats are found and important key species.

- The area contains very special habitat of marshy grassland, species-rich neutral grassland and lowland acid grass land, it also contains native woodlands which adds value also

- The area displays the reasonably intact condition of the upland pastoral fieldscape and the presence of substantial extant remains of mid -19th century extractive activity specifically associated with Robert and Lucy Thomas pioneers of the 'steam coal' industry

12.3.3.7 Relevant key management issues for the SLA include:

- Retain diversity of mosaic through limited reclamation and vegetation management

[9] https://www.merthyr.gov.uk/media/4434/sd26-special-landscape-areas-background-paper-june-2018.pdf [accessed February 2021]

- Implement creative land reclamation for sites where natural regeneration alone is insufficient.
- Limit forestry expansion to existing sites
- Extend woodland framework while retaining mosaic character.
- Conserve and enhance semi-natural habitats.

12.3.3.8 The SLA description does not refer to the A470 tip, which was added to the former mining tips in the mid-1990's when the A470 was constructed.

Ancient Woodland

12.3.3.9 There is some ancient woodland mapped as occurring within the south-west corner of the application site boundary (**Figures LA.12.2 and LA.12.5**) and the application site encompasses areas of woodland subject to Tree Preservation Orders (TPOs) as identified on the replacement LDP 2016-2031 Proposals Map. No further elaboration of this designation is given in the Local Plan, but it is understood that the basis for the TPOs on the site is mainly for non-ancient woodland reasons.

12.3.3.10 This is consistent with the conclusions of a file note obtained from the NRW SSSI file, which sets out the results of a desk and field-based investigation carried out by Dr Jim Latham in 2005 into the presence and extent of any ancient woodland on the site. This concludes that "*The available evidence suggests a long-term woodland presence in the vicinity, but cannot confirm its continuity at any given point required for the formal label of 'ancient woodland'*", going on to say "*The area of woodland (some 3ha) along the northern fringe probably has the best claim to be 'ancient' as there is less obvious disturbance than across the rest of the site and to this day it holds the highest density of mature trees. However, given the degree of disturbance in the area, more evidence would be needed (e.g., maps from the 1700s) to be confident about this*".

12.3.3.11 Investigations by Bioscan also align with this conclusion, at least in respect of the central parts of the site. There is woodland cover and a high frequency of mature trees in the central southern area coinciding with an area shown as established woodland on the 1850 Tithe Map. Parts of this area fall within the application site and corelate with a concentration of older and/or veteran trees in the north-western part of the application site. Ribbon woodland along the more undisturbed stretches of incised stream courses in the northern part of the landholding and outside the application site (the Nant Cwm Glo, Nant Rhyd-y-car and Nant Cwm-pant-bach) may also be at least part ancient in origin. It is assumed that these are the areas 'along the northern fringe' being referred to by Latham in 2005.

12.3.3.12 Beyond the immediate vicinity of the site, there are numerous small parcels of Ancient Woodland, the majority Ancient and Semi Natural Woodland, although there is also a reasonable amount of Restored Ancient Woodlands Sites, scattered across the study area. The majority are located along water courses and on steep slopes on valley sides.

Tree Preservation Orders (TPOs)

12.3.3.13 In the west of the site, along the eastern edge of the balancing pond and leat, woodland is covered by a TPO. A TPO also covers woodland within the southwest of the site.

Historic and cultural landscape designations

12.3.3.14 Relevant historic and cultural designations are shown on **Figure LA.12.2-2**.

12.3.3.15 The setting of historic and cultural designations is a consideration during the preparation of landscape and visual impact assessments as these features inform the overall landscape character, quality and value of the area. The LVIA does not address the effects on heritage assets however it considers the contribution these features make to landscape value and scenic quality.

Conservation areas and listed buildings

12.3.3.16 The setting of conservation areas and listed buildings is a consideration during the preparation of landscape and visual impact assessments.

12.3.3.17 The nearest conservation area is Merthyr Tydfil Town Centre Conservation Area, which covers High Street and its buildings and is about 600m to the northeast of the planning application boundary and 850m from the proposed Snow Centre. "It contains the historic commercial, religious and administrative centre of the industrial district that developed between the mid-18th and early 20th centuries, creating the first major industrial town in Wales[10]".

12.3.3.18 Elsewhere there are two further conservation areas in the town centre covering Thomastown and Morgantown. There is also Cyfarthfa Conservation Area to the north, covering the former ironworks site and parkland to the north of the town which "is important as it is a lasting symbol of Merthyr Tydfil's strength during the 18th and 19th Centuries as Ironworks of Worldwide significance[11]".

12.3.3.19 There is one listed structure within the site, which is the Grade II listed Base of Chimney at Cwm Pit, located in woodland in the southernmost part of the site in the proposed area for the forest lodges and about 450m to the south of the proposed Snow Centre. The feature is listed as a "particularly massively built chimney base, an historically important feature of this earlier C19 pit[12]".

12.3.3.20 Beyond the site boundary, the nearest Grade II* listed building is Ynysfach Engine House, located approximately 400m to the northeast of the ownership boundary and 1.0km to the north of the proposed Snow Centre, and is open to the public as a heritage centre. Cyfarthfa Castle, 2.3km to the north of the proposed Snow Centre, is the nearest Grade I listed building.

[10] https://www.merthyr.gov.uk/media/1148/towncentrecacalowres.pdf [accessed February 2021]
[11] https://www.merthyr.gov.uk/media/1142/cyfarthfacacalowres.pdf [accessed February 2021]
[12] http://cadwpublic-api.azurewebsites.net/reports/listedbuilding/FullReport?lang=en&id=81752 [accessed February 2021]

12.3.3.21 There are also several groups of listed buildings in close proximity to the site, including the Grade II listed terrace, Upper Colliers Row to the northeast of the ownership boundary and Grade II listed Quay Row and Abercanaid House to the southeast of the application site.

Scheduled Monuments

12.3.3.22 There are two scheduled monuments within the site boundary. Along the west boundary of the site is Cyfarthfa Balance Pond and Leat and Cwm Pit and Head of Railway is located within the southwest of the site.

12.3.3.23 **Cyfarthfa Balance Pond and Leat** "comprises the remains of a major balance pond and leat serving a number of deep mines. Coal and ironstone were extracted from land leased by the Cyfarthfa Works by surface and patch workings until 1826. From that date deep mines were dug and worked with water balances. A line of these pits was supplied with water from this balance pond by the leat, which ran along the contour to the north, from which water was taken for each pit. The system probably dates from the 1830s and is shown complete on the Tithe Map for Merthyr Tydfil of 1850… A leat runs from the NW corner of the pond. This leat is formed by a linear bank of earth and stone up to 4m in height, which creates a channel up to 3m in width between it and the slope to the W. The leat runs N for about 270m along the contour… The monument is of national importance for its potential to enhance and illustrate our knowledge of the early 19th century coal mining and iron working industries of Wales. It is the largest and best-preserved balance pond that survives on the Cyfarthfa estate, famous for its use of water balance technology in extracting coal and ironstone." [13]

12.3.3.24 **Cwm Pit and Head of Railway** "comprises the remains of Cwm Pit and the head of the Cwm Pit Railway. … Cwm Pit was not sunk as a deep mine until 1843 when it was a balance pit, eventually reaching a depth of 150 yards. The head of the railway and the site of the pit are bounded on the north side by a massive revetment wall of coursed Pennant sandstone blocks. The raking railway embankment wall rises to a height of about 4m under a heavy flat coping. It kicks out at a point where there are stone steps carried on a pair of semi-circular arches. The revetment wall continues at full height on a stepped base. There are lines of putlog holes, bigger sockets and remains of iron brackets. Within the revetment wall is a semi-circular arch opening into an adit tunnel running back under the site. ... Above and behind the revetment wall are the remains of the colliery buildings. These are reduced and buried except for the base of the engine house chimney made of massive stone blocks with yellow brick details.

12.3.3.25 The end of the railway is easily followed as a modern track… The monument is of national importance for its potential to enhance and illustrate our knowledge of the late 18th and early 19th century coal mining industry… It is the most complete coal mine complex in the Merthyr area…"[14].

12.3.3.26 Beyond the site boundary, circa 65m to the west of the site is Black Pins early ironstone workings and circa 60m to the south of the site is Cwm Pit remains Viewing Point is the Vale of Neath railway cutting and tunnel portal. To the north of the site, and within 1km of the site boundary, there are some scattered scheduled monuments associated with Cyfarthfa canal and tramroad, and Cwm Glo pit. Beyond 1km of the site there are numerous scheduled

[13] http://cadwpublic-api.azurewebsites.net/reports/sam/FullReport?lang=en&id=4338 [accessed May 2021]
[14] http://cadwpublic-api.azurewebsites.net/reports/sam/FullReport?lang=en&id=4336 [accessed May 2021]

monuments scattered throughout the study area, many of which are connected to the industrial past of Merthyr Tydfil. Many are located within the settlement area of Merthyr Tydfil with others located on higher ground at Ffos-y-Fran and Morlais Castle. Beyond the settlement edge, on open moorland, the scheduled monuments tend to comprise cairns or defence enclosures dating from the Bronze or Iron Age.

Registered Historic Parks and Gardens

12.3.3.27 The statutory register of historic parks and gardens came into force on 1 February 2022, which replaced the non-statutory register. The statutory register does not impose any new legal restrictions on Wales' historic parks and gardens or introduce a new consent regime. Registered sites continue to receive the current level of protection through the planning system. The effect of a proposed development on a registered site or its setting may also be a 'material consideration' in the determination of a planning application.[15]

12.3.3.28 Cyfarthfa Castle Park Grade II* is the nearest registered park and garden to the site, located circa 1.8km to the north. The public park contains formal gardens and a lake that is overlooked and provides the landscape setting to the Grade I listed Cyfarthfa Castle.

12.3.3.29 Circa 2.9km to the northwest of the site is Cefn Coed Cemetery Grade II and circa 2.9km to the south of the site is Aberfan Cemetery Garden of Remembrance Grade II*. The significant views at these sites are not towards the site and are therefore scoped out from further consideration in this LVIA.

Registered Historic Landscapes

12.3.3.30 Cadw, in partnership with the Natural Resources Wales (NRW) and the International Council on Monuments and Sites (ICOMOS UK) has compiled a non-statutory Register of 58 Landscapes of Outstanding or Special Historic Interest in Wales.

12.3.3.31 The site is located within the western part of Merthyr Tydfil Landscape of Outstanding Historic Interest (LOHI) with much of the wider study area located within the LOHI, which covers all of the settlement area of Merthyr Tydfil and some outskirts that includes part of Merthyr Common and Dowlais. Merthyr "still retains its industrial landscape character as the most significant Welsh town of the Industrial Revolution. The town and its environs remain a potent example of an internationally renowned industrial landscape of the 18th and 19th centuries and a permanent reminder of man's exploitation of the landscape." [16]

12.3.3.32 Part of the southeast of the study area is covered by Gelli-gaer Common LOHI. At its nearest point the LOHI is located approximately 4km from the site boundary. Due to the distance of the LOHI from the site and its very limited coverage by the ZTV, the Gelli-gaer Common LOHI has been scoped out from further consideration in this LVIA.

12.3.3.33 A small part of the most northwest extent of the study area is covered by the East Fforest Fawr and Mynydd-y-Glog Landscape of Special Historic Interest (LSHI). At its nearest point the LSHI is located approximately 4.6km from the site boundary. The LSHI mainly covers

[15] https://cadw.gov.wales/advice-support/placemaking/legislation-guidance/registered-historic-parks-and-gardens
[16] https://cadwpublic-api.azurewebsites.net/reports/historiclandscape/FullReport?lang=&id=HLW%20(MGL)%202 [accessed October 2021]

coniferous forest within the study area and is not covered by the ZTV. East Fforest Fawr and Mynydd-y-Glog LSHI is therefore scoped out from further consideration in this LVIA.

12.3.3.34 The LOHI includes the A470 tip, which was added to the former mining tips in the mid-1990's when the A470 was constructed.

Geopark

12.3.3.35 The north and northwest extent of the study area located in the BBNP is covered by the UNESCO Fforest Fawr Geopark. The purpose of a Global Geopark is to explore, develop and celebrate the links between geological heritage and all other aspects of the area's natural, cultural and intangible heritages.

Ecological designations

12.3.3.36 Ecological designations, although not specifically related to landscape amenity and not assessed within this report, are an indication of landscape value. Relevant ecological designations are shown on **Figure LA.12.2-3**.

Site of Special Scientific Interest (SSSI)

12.3.3.37 Cwm Glo a Glyndyrys SSSI covers a similar outline to the ownership boundary but excludes the majority of the site apart from the most western extent. "Cwm Glo a Glyndyrys is of special interest for its extensive areas of marshy grassland, species-rich neutral grassland and acid grassland, and for the association of these habitats with others including woodland and heath. It is also of special interest for its outstandingly diverse assemblage of grassland fungi"[17]. There are no other SSSIs within 2km of the site.

Local Nature Reserve (LNR)

12.3.3.38 Cwm Taf Fechan LNR, which is also a SSSI, is located along the banks of the Taf Fechan, circa 2.8km to the north of the site. The reserve contains ancient broadleaved woodlands, calcareous grasslands, river, and cliffs.

12.3.3.39 Due to distance and separation from the site, LNRs are not considered to be a receptor that would be affected, either adversely or beneficially, by the proposed development. LNRs have therefore been scoped out as a receptor in this assessment.

Site of Importance for Nature Conservation (SINC)

12.3.3.40 MTCBC has identified SINCs to protect areas of high wildlife value at a local level under Policy EnW3. The site and wider area that includes Gethin Woodland Park, the River Taff, Winch Fawr uplands to the northwest, and Merthyr Common to the southeast are covered by the SINC designation.

[17] https://www.merthyr.gov.uk/media/5090/ed049-cwm-glo-a-glyndyrys-sssi-citation-legal-version.pdf [accessed February 2021]

Public access

12.3.3.41 Public rights of way and access land within the study area are shown on **Figure LA.12.3**. Public access within the site are shown on **Figures LA.12.5-2, 12.5-3 and 12.5-4**.

12.3.3.42 Public rights of way routes and access land within the study area are generally concentrated on the surrounding hills, beyond the built-up area of Merthyr Tydfil and adjacent settlements, except for Long Distance Footpaths and National Cycle Routes which are described in more detail in the paragraphs below.

12.3.3.43 There is a network of public right of way within the site, which is described in more detail in paragraph 12.7.1.8 below.

12.3.3.44 Approximately 0.13km to the south of the site a bridleway transects Gethin Wood in a west to east direction bridleway, connecting to the Coed Morgannwy Way LDFP to the southwest of the site. Gethin Wood to the southeast of the site contains a strong network of public rights of way with several routes terminating at the ownership boundary.

Open Access Land

12.3.3.45 There is no open access land within the site or within the wider landholding owned by Marvel Ltd. In the study area there are large areas of access land covering high ground of Merthyr Common to the southeast, east and northeast, the high ground of the BBNP to the north and far northeast, and the majority of the Mynydd Aberdâr / Mynydd Gethin ridgeline to the southwest of the site. There is also access land on the upper slopes of Cwm Glo extending up to Mynydd Aberdâr.

Long distance footpaths (LDFP)

12.3.3.46 The Taff Trail is an 88km combined walking and cycling route between Brecon and Cardiff that follows the Taff valley between Merthyr and Cardiff. Within the study area, the route heads in a southwest direction around Morlais Castle before connecting to Merthyr Tydfil and bearing the to southeast through the centre of the town, and then onwards through Abercanaid and Pentrebach. At its nearest point the Taff Trail is located approximately 0.17km to the east of the site, on the east side of the A470.

12.3.3.47 At its nearest point the Coed Morgannwy Way LDFP is located circa 0.18km to the southwest of the site. The 58km route begins in Gethin Woods to the south of the site and heads in a broadly southwest direction through the coniferous woodland of Mynydd Gethin before continuing west and beyond the study area.

12.3.3.48 The Rhymney Valley Ridgeway Walk LDFP at its nearest point is located beyond 4.5km of the site to the northeast and is therefore scoped out from further consideration in this LVIA.

National Cycle Routes (NCR)

12.3.3.49 The Taff Trail forms part of NCR8, further detail of the route is provided in paragraph 2.3.42 above.

12.3.3.50 NCR477 passes along the eastern side of the Taff valley, approximately 600m from the site and 1.1km from the proposed Snow Centre.

12.3.3.51 Elsewhere in the study area NCR46 crosses it from west to east to the north of the Merthyr Tydfil urban area.

Other cycle routes

12.3.3.52 Bike Park Wales, a downhill mountain bike centre based in Gethin Woodlands, is centred approximately 0.9km to the south of the site. The facility is a popular attraction that offers a bike uplift service and has numerous graded routes descending through the woodlands overlooking the site.

Roads

12.3.3.53 The A470 dual carriageway runs parallel to the eastern site boundary and crosses the study area from south to north. There is near continuous mature vegetation along the roadside that both screen views towards the site and provides a degree of separation.

12.3.3.54 Other major routes in the study area include the A465 Heads of the Valleys Road, which bypasses Merthyr Tydfil to the north, and the A4060 dual carriageway that connects the two former roads via an eastern bypass of Merthyr Tydfil. There are also numerous residential roads within the settlement limits of Merthyr Tydfil to the east and north-east of the site, and in Heolgerrig to the north. There are no roads within the site.

Interim Summary

12.3.3.55 The following elements of the landscape policies and designations are relevant to the assessment of landscape and visual effects of this proposal:

- Publicly accessible open space and routes are desirable (SW10);
- The design and layout of the development proposals should contribute to its setting (SW11, EnW5);
- The setting of historic assets is a consideration (CW1);
- Safeguarding or enhancing the character and distinctiveness of the site and its setting is a material consideration (EnW5);
- The setting of, and views from, the BBNP are important considerations;
- The design and layout of the proposed development will need to be cognisant of features and character of the SLA;
- The Registered Historic Landscape;
- Public rights of way within the site and the impacts of the proposed development, including mitigation;

- The setting of the historic and/or listed structures, conservation areas and registered parks and gardens is to be taken into account;
- The setting of landscapes designated for ecological allowances is a consideration, including SSSIs and SINCs;
- The setting of and views available to users of the Taff Trail is to be considered; and
- The views available to nearby residents is a material consideration.

12.4 The Proposed Development

12.4.1 Details of the proposed development are provided on the planning application drawings and the Design and Access Statement accompanying the outline planning application. This section describes the main aspects of the proposed development which could potentially affect landscape and/or visual amenity. It also identifies features of the proposals which will assist in mitigating adverse landscape and visual impacts.

12.4.2 The main feature of the proposed development is the construction of an indoor Snow Centre in the northwest of the site. The building would form the tallest feature of the proposed development with a maximum elevation of 287.5m Above Ordinance Datum (AOD) at its highest point in the northwest of the site. The Snow Centre includes a circa 400m long east facing ski slope that would utilise the natural gradient of the site, sloping down to the east to a maximum of circa 210m AOD. Adjacent to the south of the Snow Centre, the existing topography would be re-modelled to create a 1:3 south facing slope that would be planted with a mix of grassland and scrub. Maintenance access paths would also be created on the slope with a route located at the base of the slope that connects to the main area of development to the east.

12.4.3 At the base of the Snow Centre ski slope to the east, proposals for the site include a complex of buildings that incorporate hotels and leisure activities. To the northeast of the Snow Centre are two proposed hotels with maximum building heights of 32m and 39.4m. To the east of the proposed hotels is a proposed Water Park that integrates indoor and outdoor elements. The maximum building height of the proposed Water Park would be 20.5m. Another hotel with a maximum height of 21.3m would be located immediately to the south of the Water Park.

12.4.4 A proposed Indoor Activity Centre would be located immediately to the south of the base Snow Centre ski slope, east of the planted south facing slope. The proposed Indoor Activity Centre would have a maximum height of 20m.

12.4.5 Located in the central area of the hotel and leisure complex is a proposed area for a car park, service area and ancillary uses. A Piazza is also proposed that would include hard and soft landscape areas with space for seating and outdoor space related to cafes and restaurants. The Piazza would form the main arrival space for visitors is to the development and would connect to the public routes passing through the site which are linked to the public right of way network. Landscape proposals within the space would include substantial tree planting to provide shelter from the prevailing winds and shade. The main car parking area and drop off area would be located to the south of the Piazza, to the east of the Indoor Activity Centre.

The car parking area would centre around a sloping soft landscape area with SuDS features located around the perimeter.

12.4.6 A proposed Outdoor Activity area is proposed immediately to the south of the Indoor Activity Centre, to the southwest of the proposed main car parking area. The Outdoor Activity area would extend southwards, to the east of the balancing pond and leat, towards the south boundary of the site. Within the north and east of the Outdoor Activity Area, SuDS features are proposed.

12.4.7 In the most southerly extent of the site proposals include the installation of circa 30no. lodges and associated access tracks, which would be set within existing and retained woodland. The proposed lodges would have a maximum height of 4.5m.

12.4.8 The main access to the proposed development would be provided via a new road that connects to the roundabout on the A470 at the northeast of the site. The route would head southwards along the east edge of the hotel and leisure complex to connect with the main car parking area. A road would also be constructed close to the northern boundary of the site, along the northern edge of the hotel and leisure complex and provide maintenance access to the proposed Snow Centre. Track access would also be provided via the southeast corner of the site from the A470 underpass, which would head along the existing Forest Road along the southern boundary of the site.

12.4.9 Proposals for the site include the diversion of PRoW route which pass through the site and some pf the routes may need to be formally stopped-up rather than diverted as their alignment conflicts with the proposed development. **Figure LA 12.5.2** and **Figure LA 12.5.3** shows the existing network of PRoW within the site and **Figure LA.12.5-4** shows the mitigation strategy of alternative routes included within the proposed development.

12.4.10 Other informal routes are also proposed across the site. A proposed route includes a north to south direction route that connects to the main access road in the north of the site and heads southwards, east of the main hotel and leisure complex, to connect to several routes that transect the southern area of the site, which includes a route that follows the disused railway line. The proposed routes would also seek to connect with the PRoW within the site and the surrounding PRoW network beyond the site boundary, which provide connections to Merthyr Tydfil town centre and Pentrebach.

Sources of Potential Effects on Landscape and Views

12.4.11 The main features of the development proposal which could potentially result in landscape and visual impacts are:

Construction Phase

- Temporary fencing/hoarding protecting the site perimeter.
- The diversion/ interruption/ sopping up of some public rights of way within the site.
- The removal of some trees, vegetation and grassland where areas to be regraded and profiled.



- The clearance of material, the stripping of some land, and the change of local levels including cut and fill.
- Activities and movement of large vehicles and equipment during the construction period, including the use of tall cranes.
- The construction of the proposed Snow Centre, hotels, Water Park, Indoor Activity Centre, access roads and car parking, and other associated infrastructure.
- Potential lighting associated with the construction works.

Completion

- The change of use from existing moorland, woodland, and an abandoned tip site where natural regeneration of vegetation has occurred to a major tourist attraction.
- The diversion/ stopping up of some public rights of way within the site.
- The introduction of several tall and largescale buildings, including the long Snow Centre building. The introduction of other built development and hard landscape such as access roads, car parking, and other associated infrastructure.
- The impact from the introduction and establishment of new woodland, trees, shrub planting, and grass mixes within the site on landscape character and nearby views.
- The introduction of drainage proposals within the site such as detention basins, swales, and other SuDS features. The diversion of existing watercourses is also proposed.
- Occupation features such as vehicle movement along new access roads and car parks, pedestrian activity around the commercial buildings, potential increased activity on recreational routes within the site, and street lighting and the external lighting of proposed buildings.
- Formalising recreation uses of the site along dedicated pathways.

Mitigation measures

12.4.12 The potential for adverse effects on landscape and visual amenity has been recognised and mitigation measures incorporated in the scheme to avoid or reduce adverse effects or to offset or compensate for unavoidable adverse effects.

12.4.13 Mitigation measures incorporated into the scheme design include:

- The retention of existing trees where possible, including TPO woodland. These features would also be protected during the construction phase.
- The location of the proposed lodges and access tracks in the south of the site would be determined by the existing trees, topographical, and ecological features, retaining these elements where possible.

- The north façade of the Snow Centre is designed to reduce its visual prominence from the north through the use of muted colours and a textured treatment of the elevation.

- The preservation and management of heritage features that contribute to the landscape character of the site. Access paths would be improved, and information boards would be installed to provide education opportunities.

- The proposed south facing slope adjacent to the Snow Centre would be planted with grassland and scrub with input from the Ecologist to conserve and enhance semi-natural habitats and mosaic character. The planting of the slope is also to help visually integrate the proposal into the surrounding landscape.

- Proposed tree, shrub and other vegetation, and grassland throughout the site. This is to help integrate and visually soften the proposed development within the landscape whilst contributing to the green infrastructure and placemaking of the site.

- Proposals for the site have also considered public rights of way within the site. Proposals would divert some routes around the perimeter of the site to maintain access and to ensure the site is connected to surrounding routes. While some of the routes would be removed as a result of the proposed development, a proposed network of public access will be created. Proposed routes would be safe, fit for purpose and would include information boards to explain the heritage and biodiversity of the site. A number of the routes would have appropriate width, gradient and surfacing to enable access by disabled people and young families.

12.5 Limitations of the assessment

12.5.1 This section describes the limitations and assumptions considered for the landscape character and visual amenity assessments.

12.5.2 Proposed Buildings

12.5.2.1 At this stage of design, the proposed height for each individual building has not yet been detailed but building height parameters for minimum proposed building heights and maximum proposed building heights have been provided. This LVIA assesses the worst-case scenario i.e., all proposed buildings are assessed at the proposed maximum building height, which is set out in section 4 above. Following detailed design, it is likely that the proposed buildings would have varying heights and not all proposed buildings would be designed to the defined maximum heights.

12.5.2.2 The proposed siting for each individual building has not yet been detailed, but maximum and minimum widths and lengths for each building have been provided. This LVIA assesses the worst-case scenario i.e., all proposed buildings are assessed at the closest point to the viewpoint being assessed.

12.5.2.3 At this early stage of design for the outline planning application, the proposed materials for the building facades of the ski slope building and other buildings have not been determined at the current stage of the design, which is typical for an outline planning application. This LVIA does not consider the materials of the proposed buildings, although it is recommended

in section 12.4.1.13 above that muted colours are used to reduce visual prominence on the visually prominent north elevation of the Snow Centre.

12.5.2.4 Photomontages are not provided within this LVIA because cladding materials and colours are not fixed at the current stage of the design and there is a level of uncertainty that will be addressed during detailed design. Accurate Visual Representations (AVR) wirelines are provided for a selection of viewpoints, including near viewpoints to represent views of the proposed development within the landscape. The wireline AVRs are based on the maximum parameters for the proposed development, representing a worst case in terms of the massing of proposed buildings.

12.5.3 Phases of construction and development

12.5.3.1 The landscape character and visual amenity assessments considers the construction of the proposed development and its completion as a whole. The work could also be phased, which would not alter the findings of this assessment.

12.5.4 Tip-works carried out in 2022

12.5.4.1 The landscape character and visual amenity assessments have been prepared without plans and drawing showing the extent of works or the proposed design of the tip-works that have been carried out during 2022. Efforts have been made to gain knowledge of the works carried out, which included watching drone footage and carrying out a site visit on 14 June 2022. An updated tree survey showing the number of trees removed or the root protection areas affected by the earthworks was not available at the time of updating this LVIA chapter.

12.5.5 Order Decision 2023

12.5.5.1 On the 24th of January 2023 the Order Decision was issued which confirmed some Claimed Rights of Way within the site and wider area as Public Rights of Way (PRoW). The decision also included amendments to some of the routes. **Figure LA.12.3** shows public access within the study area, however, due to the relatively dense network of routes and the scale of the plan, for clarity the PRoWs associated with the Order Decision are not illustrated on this plan. **Figure LA.12.5-2** shows the PRoW within the site and wider area.

12.6 Effects on the Landscape

12.6.1 Introduction

12.6.1.1 This section deals with the effects on the landscape of the site and its surrounding context due to the proposed construction and occupation of the site.

Assessment Criteria

12.6.1.2 The assessment process follows the methodology for assessing effects set out in **Appendix 12.2**. The degree of the likely landscape effects of the proposed development is determined by relating the sensitivity of the receptors to the changes arising from the development proposals, and the degree and nature of the changes in the landscape arising from the proposals.

Landscape Baseline

12.6.1.3 The landscape baseline is a description and analysis of the existing landscape, against which the effects of the proposed development are assessed, first, by reference to landscape character assessments for the area in which the site is located, at national and local levels and then, from site-specific surveys and analysis carried out for the purposes of this assessment.

12.6.2 LANDMAP

12.6.2.1 Landscape Assessment, following the LANDMAP methodology, has been undertaken for Merthyr Tydfil County Borough Council. The assessment uses the Natural Resources Wales (NRW) / Wales Landscape Partnership Group approach which separates the defining aspects of the landscape into five categories, or aspect layers: Geological Landscape, Landscape Habitats, Historic Landscape, Cultural Landscape Services, and Visual & Sensory. It considers the relationship that exist between people and places; how people have given meaning to places through time and how the physical landscape has shaped their actions, or how their actions have shaped the landscape.

12.6.2.2 Summarised descriptions for the most relevant aspect areas to the site and its context are outlined below for all five aspect layers. The findings of the LANDMAP studies have formed the basis of the landscape and visual baseline within this assessment. **Table 12-1** below defines the criteria that LANDMAP uses for evaluating each aspect area.

Table 12-1 Criteria for evaluating LANDMAP Aspect Areas[18]

LANDMAP Evaluation	Definition
Outstanding	of international or national importance
High	of regional or county importance
Moderate	of local importance
Low	of little or no importance
Unassessed	insufficient information exists to evaluate

12.6.2.3 Characteristics of particular relevance to the site and its context are highlighted in bold. LANDMAP aspect areas for Historic Landscape and Visual and Sensory aspect layers are illustrated on **Figure LA.12.4**.

[18] LANDMAP Methodology Overview, June 2017 https://cdn.naturalresources.wales/media/681752/landmap-methodology-overview-2017-eng.pdf?mode=pad&rnd=131547814890000000

Geological Landscape

12.6.2.4 The site is located within the south of aspect area Gellideg (**MRTHRGL007**), which is classified as **Glacial Mountain Valley** (Level 3). The geographical and topographical character of the area is described as (question GL4) "Shallow western slope above Afon Taf with two minor tributary valleys, dissected into gently S-dipping mudstone-dominated succession of Namurian Middle Shale - Productive Coal formations. Bounded to E by NNW-SSE Merthyr / Church Fault. Widespread cover of boulder clay on slopes. **Extensive made ground after coal and iron mining - closed coal mines, waste tips, old iron workings**."

12.6.2.5 The rarity/uniqueness (question GL31) of the area is evaluated as **Moderate** and the overall evaluation (question GL33) for the area is **Moderate**, see **Figure LA.12.4-1**, as the aspect area is "mudstone dominated Middle Shale - Productive Coal formations of valley slopes, coal and ironstone workings".

Landscape Habitats

12.6.2.6 The majority of the site is located in the most southerly extent of aspect area **MRTHRLH008**, which is classified as **Dwarf Shrub Heath** (Level 3). The key features that define the area's biodiversity character (question LH24) are those of an "area based on **semi-uplands, colliery spoil and tips** west of town".

12.6.2.7 The **overall evaluation** (question 45) for the area is **High,** see **Figure LA.12.4-2,** as the aspect area is "an area which contains very special habitat of marshy grassland, species-rich neutral grassland and lowland acid grassland, also contains woodland which add value also".

12.6.2.8 The southeast of the site, to the southeast of the former Merthyr Tydfil to Aberdare railway line, is located in the north of aspect area MRTHRLH011, which is classified as Acid Grassland (Level 3). The key features that define the area's biodiversity character (question LH24) are those of an "area based on semi-upland slopes west of Afon Taf".

12.6.2.9 The overall evaluation (question 45) for the area is Moderate, see Figure LA.12.4-2. No justification for the overall evaluation is given.

Historic Landscape

12.6.2.10 The majority of the site is located within aspect area Taff Valley Corridor (**MRTHRHL012**), which is classified as **Nucleated Settlement** (Level 3). The aspect area is described as (question HL4) "… the main transport/communication corridor for the Merthyr area linking the area to the ports, in particular at Cardiff and Barry, of the Glamorgan Coast. The area is also characterised by generally later industrial settlement (largely post 1850s ribbon development) associated largely with coal extraction and transport, interspersed with valley bottom fieldscape. … The area is dominated by public and industrial rail, canal and tramroad links from the industrial and urban centres of Merthyr Tydfil. The area is dominated by the embankments, cuttings, bridges and other features associated with a formerly much more extensive canal and rail corridor. The area contains nationally and internationally important canals, … and numerous industrial railways. … Other industrial remains in the area include Ironstone and coal mining features associated with Cyfarthfa, dating back to at least the late 18th century, though mostly of the period 1820-40, including the impressive remains at Cwm

Pit. The site of the Merthyr Vale Colliery of 1875 also lies in the area. The valley bottom area, defined on the west by the Glamorganshire Canal and A470(T) and on the east by the A4054, shows a range of land-use. The area includes fieldscape and settlement of late 19th and 20th century date; a result of the development of the steam coal trade from new deep pits along the valley edge. … One of the best-preserved sections of the canal follows the contour of the hill on the west side of the valley. ..."

12.6.2.11 The overall evaluation (question HL40) for the area is **High**, see **Figure LA.12.4-3**, as the aspect area "reflects the historic importance of the Taff Valley as a key industrial transport corridor, evidenced by the survival of extensive remains of industrial communication features (canals, disused tramroads and railway lines) and well-preserved 19th century industrial settlements at Abercanaid, Llwyn-yr-Eos and Pentrebach. The decision to rate this area as high rather than outstanding reflects the extent to which the remains of communication features have been impacted by modern infrastructure work and land reclamation activity".

12.6.2.12 The northwest of the site is located within aspect area Cwm-glo and Bryn-y-Badell (**MRTHRHL006**), which is classified as **Extractive** (Level 3). The aspect area is described as (question HL4) "largely enclosed hillside with extensive and nationally important industrial remains associated with the Cyfarthfa Ironworks, including outcrop and underground workings for coal and ironstone, rail and tramroad links and water management system. Agricultural use continues, though the fabric of the earlier medieval/post-medieval enclosures has been severely degraded by industrial development and subsequent dereliction. The area forms the western edge of the town of Merthyr Tydfil, rising to the Mynydd Aberdare ridge. Although mostly open ground, it has a diverse and complex pattern of past land-use. In the early post-medieval period, much of the area of the lower slopes was enclosed, and parts of the resulting fieldscape survive, notably within Cwm-glo itself. The mineral resources were heavily exploited, by 17th - 18th century hushing[19] near Winch Fawr, ironworking at Cwm Felin, and extensive ironstone levels, coal levels and coal mines, linked to the Cyfarthfa ironworks, the canal and railway to the east by a complex system of tramways, tracks and railways. Over the last century, these workings and their tips have been abandoned and now have begun to merge with area of surviving moorland and regenerated woodland as a visually integrated unit."

12.6.2.13 The overall evaluation (question HL40) for the area is **Outstanding**, see **Figure LA.12.4-3**, as the aspect area represents "a complex, historically significant industrial/extractive landscape with extensive, reasonably well-preserved remains of 18th-20th century coal and ironstone workings and related features, which has been characterised as being of 'national and international importance'.

Cultural Landscape Services

12.6.2.14 Cultural Landscape Services (CLS) now supersedes the Cultural Landscape aspect layer, which was updated in 2020. CLS responds to "Recent environment and well-being legislation and developments in current thinking relating to culture suggest the dataset would benefit

[19] Hushing is an ancient and historic mining method using a flood or torrent of water to reveal mineral veins

from a different approach to mapping if revisited..."[20] The data for CLS uses data from the other four aspect layers and provide no overall evaluations for each aspect area.

12.6.2.15 The site is located within aspect area Merthyr West Flank (**MRTHRCLS045**), which is classified as **Open/Wooded Mosaic Upland Valleys** (Level 3), refer to Visual and Sensory aspect areas below.

Visual & Sensory

12.6.2.16 The site is located within aspect area Merthyr West Flank (**MRTHRVS917**), which is classified as **Open/Wooded Mosaic Upland Valleys** (Level 3). The aspect area is described as (question VS3) lying "between the town and the ridgeline and reaches right down to the River Taf at various points along its lower edge. It is somewhat akin to a massive area of urban fringe in that the influence of the town is evident throughout, yet it is still distinctly rural in overall character. It is a complex mosaic of **tips**, transport features and **mine sites** intermingled with an upland pasture field pattern. **There are areas of woodland and substantial natural regeneration, which look like natural habitats from a distance**. There is a large total area of disused sites yet the majority of them are becoming well integrated within the mosaic... Recent housing and other developments between Heolgerrig and Gellideg has reduced the overall area size. Further south the balance is in favour of the remnant field pattern and small blocks of woodland e.g., Cwm Glo and Blaencanaid. Settlement rises to 350m on this side of the basin, which is higher than that on the eastern side of town. The **A470 cuts through this landscape** and reveals at close hand the mix of industrial heritage, field pattern and woodland on this edge of Merthyr. It is also seen as the backdrop to the town in long views from the east and the A4060. At both viewing distances the diversity and pattern of this landscape are distinctive and of high value. The naturally regenerated habitat mosaics are a particular feature of the Merthyr landscape and compare favourably visually with some of the sterile reclamation projects designed purely for industrial development or grazing."

12.6.2.17 The **scenic quality** (question VS46) of the area is evaluated as **Moderate**, see **Figure LA 12.4-4.** The **character** (question VS48) of the area is evaluated as **High**, see **Figure LA 12.4-5,** and the **overall evaluation** (question VS50) for the area is **Moderate,** see **Figure LA.12.4-6**. The justification for the overall evaluation is that "the area has a distinctive sense of place, especially around Cwm Glo with a mix of vegetation and industrial heritage features and patterns with a particular richness... The area provides a positive backcloth to the town of Merthyr and dominates its views west... However, there are detractors such as unvegetated tips".

LANDMAP Summary

12.6.2.18 The below table summarises the evaluations for each aspect area that the site is located in (overall evaluations are not provided for the Cultural Landscape Services Aspect Layer):

[20] LANDMAP Cultural Landscape Services, Report No 336, prepared by E.K Naumann, Dr K Metcalf, Environmental Systems, Cyfoeth Naturiol Cymru/Natural Resources Wales

Table 12-2 Summary of LANDMAP

Aspect Layer	Aspect Area name and Unique ID	Classification (Level 3)	Overall Evaluations
Geological Landscape	Gellideg UID: **MRTHRGL007**	Glacial Mountain Valley	Moderate
Landscape Habitats	n/a (unnamed) UID: **MRTHRLH008**	Dwarf Shrub Heath	High
	n/a (unnamed) UID: **MRTHRLH011**	Acid Grassland	Moderate
Historic Landscape	Taff Valley Corridor UID: **MRTHRHL012**	Nucleated Settlement	High
	Cwm-glo and Bryn-y-Badell UID: **MRTHRHL006**	Extractive	Outstanding
Cultural Landscape Services	Merthyr West Flank UID: **MRTHRCLS045**	Open/Wooded Mosaic Upland Valleys	N/A
Visual and Sensory	Merthyr West Flank UID: **MRTHRVS917**	Open/Wooded Mosaic Upland Valleys	Moderate

Contiguous LANDMAP Aspect Areas beyond the site

12.6.2.19 Aspect layers Geological Landscape, Landscape Habitats and Cultural Landscape Services are only considered, as above, for aspects areas that overlap fully or partially or are adjacent to the site boundary[21F21].

12.6.2.20 Historic Landscape and the Visual and Sensory aspect layers are considered further below for all aspect areas within the study area that have a High or Outstanding overall evaluation and are also indicated by the Zone of Theoretical Visibility plan (Figure LA 12.7-1) to have potential visibility of the proposed development. Aspect areas for Historic Landscape and

[21] In accordance with NRW LANDMAP GN46: https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/evidence-to-inform-development-planning/using-landmap-in-landscape-and-visual-impact-assessments-gn46/?lang=en

Visual and sensory with overall evaluations of Moderate or Low are not considered further in this LVIA as it is not considered that there would be potential large magnitude of change as a result of the proposals.[22]

Historic Landscape

12.6.2.21 To the south of the site is aspect area **Mid Taf enclosed valley side** (MRTHRHL024) and to the north and beyond 4km of the site are aspect areas **Twynau Gwynion** (MRTHRHL019) and **Morlais Quarries** (MRTHRHL021). All the aspect areas are classified as Extractive (Level 3) and have an overall evaluation of **High**. They form part of the well-defined and historically important extractive landscape.

12.6.2.22 To the north of the site is aspect area **Merthyr Tydfil Core** (MRTHRHL005), which is classified as Nucleated Settlement (Level 3). Merthyr Tydfil is linked to the intensive industrial industry from the mid-18th century onwards. The overall evaluation for the area is **Outstanding** "reflecting its key importance as a nationally important industrial centre during the 18th and 19th centuries. Merthyr Tydfil rapidly expanded from a modest village in 1750." This aspect area is scoped out from further consideration in this LVIA as the historic character and appreciation of its industrial heritage are unlikely to change or impact the landscape character as a result of the proposed development. Merthyr Tydfil's overall evaluation for Visual and Sensory is **Low** and the urban character of the area is likely to remain unaltered as a result of the proposed development.

12.6.2.23 Surrounded by Merthyr Tydfil Core aspect area is **Cyfarthfa Park** (MRTHRHL018), which is classified as Designed (Level 3). It "is characterised as a nationally important 19th century historic park and garden. It has an overall evaluation of **Outstanding** as "it represents an important, extremely rare and well-preserved example of an ironmaster's residence and estate, with strong historic associations as the seat of the Crawshay family."

12.6.2.24 Beyond 3km to the north of the site is aspect area **Taff Fechan Valley** (MRTHRHL003), which is classified as Irregular Fieldscapes (Level 3). The aspect area is "characterised by dispersed agricultural settlement and enclosed fields; the other dominant characteristic of the area is as a communications corridor: road and rail links. There is also evidence of limited small-scale extractive industry." The overall evaluation for the area is **High** "reflecting the largely intact nature of the fieldscapes and settlement pattern, and its historic associations as a long-established communications route since the Roman period."

12.6.2.25 Beyond 3km to the north of the site are aspect areas **Garn Ddu** (MRTHRHL002), **Morlais** (MRTHRHL004), **Pen March** (MRTHRHL009), and beyond 2km to the east of the site is aspect area **Cefn-y-Fan** (MRTHRHL014), which are all classified as Marginal Land (Level 3) and have an overall evaluation of **Outstanding or High** based on the survival of historic and archaeological sites and upland common.

12.6.2.26 Aspect Areas evaluated as Outstanding or High that do not overlap with the ZTV and are therefore scoped out include: MRTHRHL026, MRTHRHL022, MRTHRHL011,

[22] In accordance with NRW LANDMAP GN46: https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/evidence-to-inform-development-planning/using-landmap-in-landscape-and-visual-impact-assessments-gn46/?lang=en

CYNONHL831, CYNONHL856, CYNONHL515, CYNONHL117, CYNONHL409, CYNONHL635, CYNONHL006. Aspect areas beyond the site with Low or Moderate overall evaluation are also scoped out from further consideration.

Visual and Sensory

12.6.2.27 To the north of the site, beyond 1km, is aspect area **Cyfarthfa Park**[23F23] (MRTHRVS588), which is classified as Amenity Land (Level 3). The park is a Registered Park and Garden set within the urban area of Merthyr Tydfil. There is a sense of enclosure (Q9) with the castle and park forming a prominent feature of the valley side with views from the A470 (Q22). It has a strong sense of place. Its overall evaluation is **High** as it is prominent in views from Merthyr and the A470 and it "has a strong visual relationship with the related furnaces across the valley which is a rare feature" and the "The park is very attractive with mature trees and well-maintained grounds."

12.6.2.28 Mainly beyond 3km of the site to the northwest is aspect areas **Taff Fawr**[24F24] (MRTHRVS393), which is classified as Open/Wooded Mosaic Upland Valley (Level 3). "The open scree slopes contrast with the predominantly deciduous woodland on the western valley side... This area bounds the northwest fringes of Merthyr and acts as a buffer and as its rural setting." Its overall evaluation is **High** as "The area is an attractive upland valley with good views and distinctive features such as scree slopes and rocky outcrops. It is generally unspoilt and acts as a setting to the uplands of the Beacons to the north."

12.6.2.29 Also, to the northwest of the site and beyond 3km is aspect area **Vaynor Uplands**[25F25] (MRTHRVS387), which is classified as Upland Moorland (Level 3). It is a large open, exposed, unenclosed upland landscape that has no settlement and very little access. It has a strong sense of place with attractive views to the surrounding uplands and valleys, but Vaynor Quarry and Merthyr Tydfil provide some detracting features. The overall evaluation for the area is **High** as "The area has high scenic quality with panoramic views. It has consistent and unspoilt character throughout and a strong sense of place through rock outcrops and moorland character. The area forms part of the Brecon Beacons upland area."

12.6.2.30 Aspect Areas evaluated as Outstanding or High that do not overlap with the ZTV and are therefore scoped out include: MRTHRVS288. Aspect areas beyond the site with Low or Moderate overall evaluations are also scoped out from further consideration.

Local Landscape Assessments

12.6.2.31 The most recently published Landscape Character assessment of relevance to the study area is the **Brecon Beacons National Park Landscape Character Assessment**, which was published in 2012. Paragraph 40 of A Management Plan for the Brecon Beacons National Park 2015-2020 states the "the spatial approach of the Landscape Character Assessment provides a clear geographic reference for landscape character, special qualities and issues of landscape change across the National Park. It is intended to be used in a number of ways,

[23] https://landmap-portal.naturalresources.wales/view_survey.php?survey_id=598
[24] https://landmap-portal.naturalresources.wales/view_survey.php?survey_id=590
[25] https://landmap-portal.naturalresources.wales/view_survey.php?survey_id=589

including … contributing to the development of policies with regard to large-scale developments on the fringes of the National Park…"

12.6.2.32 The landscape character assessment covers the northern part of the study area within the National Park. The area is covered by **Landscape Character Area 8: Talybont and Taff Reservoir Valleys** with the Broad Landscape Type of Upland Valleys. The summary description describes the LCA as "characterised by its reservoirs, surrounded by steep sided, dark green forested valleys. Between the reservoir valleys are more open ridges of upland moorland which have long views across the reservoirs and their surrounding forests. This LCA is easily accessed from Merthyr Tydfil and the A470 and is a popular recreation destination".

12.6.2.33 In the Future section of Forces for Change in the Landscape, the assessment states that local forces for change and their landscape implications include "development proposals beyond the National Park boundary to the south … **potentially affecting views southwards**, particularly from higher land".

12.6.2.34 Specific Management Guidelines for the LCA include protecting "occasional **long views** which form the backdrop to the area" and to "plan to reduce the **visual impacts** of existing … development beyond the National Park boundary, and resist applications for future development which would **harm the special qualities of the area**".

12.7.1 Site-Specific Appraisal

12.7.1.1 The following paragraphs provide descriptions of the site and should be read alongside Site Context **Figures LA 12.5** and Site Photographs **Figures LA 12.06.**

The landscape of the site

12.7.1.2 The site is located on an east facing slope along the western side of the Taff Valley near Merthyr Tydfil, which historically functioned as iron and coal workings. The site slopes down from a high point of circa 255m AOD on the west boundary to approximately 180m AOD on the east boundary. The east boundary of the site is defined by land along the western side of the A470 road, which broadly forms the western edge of Merthyr Tydfil. The south boundary of the site mainly is defined by a forest access track with overhead cables of a major power line transecting the area in an east to west direction. Part of the southwest boundary is defined by the edge of the Cwm Pit and head of railway scheduled monument and the west boundary of the site is defined by the western edge of the Cyfarthfa balance pond and leat scheduled monument. The eastern section of the north boundary of the site is defined by an access track and the northwest boundary of the site is undefined by existing features.

12.7.1.3 Beyond the site boundaries, the surrounding landform to the northwest, west, and south continues to rise up towards the ridgeline of Mynydd Gethin and Mynydd Aberdare with highpoints of circa 491m AOD and 450m AOD beyond 1.5km of the site. The east facing slopes are covered by deciduous woodland with coniferous woodland located on the higher parts of the ridgeline at Mynydd Gethin. Mynydd Aberdare to the northwest is comprised of exposed upland moorland. Along the east facing slopes there are some steep sided valleys with Nant Canaid watercourse flowing to the south of the site. The alignment of the stream has been diverted to avoid the cutting for the former Merthyr Tydfil to Aberdare tunnel.

12.7.1.4 To the east of the site, and on the east side of the A470 is the western urban edge of Merthyr Tydfil. The urban edge is lined with mainly industrial and large out of town retail units, which is separated from the main settlement area of the town by the River Taff. The River Taff broadly flows through the western half of Merthyr Tydfil and close to the historic core of the town. There is a dense settlement pattern to the east of the River Taff comprised of terraces lined along the steep west facing slopes and other housing estates. There are some areas of parkland within the town, most notably Cyfarthfa Park and Thomas Town Park.

12.7.1.5 Further to the north of the site, beyond 3km, the northern edge of Merthyr Tydfil is broadly defined by the A465 Heads of the Valleys Road and surrounding former and existing extraction sites such as Ffos-y-Fran, Bryniau quarries, Morlais, and Vaynor Quarry before the exposed upland landscape expands northwards into the BBNP.

Features of the site

12.7.1.6 There are several features on the site, which have mainly been informed by its industrial past and include the following:

- The A470 tip is located in the north of the site and extends southwards. This area has a steep east facing slope with a generally level upper part; the periphery is being colonised by birch and scrub while the central part is either grassland or exposed tip material.

- The upper slopes in the northwest of the site. Here the landform slopes steeply to the east and the ground cover consists of tussocky wet grassland with scattered trees, mostly birch with some more mature oak around old areas of relatively shallow, bell pit mine workings. This area is also covered by the Cwm Glo and Glyndyrys SSSI.

- Historic remains of iron and coal workings. These are present in numerous guises, from the remnants of adits, airshafts, drifts and levels to stone ruins, former tramways and railways track beds, including the northeast entrance of the Merthyr Tunnel, the Cyfarthfa balance pond and leat scheduled monument, Cwm Pit and head of railway scheduled monument, and most prominent of all, overburden mounds. The latter are present across the southern part of the site, occupying all available space between the other mining infrastructure and comprise of a steep downslope embankment, formed by the angle of repose of the material, and topped by severely pockmarked and uneven topography.

- A large part of the site, particularly the south and eastern areas are covered by woodland. Discrete areas of this woodland have been removed during summer 2022 as a result of the formation of access routes, earthworks and the construction of drainage channels associated with tip-works. Woodland in the west of the site covered by TPO. Trees within the site are of varying ages from pioneering scrubby woodland to mature and veteran trees. Species of trees also vary from oak and birch to a mixture of alder on the wetter ground.

- Some tracks and former railway lines cross the site. An old trackway, known as Parish Road, crosses the site from the northeast to the southwest, approximately dividing the site in terms of its historic use. Forest Road crosses the southern part of the site and

there are also numerous other tracks and paths, many with historic connections to the coal and iron workings or to the former railway network. A former railway, which currently appears as its track bed and is demarked on either side by a line of concrete fence posts, gently arcs across the southeast part of the site, where it is crossed by a branch running north to south in the east of the site. The former railway lines are mainly situated in cuttings or are on embankments, both of which consist of steep slopes. There are also numerous bridges associated with the railway lines that are present within the site, crossing both under and over the former track beds.

- On the north side of the former Cwm Pit workings is a stream that enters subterranean channels linking it to Nant Cannaid to the south, beneath the tips.
- Recent engineering works (conducted by Merthyr Tydfil County Borough Council), for drainage improvements, transect the central area of the site comprise large boulder and stone lined channels, including steps for water to cascade down, drainage ditches, and widened tracks.
- There is a network of public rights of way within the site, see **Figure LA.12.5-3**, refer to paragraph 12.7.1.8 and Appendix 6.

Characteristics and aesthetics

12.7.1.7 The character of the site is derived from its landform and past industrial activities. Key characteristics and aesthetics of the site include:

- An east facing slope that is part of the large-scale landscape that forms the backdrop to Merthyr Tydfil.
- Mosaic character: varied habitats that include woodlands that contrasts with areas of grassland. The varied heritage features and structures on the site linked to the site's historical land use. This contributes to the site's sense of place.
- Woodland areas and tips create a sense of enclosure which contrasts with areas of openness on top on the A470 tip and on grassland areas.
- Some attractive and distant views from open areas that look over Merthyr Tydfil and are backdropped by the BBNP.
- The site forms the setting to Merthyr Tydfil. The site in places has urban influences such as road sound from the A470, views of major overhead pylons and cables, and some near views of large-scale retail/ industrial units.

Public Access

12.7.1.8 There is a network of public right of way within the site that are used by walkers and mountain bikers (previously as Claimed Rights of Way), see **Figures LA.12.5-2 and 12.5-3**. Notable route includes Parish Road, which runs in a northeast to southwest direction across the north of the site, and Forest Road, which runs west to east across the south of the site and connects the A470 underpass with the entrance to the (disused) Merthyr tunnel. In the west of the site

a footpath loops around the south and east of the leat as it heads northwards through the site. Like other routes within the site, the footpath continues beyond the site, and connects to the surrounding PRoW network.

Landscape Value

12.7.1.9 The characteristics, sensitivities and guidelines in the existing character assessments at national and local level and the site-specific analyses carried out for the purposes of this LVIA were taken into account as indicators of the aspects of the landscape important to the character and evaluated according to the criteria in **Appendix 12.2, Table A12.2-1** in order to determine the value of the landscape receptors.

12.7.1.10 The features/elements/characteristics identified as important or "key" to the landscape character of the site are:

- The landform of the east facing slope
- Areas of woodland and trees
- Mosaic character influenced by the ranging habitats and various heritage features.
- Some attractive distance views from open elevated areas
- Setting to the urban edge of Merthyr Tydfil
- Recreational access and setting to PRoW and public access land.

12.7.1.11 Beyond the site boundary, important landscape character areas are identified below. The identification of important landscape character areas followed a review of surrounding landscape designations, LANDMAP Historic Landscape and Visual and Sensory Aspect Areas, and field studies. LANDMAP aspect area that are further considered are those that are evaluated as Outstanding and High that also overlap with the ZTV. The Historic Landscape and Visual and Sensory aspect areas are then overlain and amalgamated, based on Level 3 classifications or reflect the interaction between the aspect areas, to create composite character areas that are to be assessed further; refer to **Figure 12.4-7**:

- Cyfarthfa Park
- The upland and extractive landscape between Merthyr Tydfil and the BBNP
- The BBNP
- Upland common to the east of the site

12.7.2 Effects on the Landscape

12.7.2.1 This section examines the nature and significance of the landscape effects arising as a result of the proposed development with reference to:

- effects on landscape fabric within the site, its features and qualities;



- effects on landscape character, including consideration of effects on designated landscapes; and
- effects on the landscape setting of settlements, public rights of way and roads.

12.7.2.2 Landscape character is derived from the combination and pattern of landscape elements. The effects of proposed development on landscape character would arise from its relationship to these combinations and patterns, and thus the character of the landscape. Effects on the landscape features, qualities and character may occur where there are either direct or indirect physical changes to the landscape. Direct changes to landscape fabric would only occur within the application boundary.

12.7.2.3 The effect of the proposed development on landscape character will depend on key characteristics of the receiving landscape; the degree to which the proposed development is considered consistent with or at odds with them; and how the proposed development would be perceived within the setting, with perception being influenced by:

- the distance to the site;
- weather conditions; and
- the 'fit' of the proposed development within the landscape pattern and characteristics.

12.7.2.4 The LVIA covers the following scenarios:

- Construction phase - this includes all clearance works, local level changes, remediation of the site, tree and vegetation removal, and of the construction of the proposed development.
- Completion – the fully constructed and completed proposed development, which would be open to the public.
- At year 15 – the establishment of the proposed landscape strategy and mitigation proposals.

Sensitivity

12.7.2.5 Landscape sensitivity is a product of consideration of the value associated with the landscape receptor and its susceptibility to the changes likely to arise from the proposed development. Criteria for determining the landscape value and landscape susceptibility are set out in **Appendix 12.2.** For this LVIA the assessment of sensitivity is based on bringing value and susceptibility considerations together in one combined step, in accordance with the criteria set out in **Appendix 12.2**.

12.7.2.6 The receptors, their value and susceptibility are set out in the following table, with the resultant judgement of their sensitivity to the proposed development:

Table 12-3 Susceptibility and Sensitivity of Landscape Receptors

Receptor	Value	Susceptibility	Sensitivity
Features, qualities, and characteristics within the site			
The landform of the east facing slope	**Medium value**: a key characteristic of the site but it is in a deteriorating condition with several tips, shafts, and alterations within the site from past industrial and construction activities, and more recent engineering works. Reflective of Moderate LANDMAP evaluation for geological landscape.	**Highly susceptible** to change and disturbance, although some recent disturbance has taken place, as the site is to be re-profiled, and levels altered.	**Moderate-high sensitivity**
Areas of woodland and trees	**High value**: some areas are covered by TPOs. The site also contains veteran trees. Although some areas have been recently disturbed with the removal of some trees, the woodland habitat forms part of the important mosaic character of the site.	**High-Moderately susceptible** to disturbance. Discrete areas of woodland have been removed during summer 2022 during the tip-works and further areas of woodland are to be removed as a result of the proposed development. Protected areas are to be retained.	**High sensitivity**
Mosaic character	**High value:** A key characteristic and feature of the local SLA designation, which also contributes to the sense of place. Some cultural and heritage, and ecological designated sites of national and local value. Mostly high LANDMAP overall evaluations for landscape	**Highly susceptible** to change and disturbance with the construction of built development, the removal of some habitat areas, and changes to the setting of heritage features.	**High sensitivity**

Receptor	Value	Susceptibility	Sensitivity
	habitats and historic landscape aspect layers.		
Attractive distant views from open elevated areas	**Medium value**: Where available forms a characteristic, views are backdropped by the BBNP with a visual connection to Merthyr Tydfil and contributes to the sense of place. Reflects the Moderate visual and sensory evaluation for scenic quality.	**Highly susceptible** to change with the construction of tall and large-scale buildings.	**Moderate-High sensitivity**
Setting to the urban edge of Merthyr Tydfil	**Medium value**: of local importance forming the backdrop to Merthyr Tydfil. Some detractors such as unvegetated tips. Reflective of Moderate LANDMAP overall evaluation for visual and sensory.	**Highly susceptible** to change with the construction of tall and large-scale buildings.	**Moderate-High sensitivity**
Recreational access and setting to PRoW and public access land	**Medium value**: of local importance for recreational use.	**Highly susceptible** to change with PRoWs within the site being diverted and the setting to retained and nearby routes susceptible to change. Potential for increased recreational use.	**Moderate-High sensitivity**
Landscape context of the site			
Merthyr Tydfil	**Medium value**: reflective of LANDMAP High overall evaluations for historic landscape but Low overall evaluations for visual and sensory. Covered by the non-statutory designation LOHI.	**Low susceptibility** to change as the landscape character and appreciation for its industrial heritage are unlikely to alter.	**Lesser sensitivity**
Cyfarthfa Park	**High value**: Registered Park and Garden Grade II*, contains listed buildings, important area of public open space and visitor attraction for the region. It also reflects the outstanding and high LANDMAP evaluations for aspect areas MRTHRHL018 and MRTHRVS588.	Visual relationship and heritage connection **Highly susceptible** to change with the construction of tall and large-scale buildings.	**High sensitivity**

Receptor	Value	Susceptibility	Sensitivity
Upland and extractive landscape between Merthyr Tydfil and the BBNP and upland common to the east of the site	**Medium value**: reflective of LANDMAP Outstanding and High overall evaluations for historic landscape but Moderate and Low overall evaluations for visual and sensory. Covered by the non-statutory designation LOHI.	**Low susceptibility** to change as the landscape character and historic associations are unlikely to alter.	**Lesser sensitivity**
BBNP	**High value**: a statutory designated landscape of national importance.	Views to the south **Moderately susceptible** to change with the construction of tall and large-scale buildings.	**Moderate-High sensitivity**

Magnitude of change

12.7.2.7 The magnitude of change considers the key features of the proposed development, as described in **section 12.3.0**, and the degree to which aesthetic or perceptual aspects of the landscape are altered by these changes or by the structures associated with the development. The magnitude of change is described and set out in **Appendix 12.3, Table Appendix 12.3.1**. **Table 12-4** below provides a summary of the assessments:

Table 12-4 Landscape receptors and magnitude of change summary

Landscape Receptor	Magnitude of Change
Features, qualities, and characteristics within the site	
The landform of the east facing slope	During Construction: **Great** Completion: **Great** At 15 years: **Small - medium**
Areas of woodland and trees	During Construction: **Great** Completion: **Great** At 15 years: **Medium**
Mosaic character	During Construction: **Great** Completion: **Medium - great** At 15 years: **Medium**
Attractive distant views from open elevated areas	During Construction: **Medium** Completion: **Small** At 15 years: **Small**
Setting to the urban edge of Merthyr Tydfil	During Construction: **Medium - great** Completion: **Great** At 15 years: **Medium - great**
Recreational access and setting to PRoW and public access land	During Construction: **Great** Completion: **Great** At 15 years: **Great**

Landscape Receptor	Magnitude of Change
Landscape context of the site	
Merthyr Tydfil	During Construction: **Small** Completion: **Small** At 15 years: **Negligible**
Cyfarthfa Park	During Construction: **Small - medium** Completion: **Small** At 15 years: **Small**
Upland and extractive landscape between Merthyr Tydfil and the BBNP and upland common to the east of the site	During Construction: **Small - medium** Completion: **Small – medium** At 15 years: **Small**
BBNP	During Construction: **Small** Completion: **Small** At 15 years: **Negligible**

12.7.2.8 The assessments conclude that for features and characteristics within the site during the construction phase, the magnitude of change would be mainly great or medium-great. At completion the magnitude of change would mainly remain great or medium-great with the magnitude of change reducing for some landscape receptors reducing.

12.7.2.9 At 15 years after completion, the magnitude of change would be mainly medium or small. The site would undergo large-scale changes, including changes to landform and removal of woodland and trees and other habitats that contribute to the mosaic character. Beyond the boundary of the site where existing woodland and trees are retained the change to landscape character would be limited due to the enclosure provided by vegetation. The changes to the character of the site would change the setting to the urban edge of Merthyr Tydfil and partially alter the setting to routes used by the public and public rights of way. Overtime, planted woodland and trees would continue to establish, seeded grassland and scrub would be established, all of which would help to integrate the proposed development into the surrounding landscape and contribute to the mosaic character.

12.7.2.10 For the wider landscape character, the magnitude of change would be limited to indirect effects on the visual appreciate of the landscape. The magnitude of change was assessed as predominantly small or small-medium during construction and at completion. At 15 years after completion, the magnitude of change would diminish with some reducing to negligible as the proposed development is likely to become assimilated into the landscape.

Assessment of effects on the landscape

12.7.2.11 Consideration of the magnitude of the changes due to the proposals is combined with consideration of the sensitivity of landscape receptors affected by the proposals to assess the degree and nature of the effect at each stage of the proposed development from construction to 15 years after completion.

12.7.2.12 Final conclusions about the degree of landscape effect, whether adverse or beneficial, relate the separate judgements about sensitivity of the receptors and magnitude of the changes, as illustrated in the indicative criteria shown in **Table A12.2-11**. The assessment is provided in **Appendix 12.3, Table Appendix 12.3.2** and a summary of the effects and significance is provided below in **Table 12.5**:

Table 12-5 Effects and significance on Landscape Receptors

Landscape Receptors and Sensitivity	Effects and significance during construction	Effects and significance at completion	Effects and significance after 15 years
Features, qualities, and characteristics within the site			
The landform of the east facing slope: **moderate-high sensitivity**	**Major adverse Significant**	**Major adverse Significant**	**Moderate neutral Not Significant**
Areas of woodland and trees: **high sensitivity**	**Major adverse Significant**	**Major adverse Significant**	**Moderate adverse Not Significant**
Mosaic character: **high sensitivity**	**Major adverse Significant**	**Major-moderate adverse Significant**	**Moderate neutral Not Significant**
Attractive distant views from open elevated areas: **Moderate-High sensitivity**	**Moderate adverse Not Significant**	**Minor adverse Not Significant**	**Minor neutral Not Significant**
Setting to the urban edge of Merthyr Tydfil: **moderate-high sensitivity**	**Major-moderate adverse Significant**	**Major adverse Significant**	**Major-moderate adverse Significant**
Recreational access and setting to PRoW and public access land: **moderate-high sensitivity**	**Major adverse Significant**	**Major adverse Significant**	**Major adverse Significant**
Landscape context of the site			
Merthyr Tydfil: **Lesser sensitivity**	**Minor adverse Not Significant**	**Minor adverse Not Significant**	**Negligible**
Cyfarthfa Park: **High sensitivity**	**Moderate adverse Not Significant**	**Minor adverse Not Significant**	**Minor adverse Not Significant**

Landscape Receptors and Sensitivity	Effects and significance during construction	Effects and significance at completion	Effects and significance after 15 years
Upland and extractive landscape between Merthyr Tydfil and the BBNP and upland common to the east of the site: **Lesser sensitivity**	**Minor adverse** **Not Significant**	**Minor adverse** **Not Significant**	**Minor adverse** **Not Significant**
BBNP: **Moderate-High sensitivity**	**Minor adverse** **Not Significant**	**Minor adverse** **Not Significant**	**Negligible**

12.7.2.13 The landscape receptors within the site where effects were assessed as major adverse or major-moderate adverse during construction and at completion phases are receptors that have high or moderate-high sensitivity. These receptors would undergo great change as a result of the proposed development, and include landform, areas of woodland and trees, the mosaic character, setting the urban edge of Merthyr Tydfil, and recreational access and setting to PRoW and public access land. At 15 years after completion, effects would reduce, with effects mainly reducing to moderate adverse as the magnitude of change reduces, except for recreational access and setting to PRoW and public access land.

12.7.2.14 The remaining landscape receptor within the site (attractive distant views from open and elevated areas)has a moderate-high sensitivity and was assessed as having a medium and small magnitude of change during construction and at completion, and would reduce to minor neutral 15 years after completion.

12.7.2.15 For the wider landscape character, indirect effects resulting from the proposed development were assessed to be mostly minor adverse during construction and at completion. After 15 years some effects would reduce to negligible as the magnitude of changed reduced as the proposed development is likely to become assimilated into the landscape.

12.8 Effects on Visual Amenity

12.8.1 Scope and Assessment Criteria

12.8.1.1 This section deals with the effects on visual amenity, arising from changes in the views available to people in the surrounding area.

12.8.1.2 The general methodology for assessing the effects in this report is set out in **Appendix 12.2**.

12.8.1.3 The degree of the likely visual effects of the proposed development is determined by relating the sensitivity of the receptors to the changes arising from the development proposals, and the degree and nature of the changes in the views available to people and in their visual amenity arising from the proposals.

12.8.2 Visual Baseline

Zone of Theoretical Visibility (ZTV)

12.8.2.1 A Zone of Theoretic Visibility (ZTV) plan has been generated by computer to identify the geographic extents within which views may be available of the proposed development within the visual study area. The ZTV is calculated to the maximum height of the proposed Snow Centre, which forms the tallest proposed feature on the development, to represent the 'worst case scenario'. The viewer eye-height for the ZTV has been set at 2m above ground level.

12.8.2.2 Figures LA.12.7 shows the predicted extent of the ZTV for the proposed development, including the screening effect of surrounding buildings and woodlands, which was calculated using LiDAR 2m DTM resolution data (with heights of existing buildings and vegetation included in the LiDAR data). The screening effects of other surface features such as individual trees and hedgerows may not be picked up in the data. The data also does not take into account any felled areas of woodland since the LiDAR survey was carried out in 2015 [26], which is the most recent survey.

Viewpoint study

12.8.2.3 A photographic survey was undertaken to identify the potential extent of the visibility of the proposed development by locating viewpoints available to sensitive receptors. To inform the initial viewpoint selection, a visual study area from the site was mapped showing the surrounding landscape designations, public access, landscape character, and the predicted ZTV for the proposed development. Potentially sensitive visual receptors within the study area include residents, users of public rights of way and areas of open access land, visitors to the BBNP and areas or sites of historic interest, visitor attractions, and road users.

12.8.2.4 Based on the collated data, initial representative viewpoint locations were selected that relate to the "receptors", that is, residents and users of the landscape, and locations from which they may have views towards or of the site. Prior to the Order Decision[27] (see Appendix 6), MTCBC were consulted about the scope of the visual studies, including the initial viewpoint selection, MTCBC requested additional views to be considered which were all photographed, further detail is provided in **Appendix 12.4.**

12.8.2.5 For each of the viewpoints, the precise location was chosen during the field studies to represent the most open view available subject to local features such as vegetation, buildings or localised topographic variation. From some locations, the ground level of the site may not be visible. However, due to the height of the proposed development, which may be taller than surrounding features, viewpoint locations include areas where the proposed development may potentially be seen extending above intervening screening features.

12.8.2.6 A total of 26 views beyond the site boundary were photographed to illustrate the site and its appearance in publicly available locations. Of the 26 views that were taken, 16 views were carried forward as representative viewpoints for the visual amenity assessment. The locations of the 16 viewpoints (1-16) and 10 context views (A-J) are shown on **Figure LA**

[26] https://libcat.naturalresources.wales/folio/
[27] Order Decision in relation to PRoW within the site dated 24th January 2023

12.07-1. Views prefixed with the letters MC are locations that were requested by MTCBC. **Appendix 12.4** details the reasons why the context views were not carried forward as viewpoints for assessment.

12.8.2.7 The context photographs are shown on **Figures LA 12.8** and viewpoint photographs are presented on **Figures LA 12.9**. **Figures 12.11** provides 6 viewpoint photographs that represent users on PRoWs within the site. Some viewpoints beyond the site boundary were selected to show wireline visualisations of the proposed development within the view. The location maps of the viewpoints and wireline views are shown on **Figures LA 12.10.**

12.8.2.8 Table 12.6 below lists the 16 viewpoints beyond the site boundary, the location details, the receptors represented, and the reasons for selection.

Table 12-6 Viewpoint details

VP Ref	Location	Distance from site (km)	Receptors represented/Reasons for selection
01	Footbridge over A4102 (Bridleway 101/3)	100m	Users of the footbridge, bridleway and nearby Taff Trail walking route, National Cycle Route 8, and road users. • The viewpoint is located within 1km of the proposed snow centre buildings. • It is located on a public right of way. • The viewpoint is located in the Landscape of Outstanding Historic Interest.
MC02	A4054 between Pentrebach Road and Merthyr Road	2.1km	Users of the National Cycle Route, public path and local road users • The viewpoint was requested by the LPA. • The ZTV indicates that the majority of the proposed snow centre buildings would be visible.
03	Jowett Avenue, Ysgubor Newydd	1.4km	Residents and local road users • The viewpoint is located at an elevated settlement area within 2km of the proposed snow centre buildings. • The ZTV illustrates there would potentially be views of the majority of the proposed buildings. • The viewpoint is located in Landscape of Outstanding Historic Interest

VP Ref	Location	Distance from site (km)	Receptors represented/Reasons for selection
04	Junction of Brynteg Terrace and St Tydfil's Avenue	1.0km	Residents and local road users • The viewpoint is located at an elevated settlement area within 2km of the proposed snow centre buildings. • The ZTV illustrates there would potentially be views of the majority of the proposed snow centre buildings. • The viewpoint is located in a conservation area and a Landscape of Outstanding Historic Interest.
MC05	Boer War Memorial, Thomas Town Park	1.4km	Users of the park and visitors to the memorial, nearby residents and local road users. • The view was requested by the LPA. • The park is popular with local residents. • The viewpoint offers elevated views towards the site. • The viewpoint is next to the listed buildings/ monument and within a conservation area. The viewpoint is located in the Landscape of Outstanding Historic Interest.
MC06	Merthyr Tydfil Civic Centre, Law Courts and War Memorial	1.3km	Visitors to Merthyr Tydfil town centre and local road users. • The view was requested by the LPA. • The viewpoint is located within 2km of the proposed snow centre buildings. • The illustrates there would potentially be views of the majority of the proposed snow centre buildings. • The viewpoint is located within the Landscape of Outstanding Historic Interest.
07	Shirley Drive, Heolgerrig	1.8km	Residents and local road users • The viewpoint is located at an elevated settlement area within 2km of the proposed snow centre buildings. • The ZTV illustrates there would potentially be views of the majority of the proposed buildings.

VP Ref	Location	Distance from site (km)	Receptors represented/Reasons for selection
			• The viewpoint is located in Landscape of Outstanding Historic Interest
MC08	Cyfarthfa Park	2.1km	Visitors to Cyfarthfa Castle and Park • The view was requested by the LPA. • Cyfarthfa Park and Castle is a popular tourist attraction, which has received backing from the Council for a masterplan to transform the site to a major museum and visitor attraction. • The ZTV indicates that there would potentially be views of the majority of the proposed snow centre buildings from the park and grounds. • The viewpoint is located in a Historic Park and Garden • The viewpoint is also located in a Conservation Area and close to Grade I and II Listed Buildings • The viewpoint is located in a Landscape of Outstanding Historic Interest.
09	Galon Uchaf Road/ 5th Avenue, Galon Uchaf	2.4km	Residents, users of the public open space, and local road users • It represents key receptors including residents. • The viewpoint is at an elevated location. • The ZTV indicates that the majority of the proposed buildings would be visible. • The viewpoint is located in the Landscape of Outstanding Historic Interest
10	Cefn Cil-Sanws above Merthyr Tydfil Golf Club	4.3km	Visitors to the BBNP, users of the access land, and users of the nearby golf course • The viewpoint is located in the Brecon Beacons National Park

VP Ref	Location	Distance from site (km)	Receptors represented/Reasons for selection
			• The viewpoint is at an elevated location and the ZTV indicates that the majority of the proposed buildings would be visible. • The viewpoint is located in the Landscape of Outstanding Historic Interest
11	Morlais Castle	4.6km	Visitors to the area. • The viewpoint is in a Special Landscape Area. • Although not designated as access land and there are no formal public rights of way at the location, it is a popular local walking route. • The viewpoint is in the Landscape of Outstanding Historic Interest and close to a Scheduled Monument. • The ZTV indicates that the majority of the proposed snow centre buildings would be visible from the elevated location.
MC12	Twynau Gwynion Quarries	5.6km	Users of the bridleway and access land. • The viewpoint was requested by the LPA. • Popular climbing and recreational pursuit area. • The viewpoint is located in an elevated area and the ZTV illustrates that there would potentially be views of the majority of the proposed snow centre buildings. • The viewpoint is located in the Landscape of Outstanding Historic Interest.
13	National Cycle Route 46, Dowlais Top	4.5km	Users of the public footpath, the National Cycle Route, and visitors to the reservoir. • The viewpoint is at a popular recreation area. • The viewpoint is located at an elevated location. • The ZTV indicates that the majority of the proposed buildings would be visible.

VP Ref	Location	Distance from site (km)	Receptors represented/Reasons for selection
14	Duffryn Fawr, Pentrebach	2.1km	Users of the public path, nearby residents, and local road users • It represents key receptors including residents. • The ZTV indicates that the majority of the proposed snow centre buildings would be visible. • The viewpoint is located in the Landscape of Outstanding Historic Interest.
15	Merthyr Common (Mynydd Cilfach-yr-encil)	3.6km	Users of the access land (Merthyr Common) • The viewpoint is at an elevated location. • The ZTV indicates that there would be views of the majority of the proposed buildings from the common. • The site is located within Landscape of Outstanding Historic Interest and close to a Scheduled Monument
16	Gethin Woodland Park	2.2km	Visitors to Bike Park Wales, users of the bridleway and access land • Bike Park Wales is a popular and nationally recognised tourist attraction. • The viewpoint is located in a Special Landscape Area • The viewpoint is located in the Landscape of Outstanding Historic Interest. • To verify the ZTV as some woodland has been recently cleared.
MC17	Footbridge over the A470, south of Health Park	1km from the Snow Centre building	Pedestrians using the footbridge and road users on the A470. • The viewpoint was requested by the LPA. • The A470 is the main road within the study area and is the main route between Merthyr Tydfil and the BBNP. • The viewpoint is elevated above the A470 representing 'worse case scenario' of potential views of the snow centre and other proposed buildings.

VP Ref	Location	Distance from site (km)	Receptors represented/Reasons for selection
			• The viewpoint is located in the Landscape of Outstanding Historic Interest.

12.8.2.9 Table 12.7 below provides a description of the landscape context at each of the 16 viewpoint locations beyond the site boundary and description of the existing view towards the site.

Table 12.7 Existing assessment viewpoint descriptions

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
01 - Footbridge over A4102 (Bridleway 101/3)	The viewpoint is located on the eastern side of the A470 on the bridleway over bridge crossing the A4102. It is located to the south of the retail park overlooking the roundabout on the A470 at the proposed site access. The bridleway link through to a second over bridge crossing the A470 where the bridleway enters the site. This section of A470 is well vegetated along both sides of the road. Along the western side woodland and scrub throughout the former mining landscape extent towards the coniferous woodland of Mynydd Gethin. The viewpoint is located above a busy roundabout that creates movement and detracts from the wooded hillside views, and the associated sound forms a dominant feature.	The foreground of the view is of the roundabout providing a connexion from the A470 to the A4102. High railings along each side of the overbridge filter the view of the roundabout. Existing vegetation along the eastern side of the A470 frames the view of the roundabout. Beyond the roundabout the vegetation along the western side of the A470 extends away into the distance and merges into other woodland and scrub extending up the hillside towards Mynydd Gethin and the coniferous woodland which forms the horizon. The land surface of the site is not visible due to the screening provided by intervening vegetation.
MC02 - A4054 between Pentrebach Road and Merthyr Road	The viewpoint is located in the south of Merthyr Tydfil, on the eastern side of the roundabout on the A4054 between Pentrebach Road and Merthyr Road. It is in the centre of an industrial area with the River Taff and the Cardiff railway line to the west, a group of car showrooms to the north, the former Hoover factory to the south, and open space and woodland around the Trevithick Tunnel to the east. Trees along the roads, river, railway, and between industrial sites create a degree of	The foreground of the view is of the roundabout with mature ornamental trees and the grounds of a car show room and an industrial unit. Views towards the site on the east facing slopes are partially screened and filtered by the foreground trees with more open views between the gaps of the trees and industrial unit. The ground level of the site is largely screened by a combination of foreground and middle ground trees. Above the site, the horizon is formed by the conifer woodland on Mynydd Gethin and Mynydd Aberdare further to the north. In the distance to

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
	fragmentation in the area and restrict views towards the nearby hills. The Trevithick Tunnel, which is set amidst dense woodland nearby to the east, is accessed via a footpath and cycle route from a car park just to the south of the viewpoint. Vegetation screens external views from these routes and from the nearby National Cycle Route 477.	the north there are some views of the residential properties in Heolgerrig.
03 - Jowett Avenue, Ysgubor Newydd	Ysgubor Newydd is a residential area in the south of Merthyr Tydfil, primarily consisting of semi-detached two-storey houses. It is located on land that drops to the southwest into the Taff valley. The gradient is sufficient to allow views from residential properties over the rooflines of nearby buildings to the opposite side of the Taff valley. Several open spaces around the residential areas also allow for views towards the west across the valley. Ysgubor Newydd is situated in the Merthyr Tydfil Landscape of Outstanding Historic Interest, while the open spaces are protected for informal recreation and amenity in the Local Development Plan 2006-2021.	The foreground of the view is occupied by two storey semi-detached residential properties, which can be seen descending the hillside to the southwest. Although nearby properties screen the bottom of the Taff valley, the gradient of the slope allows for views over nearby properties to the western valley side, including towards the site. Views of the site and the east facing slopes above the residential properties are covered in deciduous woodland. Above the site and deciduous woodland there are views of conifer woodland blocks on the horizon. A major powerline can be seen on the horizon in a gap in the conifers above the site. To the right of the conifer woodland there are distant views of Mynydd Aberdare and the residential area of Heolgerrig below.
04 - Junction of Brynteg Terrace and St Tydfil's Avenue	The viewpoint is located in the central area of Merthyr Tydfil, in a residential area east of the town centre. The viewpoint is located in the south of Thomastown conservation area. The elevated viewpoint is on a west facing slope with two storey semi-detached and terraced properties lined along the lower slopes in a northwest to southeast direction. The properties are generally orientated towards the west/ southwest alongside the residential roads with brick walls forming curtilage boundaries. The residential area is dense with properties, except to the north around Sandbrook	The foreground of the view is of local roads and residential properties descending steeply down the west facing slope. The properties screen views of the centre of Merthyr Tydfil below, although there are some views of taller buildings such as the Welsh Government Offices and residential flats. Above the built development, there are views towards the site in the mid-distance and the deciduous wooded east facing slopes. Within the site there are views of some features such as the A470 tip and access tracks. Above the site, there are views of the coniferous woodland blocks on Mynydd Gethin which forms the horizon.

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
	Place. Further to the north is Thomastown Park.	
MC05 - Boer War Memorial, Thomas Town Park	The viewpoint is located in the west of Thomastown Park, close to the Boer War Memorial. The memorial is Grade II listed and Thomastown Park is within the Thomastown conservation area. The park is bisected by Queen's Road, a north to south direction local road, with the most popular area of the park in the east comprising mature trees, circular footpath routes, play spaces and equipment. The west of the park is on an elevated grassed area with the Boer War Memorial surrounded by fencing and benches that has distant views to the west. To the west of the memorial, land steeply drops to a wooded area that defines the edge of the residential area. To the northeast of the memorial, some two storey properties are orientated towards the west with partial views over the bowls green, hardcourt tennis courts, and club house.	Foreground views of amenity grass with the Boer War Memorial and benches orientated to the east before the land steeply falls with views of deciduous trees and vegetation on the lower slopes. Views of Merthyr Tydfil in the valley below are mainly screen by the topography, but there are some filtered roofscape views between the vegetation and trees. In the distance, there are views of the site and surrounding wooded east facing slopes with features on the site difficult to perceive. To the north, there are some views of Heolgerrig. The horizon, above the site, is comprised of the Mynydd Aberdare and Mynydd Gethin ridgelines with the coniferous woodland blocks on top of Mynydd Gethin.
MC06 - Merthyr Tydfil Civic Centre, Law Courts and War Memorial	The viewpoint is located in the north of Merthyr Tydfil town centre, close to the Civic centre and a war memorial. The war memorial, just to the northeast of the viewpoint, is set with a formal square with amenity grass, flower beds, footpaths, and benches. Immediately to the southeast of the viewpoint is Castle Street and the bus station. At the time of the viewpoint photography, the bus station was operational, but the station has since moved to a new site further to the southeast, which opened in June 2021. To the west of the viewpoint is the A4054, which forms part of the one-way system around Merthyr Tydfil town centre. The River Taff is immediately to the west and below the road with a public car park to the west of the river.	Hard landscape with Castle Street occupies the foreground of the view, with some amity grass and trees to the right. A commercial unit and the bus station are viewed in the middle ground with retail units, a shopping centre, and two trees viewed above the bus station. A public car park and Merthyr Tydfil College is viewed to the right. Wooded slopes form the backdrop in the mid-distance to Merthyr Tydfil College and public car park. To the left, views towards the site are above the bus station and retail units in the distance, comprised of wooded slopes with features on the site difficult to discern. Above the site, there are views of the coniferous woodland block that forms the horizon along Mynydd Gethin.

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
07 - Shirley Drive, Heolgerrig	The residential areas of Heolgerrig, Gellideg and Clwydfagwyr to the north, represent existing development to the west of Merthyr Tydfil on the lower slopes of Mynydd Aberdare, which are separated from the main urban area by the A470 dual carriageway. The irregular street pattern of the Heolgerrig, which also contains a large variety of building styles and sizes, is unusual for the area. The often narrow roads and curtilage vegetation limit the availability of views out from the area, those that are available are generally towards the east and northeast across Merthyr Tydfil and towards the BBNP. The viewpoint is located where a framed view towards the site is available, while also depicting that the majority of the properties in the surrounding area are either orientated perpendicular to the direction of the site or are set on lower ground where other nearby buildings and vegetation are likely to screen the views.	Publicly accessible areas from which views towards the site are available are infrequent from Heolgerrig, although views are likely to be more commonplace from within private properties. The viewpoint is located on a hill which provides sufficient elevation for a view to be available above the mid-ground residential area towards site. Land in the context of the site is predominantly covered with deciduous trees, although it is interspersed with areas of wet grassland with tussocky vegetation. The ground level of the site is not visible, being screened by both topography and vegetation. Above the site to the right, the horizon consists of the conifer woodland blocks on top of Mynydd Gethin with far distant views of uplands to the southeast. Between gaps of nearby residential properties in the left of the view, there are distant views of central Merthyr Tydfil.
MC08 - Cyfarthfa Park	Cyfarthfa Park is both a conservation area and a historic park and garden with a significant view from the castle, a Grade I listed building in its centre, towards the southwest. The park is situated on the northern side of Merthyr Tydfil and on the eastern side of the Taff valley, near to the point where the Taf Fawr and Taf Fechan converge. The viewpoint is located in parkland about 220m to the southeast of the castle. The park contains numerous mature trees and areas of woodland, limiting views out of the park to surrounding area. Open areas in the park are either at its lowest point along the western boundary or along the eastern boundary where woodland and treelines screen views. Dense suburban	Open views towards the site from within the Cyfarthfa Park are unusual, requiring both gaps between the mature parkland trees and sufficient elevation to see over intervening features. The viewpoint represents such a combination providing an open, but framed view to the south. The south-westernmost part of the park occupies the foreground of the view with suburban Merthyr Tydfil visible beyond the park boundary, consisting of roofscape views of school buildings, residential properties, and large retail units, interspersed with woodland. The wooded slopes of Mynydd Gethin are visible beyond, with deciduous lower slopes and conifers along the horizon. Views towards the site are distant, situated amid the deciduous woodland on the lower slopes and its position is

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
	development of varying ages and design surround the park.	difficult to discern from this distance and elevation.
09 - Galon Uchaf Road/ 5th Avenue, Galon Uchaf	Pen-y-Darren and Galon Uchaf are large and dense residential suburbs on the northern side of Merthyr Tydfil with Galon Uchaf Park at their centre. The properties are primarily two storey and either semi-detached or short terraces. The residential area is situated on a plateau of between approximately 250m and 300m AOD which slopes gently towards the south. Aside from around the perimeter of the park, trees and mature vegetation are uncommon. The park itself consists of a number of terraces containing playing fields and a wooded valley along its western side.	Views towards the site from publicly accessible areas are either framed by buildings or filtered by vegetation. At the viewpoint, trees along Galon Uchaf Road restrict the availability of views and frame those that do exist. From the viewpoint the land drops into playing fields into the adjacent park, which provides the opportunity for distant views across the Taff valley towards Mynydd Gethin and Mynydd Aberdare. Topography screens the lower parts of Merthyr Tydfil although filtered views of Heolgerrig and Trago Mills below are available through trees to the right. The site is situated in the distance amongst woodland on the far side on the valley, with the conifer capped ridgeline of Mynydd Gethin above the site. The rooflines of buildings near to the A465 are just visible below the site.
10 - Cefn Cil-Sanws above Merthyr Tydfil Golf Club	Cefn Cil-Sanws is an upland limestone ridge to the north or Merthyr Tydfil, on the eastern side of the Taf Fawr valley, and is in the BBNP. It is a mountain environment with areas of tussocky and stony ground and is grazed by sheep. The higher slopes of the hill show little sign of human use with only a few indistinct paths across the area. On the lower slopes to the south and east is Merthyr Tydfil Golf Course. Panoramic views to the west, south and east are available from the southern side of the hill, over Merthyr Tydfil and down the Taff valley. The view is representative of the views available to users of the nearby Merthyr Tydfil Golf Course, although buildings screen the view from the car park itself.	From an upland setting the view faces south directly down the Taff valley, dropping away in the immediate foreground to reveal urban Merthyr Tydfil beyond. In the centre of the valley and on the eastern lower slopes the grounds of Cyfarthfa Castle, with its parkland and lake, are visible. To the right of this are views of the buildings of Cyfarthfa Retail Park and the large building of Trago Mills superstore. Throughout Merthyr Tydfil the urban area is interspersed by trees and areas of woodland, which softens the built form it in the view. Beyond the urban area, the open Merthyr Common ridge on the eastern side of the Taff valley is prominent. To the west the ridge is predominantly wooded, with deciduous trees on the lower slopes and conifers on the upper. The site is situated here on the lower deciduous slopes and its location identifiable by the nearby major powerline.

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
11 – Morlais Castle	Morlais Hill is a local high point just beyond the northern edge of urban Merthyr Tydfil and a 360º panorama is available from its summit. Below the hill to the southeast is a golf course and to the north and west are disused quarries. The hill is topped by the ruined remains of Morlais Castle, a scheduled monument. Further north is the deeply incised and wooded valley of Cwm Taf Fechan, through which run the Taf Fechan river and the Taff Trail. Pastoral farmland consisting of small and irregular shaped tree-lined fields surround these features, which then give way to the open moorland of the BBNP to the north and to the built form of Merthyr Tydfil to the south. Although there are no public rights of way on the hill and it is not access land, it is a popular and well visited location with no constraints to access.	In the foreground the land drops steeply across pastoral farmland bounded by trees and hedgerows. To the south, the A465 Heads of the Valleys Road forms an edge to the built-up area of Merthyr Tydfil in the mid-ground of the view as the land use changes abruptly from rural to urban. The built form of the town occupies the lower reaches of the Taff valley and includes views of large buildings such as the Prince Charles Hospital and Trago Mills superstore. Built development is viewed extending southwards and out of sight in the left of the view. The site is viewed among woodland on the far side of the valley, above built development and below the conifer woodland blocks on Mynydd Gethin that form part of the horizon in the distance. Although the location of site is identifiable within the view, features within the site are barely perceptible.
MC12 - Twynau Gwynion Quarries	The viewpoint, located by Twynau Gwynion Quarries, represents views available from high ground on the northeast side of Merthyr Tydfil, including Morlais Hill, Dowlais Top and the BBNP. Twynau Gwynion Quarries are located on the northernmost part of Merthyr Common between the urban fringe of north Merthyr Tydfil and the BBNP. The quarries, which are disused, are a popular destination for informal recreational activities. To the north and east is an upland plateau of rough moorland interspersed with limestone rocky outcrops. To the west the land drops steeply into the wooded Cwm Taf Fechan, which is bordered by small tree lined pastoral fields. To the south, beyond small stone walled pastoral fields, is suburban Merthyr Tydfil, the edge of which consists of mixed land uses including a golf course, industrial estate, and cemetery to the southwest, a residential area to the	The view is oriented towards the southwest across the bowl in the Taff valley that Merthyr Tydfil occupies. The foreground of the view contains a pockmarked landscape of disused mining features that are covered in short grazed grass. In the mid-ground there are views of the northern suburbs of Merthyr Tydfil, but the town centre beyond is screened by topography. To the left of Merthyr Tydfil, the Ffos-y-frân opencast coal working are prominent on the skyline, while disused quarries at Morlais Hill and Vaynor are visible to the right among pastoral farmland, woodlands and golf courses. The views towards the site in the distance are above Pant Industrial Estate with features within the site difficult to identify as part of the lower wooded slopes of the Mynydd Aberdare ridgeline. The coniferous woodland blocks on Mynydd Gethin are prominent along the skyline above the site, while wind turbines and masts can be seen along the horizon to the right.

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
	south, and an industrial and retail area to the southeast.	
13 - National Cycle Route 46, Dowlais Top	Dowlais Top is a mixture of industrial sites, residential areas, major infrastructure, allotments, farmland and moorland, all punctuated with public footpaths, cycleways, and areas with public access around reservoirs. This irregular pattern is further emphasised by the area's exposure, being at nearly 400m AOD and in a pass between the Taff and Rhymney valleys. The altitude also dictates the vegetation types, with scrub and tussocky grass widespread and a notable absence of large trees. To the north the land rises gently to the open expanse of Merthyr Common and the BBNP, while to the south are the cutting and overburden mounds of the Ffos-y-frân opencast coal mine. The section of the A465 Heads of the Valleys Road immediately in front of the viewpoint is currently in the process of being dualled, resulting in vegetation along the roadside being cleared and opening up views to the southwest and across Merthyr Tydfil. The A465 is a key transport route to the north of Merthyr Tydfil with its associated road sound influencing the character of the area.	The site of the proposed Snow Centre lies to the southwest of the viewpoint on the far side of the Taff valley. The A465 crosses the foreground of the view. An associated reservoir is just visible on the south side of the road with the roofscape on a nearby industrial area. To the south of the industrial area the land drops, which screens most of Merthyr Tydfil. The bowl-shaped topography of Merthyr Tydfil's setting is apparent, with the ridgeline to its west, and behind the site, forming the horizon. The site occupies approximately the lower third of Mynydd Aberdare slope in the distance, which is hard to distinguish amongst the deciduous woodland and context. The coniferous trees of Gethin Woodlands occupy the skyline above the site and extend southwards along the skyline to the left. In the mid-distance, the left of the view is occupied by the partially screened Ffos-y-frân opencast coal mine. To the right of the site the blades of wind turbines protrude above the horizon of Mynydd Aberdare, while the residential area of Heolgerrig and the Trago Mills superstore are identifiable on the lower slopes above foreground vegetation.
14 - Duffryn Fawr, Pentrebach	Pentrebach is a suburb in the south of Merthyr Tydfil, situated on the eastern side of the valley bottom between the River Taff and where the land starts to rise. Industrial areas occupy the valley floor to the northwest and south of the suburb, with the residential area of Abercanaid on the opposite bank of the River Taff to the west. National Cycle Route 477 runs along the eastern side of the residential area, beyond which the land rises steeply to Mynydd Cilfach-yr-encil. The lower slopes consist of scattered small woodlands and fields	The viewpoint is located on a section of pavement that is raised above the adjacent street level by approximately 2m. The height difference allows for an open view over the adjacent housing, between properties, towards the site and is representative of the views available from residential properties in the area, particularly from the first floor. The foreground of the view consists of the roofscape of residential properties with filtered views of the roofscape of industrial buildings behind some trees. The site is viewed in the mid-distance above the roofscape on the west facing slopes

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
	interspersed with remnants of former mining activity. Higher the slopes transition to open grazing land, which are part of Merthyr Common. The area is well served by infrastructure with the A470 dual-carriageway, a railway and the A4054 running along the valley bottom. External views from publicly accessible locations in the area are relatively unusual due to a combination of the orientation of the streets and vegetation along the side of the major roads and cycleway. However, views are likely to be available from residential properties, particularly from upper floors.	of Mynydd Aberdare. The open areas in the west of the site, in its upper reaches, are just visible amidst trees, while the lower parts are indiscernible among the woodland. The Mynydd Aberdare ridgeline forms the horizon in the view above the site. The surrounding context appears heavily wooded and undeveloped in the view, but it is partially backdropped against Heolgerrig residential area, and partially interrupted by pylons and overhead cables for a major powerline that climbs the hill before disappearing over the skyline.
15 - Merthyr Common (Mynydd Cilfach-yr-encil)	Mynydd Cilfach-yr-encil, at 445m AOD, is the highpoint on the ridgeline along the east side of the Taff valley to the south of Merthyr Tydfil. The ridgeline is capped by common and access land, which consists of grassland tightly cropped by grazing horses and sheep. To the west, the land drops steeply into the Taff valley with the lower slopes containing signs of old mining activities and are becoming bracken covered. To the east is Cwm Bargoed, a unique valley in South Wales as there are no roads or residential areas along the valley floor. From Dowlais Road, an old track that runs along the top of the ridgeline that provides access to the common, panoramic views are available in all directions.	Industrial areas in Pentrebach and residential areas of Abercanaid and Pentrebach occupy the Taff valley floor between the viewpoint and the site in the middle ground of the view. Some trees and areas of public open space break up areas of development. Above the built-up area there are some views of the A470. Views towards the site, in the mid-distance, are just above the A470 and it is viewed amongst the surrounding woodland. Above the site, the summit and ridgeline of Mynydd Aberdare is mainly comprised of coniferous blocks of woodland, which partially screen views of the uplands with wind farms that forms part of the horizon in the far distance. In the right of the view, the built-up area of Merthyr Tydfil extends northwards and spreads out up the valley in the distance and include views of some distinctive buildings such as Trago Mills and Cyfarthfa Retail Park. The Brecon Beacons form the horizon in the far distance above Merthyr Tydfil.
16 - Gethin Woodland Park	Gethin Woodlands cover the Mynydd Gethin ridgeline and its slopes on the western side of the Taff Valley, to the south and west of the site. The woodlands are NRW managed forestry, in which sections are felled in rotation. This would allow for	The viewpoint is located on a bridleway approximately halfway up the side of Mynydd Gethin where young trees currently allow for views across the Taff valley. The bridleway is also used as part of the 'up track' for Bike Park Wales, which cyclists can climb to get to the start

Viewpoint reference	Landscape context at viewpoint location	Existing view towards site
	views across the Taff valley and north towards Merthyr Tydfil and the Brecon Beacons until new planting has become established. The woodlands are also the location of Bike Park Wales, a very popular downhill mountain bike centre, which is based in the woods approximately 1.5km to the south of the proposed Snow Centre. The woodlands are access land and are crossed by a network of public rights of way, particularly in their northern half.	of the downhill routes if not using the uplift bus. The young trees and the elevated position on the steep side slope allow for distant views to the north. Pen-y-Fan forms a distinctive feature in the far distance on a clear day with the surrounding uplands of the BBNP forming the horizon. Below the uplands, views of the built-up area of Merthyr Tydfil form the middle ground of the view and include views of Heolgerrig and Trago Mills superstore. The built-up area of Merthyr Tydfil extends southwards in the view and closer to the viewpoint with views of A470 and Pentrebach industrial area to the east. To the west of the A470 and south of Trago Mills there are views of the site. To the south of the site the steep slopes comprised of mixed woodland occupy the foreground.
MC17 - Footbridge over the A470, south of Health Park	The viewpoint is located on a footbridge over the A470, on a footpath that connects Ynys-fach, west Merthyr Tydfil to properties along Upper Collier's Row, southeast of Heolgerrig. It is located to the south of Health Park and Cyfarthfa Retail Park. The A470 heads in a southeast to northwest direction connecting Merthyr Tydfil to the BBNP. Both sides of the road are lined by dense vegetation, separating the road from nearby development and fields. The A470 is a busy road with constant fast-moving traffic. The associated sound is a dominant feature.	From this slightly elevated view above the A470, dense vegetation on the east side of the road screens views to the southeast with glimpse views of the distant hills between gaps in the vegetation. Below, the A470 and its traffic heads in a southeast direction before being screened from view in the mid-distance by the roadside vegetation. Lighting columns along the central reservation partially interrupts views on the west side of the road, which is also line by dense vegetation. Between some gaps there are views of a grass field in the mid-distance with the wooded hillsides and coniferous woodland on top on Mynydd Gethin above. Views towards the site are of the woodland with the land surface of the site screened from view.

12.8.3 Visual receptors

12.8.3.1 The assessment of visual effects is described by considering how the different groups of "visual receptors" may be affected. The following is a review of the viewers (the visual receptors) and the views available to them at the selected representative locations:

People in settlements and residential properties

12.8.3.2 People in settlements located along the valley floor and eastern valley side slopes will have opportunities for views towards the site along the western side slopes of the valley. Many potential views are filtered or partly obscured by other built development and intervening features, however, open views towards the site are available from some locations within Merthyr. A representative sample of these open views have been taken forward to the assessment:

- **03** - Jowett Avenue, Ysgubor Newydd
- **04** - Junction of Brynteg Terrace and St Tydfil's Avenue

12.8.3.3 A representative sample of view available to residents which are filtered, oblique or partly obstructed have also been taken forward to the assessment:

- **MC05** - Boer War Memorial, Thomas Town Park
- **MC06** - Merthyr Tydfil Civic Centre, Law Courts and War Memorial
- **07** - Shirley Drive, Heolgerrig
- **09** - Galon Uchaf Road/ 5th Avenue, Galon Uchaf
- **14** - Duffryn Fawr, Pentrebach

Users of public rights of way and areas of public access

12.8.3.4 Walkers, cyclists and equestrians experience changing views while moving through the landscape and many potential views are filtered or partly obscured by intervening features. Where a particular view is available these receptors are more likely for their attention or interest to be focused on the views or the visual amenity they experience at particular locations**. Appendix 12.6** provides a representative sample of view from public rights of way within the site.

12.8.3.5 Beyond the site boundary, there are several public rights of way locally, including the Taff Trail walking route, National Cycle Route 8, from which views are oblique or partially screened. A representative sample of these views have been taken forward to the assessment:

- **01 -** Footbridge over A4102 (Bridleway 101/3)
- **MC02 -** A4054 between Pentrebach Road and Merthyr Road
- **MC05** - Boer War Memorial, Thomas Town Park
- **MC06 -** Merthyr Tydfil Civic Centre, Law Courts and War Memorial
- **MC08** - Cyfarthfa Park

- **10 -** Cefn Cil-Sanws above Merthyr Tydfil Golf Club
- **11 -** Morlais Castle
- **15** - Merthyr Common (Mynydd Cilfach-yr-encil)
- **16 -** Gethin Woodland Park
- **MC17 -** Footbridge over the A470, south of Health Park

12.8.3.6 Context views were also photographed from other public access routes or areas with public access within the study area but were scoped out from assessment as views towards the site are largely screened and are represented by other near viewpoint locations. These include (refer to **Appendix 12.4** for more detail):

- MC A – Robert and Lucy Thomas Fountain
- MC B – Castle Yard/ Castle Street car park, Merthyr Tydfil
- MC C – Cyfarthfa Castle
- MC D Merthyr Tydfil Golf Club
- MC E Dowlais Road, Ffos-y-fran
- F – National Cycle Route 477, Pentrebach

Road users

12.8.3.7 Users of public roads are less sensitive to changes in the wider landscape because their view is constantly changing as they travel through the landscape/townscape. Movement through the landscape results in views being filtered or partly obscured by intervening features and any specific development would not be the focus of interest for a long duration. Within Merthyr the roads, dwellings, other buildings and the activity of the street would occupy the foreground of views for road users and provide a focus for the view available.

12.8.3.8 There are many locations within Merthyr and the surrounding areas where views are available for road users. A representative sample of these views have been taken forward to the assessment:

- **01 -** Footbridge over A4102 (Bridleway 101/3)
- **MC02 -** A4054 between Pentrebach Road and Merthyr Road
- **03** - Jowett Avenue, Ysgubor Newydd
- **04** - Junction of Brynteg Terrace and St Tydfil's Avenue
- **MC05** - Boer War Memorial, Thomas Town Park

- **MC06 -** Merthyr Tydfil Civic Centre, Law Courts and War Memorial
- **07 -** Shirley Drive, Heolgerrig
- **MC17** - Footbridge over the A470, south of Health Park

12.8.3.9 Context views were also photographed from other roads within the study area but were scoped out from assessment as views towards the site are largely screened, views would be oblique and very short in duration, and are represented by other near viewpoint locations. These include (refer to Appendix 12.4 for more detail):

- MC G – Minor road at Penddeugae
- MC H – A4060 road bridge over Gethin Street and the River Taff, west of Pentrebach
- MC I – Goat Mill Road, just west of the A4060 and Bogey Road

Other areas with a specific landscape interest

12.8.3.10 Visitors to the Brecon Beacons National Park (BBNP) are more aware of changes in the landscape and the views available from public rights of way and access land. There are many locations within the National Park where views are available for visitors, the nearest of which would be beyond 2.5km to the north-northwest of the site at Gellideg, to the north of Heolgerrig. However, the ZTV has intermittent coverage in this location and a view could not be found during the field survey. The BBNP Authority were consulted on the location of assessment viewpoints within the LVIA as part of the EIA scoping/screening and made no comment.

12.8.3.11 The available views from within the BBNP are generally more elevated than the site and over 4km away from the proposed development. A representative sample of these views have been taken forward to the assessment:

- **10 -** Cefn Cil-Sanws above Merthyr Tydfil Golf Club
- **11 -** Morlais Castle

12.8.4 Effects on visual amenity

12.8.4.1 The visual assessment covers the assessment scenarios described in paragraph 12.5.4.4.

12.8.4.2 Visual assessment for users of PRoW within the site are assessed separately within **Appendix 12.6.**

Sensitivity

12.8.4.3 The susceptibility of viewers is affected by factors such as the distance to the viewer, the relative number of viewers affected and the importance of the site in the overall view. The context of the viewpoint may also contribute to the ability to accommodate change, for example, people viewing from residential properties or from a valued landscape might be regarded as less able to accommodate change, than those viewing from an industrial context. Table A12.2-8 in Appendix 12.2 provides examples of High, Moderate and Lesser sensitivity, demonstrating how the contributing factors are interpreted.

12.8.4.4 The sensitivity of the visual receptors is assessed as follows:

- People in settlements and residential properties: high susceptibility to changes in their visual amenity; open unobstructed views including the site assessed as of high value: high sensitivity, and filtered, oblique or partial views of medium value: moderate sensitivity.
- Users of public rights of way or access land within the BBNP: high susceptibility to change in their visual amenity; open views of the site high value: high sensitivity and filtered, oblique or partial views of medium value: moderate sensitivity.
- Users of public rights of way or access land beyond the site: moderate susceptibility to change in their visual amenity; open views of the site of medium value: moderate sensitivity and filtered, oblique or partial views of low value: lesser sensitivity.
- Users of public roads: low susceptibility to change in their visual amenity: filtered, oblique or partial views of low value: lesser sensitivity.

Magnitude of Change

12.8.4.5 The existing views for each representative viewpoint beyond the site boundary are described in Table 12.7 above. Descriptions of the proposed development within each view is described and an analysis of the degree and nature of changes is presented in Appendix 12.3, **Table Appendix 12.3.3**. A summary of the magnitude of change is provided in Table 12.8 below.

Table 12.8 Viewpoint and magnitude of change summary

Reference viewpoints	Magnitude of change:
01-Footbridge over A4102 (Bridleway 101/3)	During Construction: **Medium-great** Completion: **Great** At 15 years: **Medium-great**

Reference viewpoints	Magnitude of change:
MC02-A4054 between Pentrebach Road and Merthyr Road	During Construction: **Medium-small** Completion: **Medium-small** At 15 years: **Medium-small**
03 - Jowett Avenue, Ysgubor Newydd	During Construction: **Great** Completion: **Great** At 15 years: **Medium-great**
04 - Junction of Brynteg Terrace and St Tydfil's Avenue	During Construction: **Medium-great** Completion: **Medium-great** At 15 years: **Medium**
MC05 - Boer War Memorial, Thomas Town Park	During Construction: **Medium** At completion: **Medium** After 15 years: **Small**
MC06 – Merthyr Tydfil Civic Centre, Law Courts and War Memorial	During Construction: **Medium** At completion: **Medium** After 15 years: **Small**
07-Shirley Drive, Heolgerrig	During Construction: **Small** At completion: **Small** After 15 years: **Small**
MC08 - Cyfarthfa Park	During Construction: **Medium** At completion: **Medium** After 15 years: **Medium**

Reference viewpoints	Magnitude of change:
09 - Galon Uchaf Road/ 5th Avenue, Galon Uchaf	During Construction: **Medium** At completion: **Medium** After 15 years: **Medium**
10 - Cefn Cil-Sanws above Merthyr Tydfil Golf Club	During Construction: **Medium-small** At completion: **Medium-small** After 15 years: **Medium-small**
11 – Morlais Castle	During Construction: **Medium-small** At completion: **Medium-small** After 15 years: **Medium-small**
MC12 - Twynau Gwynion Quarries	During Construction: **Small** At completion: **Medium** After 15 years: **Small**
13 – National Cycle Route 46, Dowlais Top	During Construction: **Small** At completion: **Medium** After 15 years: **Small**
14 -Duffryn Fawr, Pentrebach	During Construction: **Medium** At completion: **Medium** After 15 years: **Small**
15 – Merthyr Common (Mynydd Cilfach-yr-encil)	During Construction: **Medium** At completion: **Medium** After 15 years: **Small**

Reference viewpoints	Magnitude of change:
16 - Gethin Woodland Park	During Construction: **Medium-great** At completion: **Medium-great** After 15 years: **Medium**
MC17 - Footbridge over the A470, south of Health Park	During Construction: **Small-medium** At completion: **Medium** After 15 years: **Medium**

12.8.4.6 The assessments generally concluded that for viewpoints with open views located within 1km of the site, the magnitude of change would mostly be great or medium-great during construction and at completion. The magnitude of change may reduce from great to medium-great 15 years after completion as proposed planting becomes established.

12.8.4.7 For viewpoints located between 1 and 3km of the site, the magnitude of change was mainly assessed as medium during construction and at completion. The magnitude of change may reduce from medium to small 15 years after completion.

12.8.4.8 Beyond 4km of the site, the magnitude of change for elevated viewpoints were mainly assessed as medium-small or small during construction and at completion with the magnitude of change reducing 15 years after completion as the proposed development becomes more ingrained into the landscape and planting becomes established.

Effects on visual receptors

12.8.4.9 Final conclusions about the degree of visual effects, whether adverse or beneficial, relate the separate judgements about sensitivity of the receptors and magnitude of the changes, as illustrated in the indicative criteria shown in **Appendix 2, Table A12.2-11**. Visual receptors are grouped based on their sensitivity and the nature of the view available. For each group of receptors, representative viewpoints are listed. Detailed assessments are provided in **Appendix 12.3**, Table Appendix 12.3.4 and a summary of the effects and significance is provided below in Table 12.9:

Table 12.9 Effects and significance on Visual Receptors

Visual receptors, sensitivity, and reference viewpoints	Effects during construction	Effects at completion	Effects after 15 years
Users of the footbridge, bridleway and nearby Taff Trail walking route, National Cycle Route 8, oblique views, partially screened: **moderate sensitivity.** **01-**Footbridge over A4102 (Bridleway 101/3)	**Moderate adverse** **Not Significant**	**Major -moderate adverse** **Significant**	**Moderate adverse** **Not Significant**
Users of the National Cycle Route and public footpaths: **moderate sensitivity** **MC02-**A4054 between Pentrebach Road and Merthyr Road	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**
People in settlements and residential properties, open views to the east of the site: **high sensitivity** **03** - Jowett Avenue, Ysgubor Newydd	**Major adverse** **Significant**	**Major adverse** **Significant**	**Major -moderate adverse** **Significant**

Visual receptors, sensitivity, and reference viewpoints	Effects during construction	Effects at completion	Effects after 15 years
Users of public roads within 2km of the site: **lesser sensitivity** **01-**Footbridge over A4102 (Bridleway 101/3) **MC02-**A4054 between Pentrebach Road and Merthyr Road **03** - Jowett Avenue, Ysgubor Newydd **04** - Junction of Brynteg Terrace and St Tydfil's Avenue **MC05** - Boer War Memorial, Thomas Town Park **MC06** – Merthyr Tydfil Civic Centre, Law Courts and War Memorial **07-**Shirley Drive, Heolgerrig **MC17** - Footbridge over the A470, south of Health Park	**Moderate-minor adverse** **Not Significant**	**Moderate-minor adverse** **Not Significant**	**Moderate-minor adverse** **Not Significant**
People in settlements and residential properties, open views to the northeast of the site: **high sensitivity** **04** - Junction of Brynteg Terrace and St Tydfil's Avenue	**Major adverse** **Significant**	**Major-moderate adverse** **Significant**	**Moderate adverse** **Not Significant**
Visitors to Thomas Town Park, Merthyr Tydfil town centre and visitors to the memorial, nearby residents with filtered, oblique or partly obstructed views: **moderate sensitivity** **MC05** - Boer War Memorial, Thomas Town Park **MC06** – Merthyr Tydfil Civic Centre, Law Courts and War Memorial	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate – minor adverse** **Not Significant**

Visual receptors, sensitivity, and reference viewpoints	Effects during construction	Effects at completion	Effects after 15 years
People in settlements and residential properties in elevated locations to the northwest with filtered, oblique or glimpsed views: **moderate sensitivity** **07-**Shirley Drive, Heolgerrig	**Minor adverse** **Not Significant**	**Minor adverse** **Not Significant**	**Minor adverse** **Not Significant**
Visitors to Cyfarthfa Castle and Park with filtered, oblique or partial views: **moderate sensitivity** **MC08** - Cyfarthfa Park	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**
People in settlements and residential properties close to the site with filtered, oblique or partial views: **moderate sensitivity.** **09 -** Galon Uchaf Road/ 5th Avenue, Galon Uchaf	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**
Visitors to the BBNP, users of the access land, and users of the nearby golf course, visitors to Morlais Castle. **high sensitivity** **10 -** Cefn Cil-Sanws above Merthyr Tydfil Golf Club	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**
Users of public rights of way beyond 4km to the north: **moderate sensitivity** **11 –** Morlais Castle **MC12** - Twynau Gwynion Quarries	**Moderate-minor adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate-minor adverse** **Not Significant**

Visual receptors, sensitivity, and reference viewpoints	Effects during construction	Effects at completion	Effects after 15 years
Users of the public paths and nearby residents at Pentrebach to the southeast of the site with filtered, oblique or partly obstructed views. **moderate sensitivity** **14** -Duffryn Fawr, Pentrebach **15** – Merthyr Common (Mynydd Cilfach-yr-encil)	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate-minor adverse** **Not Significant**
Users of access land, public rights of way, Bike Park Wales with filtered, oblique/partial views or glimpsed open views: **moderate sensitivity.** **16 -** Gethin Woodland Park	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**
Users of the footbridge and footpath over the A470 **MC17** - Footbridge over the A470, south of Health Park	**Moderate-minor adverse** **Not Significant**	**Moderate adverse** **Not Significant**	**Moderate adverse** **Not Significant**

12.8.4.10 The visual assessments conclude that for residents with open views to the east of the site that have high sensitivity, the visual effects would be major adverse during construction and at completion as the magnitude of change was assessed as great. Effects would reduce to major-moderate after 15 years of completion as the magnitude of change reduces. For residents to the northeast of the site where the proposed development would be less prominent in views, the visual effects were assessed as major at construction, reducing to moderate 15 years after completion. For residents with moderate sensitivity, effects were assessed as moderate or minor for each phase.

12.8.4.11 For users of public open space within Merthyr Tydfil with moderate sensitivity, visual effects were assessed as moderate adverse during construction and at completion, reducing to moderate-minor 15 years after completion as the mitigation planting establishes reducing potential visual effects.

12.8.4.12 For users of public rights way and National Cycle Route 8 with oblique or partially screened views with moderate sensitivity, the visual effects were mainly assessed as moderate adverse during construction, at completion, and after 15 years.

12.8.4.13 For road users within 2km of the site with lesser sensitivity, the visual effects were assessed as moderate-minor adverse during construction, at completion, and 15 years after completion. Road users would typically have oblique or partial views towards the proposed development that would be short in duration with the proposals viewed in context to the surrounding townscape.

12.9 Summary and Conclusions

12.9.1 Baseline

12.9.1.1 This Landscape and Visual Impact Assessment relates to an Outline Planning Application for a destination sports, leisure and tourism led, mixed-use development proposal on land to the southwest of the Rhydycar roundabout on the A470, South of Merthyr Tydfil. The site extends to 30.4 hectares. It is located west of Rhydycar and to the southwest of Merthyr Tydfil, between the A470 to its east, Gethin Woodland Park to the south and west, and Heolgerrig to the north.

12.9.1.2 This LVIA has assessed the potential effects of the proposed development on the landscape character and visual amenity. The immediate landscape context extends to approximately 0.5km to the north, west and south from the site with the A470 reducing the immediate context to circa 0.1km to the east of the site. The wider landscape context extends between 1 and 2km from the site boundary, which is influenced by vegetation, built form and/or topography. The visual study area, which is defined by the surrounding valleys topography, extends 3km to the west and south of the site, 5km to the southeast of the site, 4km to the east of the site, and 6km to the north.

12.9.1.3 The methodology used for assessing the potential effects on landscape character and visual amenity were based on the recommendations in GLIVA3. The application of the guidance document established an appropriate scope for this assessment to be undertaken. Merthyr Tydfil Country Borough Council were also consulted on the viewpoint selection, study area sizes, and assessment methodology. BBNP Authority were consulted on the scope of the LVIA within the EIA scoping/screening and made no comment.

12.9.2 The proposed development

12.9.2.1 Details of the proposed development are provided on the planning application drawings and the Design and Access Statement accompanying the outline planning application. The largest building within the proposed development is the indoor Snow Centre in the northwest of the site. The building would rise to a maximum elevation of 287.5m Above Ordinance Datum (AOD) at its highest point in the northwest of the site. The Snow Centre includes a circa 400m long east facing ski slope that would utilise the natural gradient of the site, sloping down to the east to a maximum of circa 210m AOD. Adjacent to the south of the Snow Centre, the existing topography would be re-modelled to create a 1:3 south facing slope that would be planted with a mix of grassland and scrub.



12.9.2.2 At the base of the Snow Centre to the east, proposals for the site include a complex of buildings that incorporate hotels and leisure activities. To the east of the proposed hotels is a proposed Water Park that integrates indoor and outdoor elements. A hotel wing would be located immediately to the south of the Water Park. A proposed Indoor and Outdoor Activity Centre would be located immediately to the south of the base Snow Centre, east of the planted south facing slope.

12.9.2.3 Located in the central area of the hotel and leisure complex is a proposed area for a car park, service area and ancillary uses. A Piazza is also proposed that would include hard and soft landscape areas with space for seating and outdoor space related to cafes and restaurants. The Piazza would form the main arrival space for visitors is to the development and would connect to the public routes passing through the site which are linked to the public right of way network. Landscape proposals within the space would include substantial tree planting to provide shelter from the prevailing winds and shade.

12.9.2.4 In the most southerly extent of the site proposals include the installation of circa 30no. lodges and associated access tracks, which would be set within existing and retained woodland. The proposed lodges would have a maximum height of 4.5m.

12.9.2.5 Proposals for the site include the diversion of PRoW through the site and some would need to be formally stopped-up as they conflict with the proposed development. Figure LA 12.5.2 shows the existing network of PRoW within the site and Figure LA.12.5-3 shows the mitigation strategy. on.

12.9.2.6 Other informal routes are also proposed across the site. A proposed route includes a north to south direction route that connects to the main access road in the north of the site and heads southwards, east of the main hotel and leisure complex, to connect to several routes that transect the southern area of the site, which includes a route that follows the disused railway line. The proposed routes would also seek to connect with the PRoW within the site and the surrounding PRoW network beyond the site boundary, which provide connections to Merthyr Tydfil town centre and Pentrebach.

12.9.3 Summary of findings

Landscape assessment

12.9.3.1 The landscape assessment assessed the potential impact on landscape receptors during the construction phase, at completion, and 15 years after completion of the proposed development.

12.9.3.2 LANDMAP assessments and the BBNP Landscape Character Assessment were referred to. The key characteristics that are of relevance to the site and surrounding area include: the site's location between an upland ridge and the town of Merthyr Tydfil, adjacent to the A470 road; the site and surrounding area contains serval historical features associated with former industrial activities such as railway and canal corridors, mining features and tips; the biodiversity character is influenced by the historic mining and transport routes, and natural regeneration containing areas of woodland and grassland; and the characteristics are rural, but on the urban fringe. In the wider landscape context, the study area contains the urban area of Merthyr Tydfil, which contains several historic sites including Cyfarthfa Park. Extractive and upland landscape is located between the northern edge of Merthyr Tydfil and the south edge of the BBNP. The BBNP extends northwards and beyond the study area.

12.9.3.3 A site-specific appraisal was also carried out identifying the landscape features, characteristics, and aesthetics. The site appraisal confirmed the site's location on and east facing slope above Merthyr Tydfil, below the ridgelines of Mynydd Gethin and Mynydd Aberdare. There are some distant views out of the site from open areas, but other areas of the site are enclosed by woodland and steep sided tips and embankments. Grassland areas are located in the northwest of the site and in the north on top of the A470 tip. In the western part of the site an area of woodland is covered by a TPO. The site also contains several heritage features associated with the former iron and coal workings including former railway tracks, embankments, bridges, shafts and tips. Recent engineering works have also been undertaken, in the central part of the site, as part of drainage improvements. This work has created large boulder and stone line channels and cascades, drainage ditches, and some tracks have been widened. There is also a network of public right of way within the site that are used by walkers and mountain bikers (formally claimed rights of way).

12.9.3.4 The assessment of landscape effects considered the effects of the proposed development on landscape features, qualities, and characteristics within the site, as well as effects on the wider surrounding landscape character. The findings of the assessment concluded that during the construction phase, effects would be adverse and mostly major and significant. The site would undergo large-scale changes, including changes to landform and removal of woodland and trees and other habitats that contribute to the mosaic character. Heritage features would be retained, but former mining tips and the A470 tip formed in the mid 1990's would be removed/dispersed on site, and distant views out of the site would be disturbed. This would change the character of the site's setting to the urban edge of Merthyr Tydfil and would alter PRoW within the site with diversion and stopping up of routes with the setting to PRoW access land being affected. At completion, most effects would remain major and significant, but effects in relation to views out of the site would reduce to minor adverse or neutral and not significant.. After 15 years, planted woodland and trees would be continuing to establish, seeded grassland and scrub would be established, which would help integrate the proposed development into the surrounding landscape and its contribution to the mosaic character with effects reduced to moderate and not significant. Changes to the landform would also be settled with effects reduced to moderate neutral and not significant. Although the altered PRoW access through the site would be established, the impact of the proposed development would remain as major adverse and significant.

12.9.3.5 For the wider landscape character, indirect effects resulting from the proposed development were concluded to be mostly minor adverse and not significant during the construction phase. Construction activities would be mostly viewed in the distance and within the surrounding context of Merthyr Tydfil with the key characteristics of each area remaining unaltered. However, the character area of Cyfarthfa Park was assessed as moderate adverse as the visual connection, a historic feature of the area, would be altered. At completion, effects were all assessed as minor adverse and not significant. At 15 years after completion, effects were either assessed as minor adverse or negligible and not significant. The establishment of woodland and vegetation is likely to reduce the extend of views of the proposed development. The proposed development is likely to be ingrained within the landscape with key characteristics of the landscape character areas remaining intact, including from the BBNP.

12.9.3.6 Overall, the development of the site would change the character of some features within the site, particularly during the construction phase and at completion. The proposed development would introduce new features, including buildings and associated infrastructure. However, some areas of the site, particularly in the south, and within the wider area of ownership the key characteristics would remain largely intact. The development of the site provides some opportunities for education with the retention of historic features and connect local people to the landscape. 15 years after completion, it is likely that some features of the site would be ingrained within the wider landscape and would contribute to its mosaic character, including the planted south facing slope and new woodland areas. Other characteristics are likely to remain largely unchanged, including available distant views out of the site and retained woodland areas.

Visual assessment

12.9.3.7 To confirm the baseline studies of designations, landscape character, and ZTV mapping, a total of 24 views were photographed beyond the site boundary to illustrate the site and its appearance in publicly available locations. Of the 24 views that were taken, 16 views were carried forward as representative viewpoints for the visual amenity assessment. The photographs are reproduced on Figure LA 12.9 in Appendix 12.1. The locations of the 16 viewpoints (1-16) and 8 context views (A-G) are shown on Figure LA 12.7 in Appendix 12.1. Viewpoints prefixed with the letters MC are locations that were requested by MTCBC. Appendix 12.4 provides details the reasons why the context views were not carried forward as viewpoints for assessment. Following the Order Decision in January 2023, an additional 6 viewpoints were presented on Figures LA.12.11 to represent views within the site for users of PRoW.

12.9.3.8 The visual assessment concluded that for residents within 2km of the site with filtered, oblique or partial views visual effects were assessed as moderate adverse and not significant during construction and at completion. Following the completion of the proposed development, adverse visual effects would remain as moderate adverse. As distance increases from the site, visual effects would further reduce to minor adverse and the opportunity for views would reduce as the number of potential intervening features increases. Proposed mitigation measures included within the design of the proposed development would moderate potential effects after construction and reduce the visual effects 15 years after completion by softening the appearance of the development in the view.



12.9.3.9 The visual assessment concluded that for residents with open views visual effects were assessed as Major adverse and significant during construction. At completion visual effects were assessed as Major adverse and significant for direct, open views experienced by residents on the opposite side of the valley from the site at Jowett Avenue, Ysgubor Newydd. In other locations where the site is viewed from along the valley from the north or south the effects on residents' views is assessed as Major-moderate adverse and significant, because the site is less prominent in the view. Proposed mitigation measures included within the design of the proposed development would moderate potential effects 15 years after completion by softening the appearance of the development in the view. For residents at Jowett Avenue, Ysgubor Newydd, the effects on views would be Major-moderate adverse and significant, and for residents with a less direct view, Moderate adverse and not significant.

12.9.3.10 For users of public rights of way within the site, the visual assessments in Appendix 12.6 concluded that for PRoWs within the central and northern areas of the site, where the main area of proposed development conflicts with existing routes or is in very close proximity, effects would be major adverse and significant during all stages. From more sheltered areas of the site, such as in wooded locations where the nature of view allows views towards the main area of the proposed development, effects would be moderate adverse not significant during construction and major-moderate adverse and significant at completion and at year 15. In the southeast of the site where views are prevented towards the main area of the proposed development, but where there are likely to be view of other features of the proposals, effects would be minor-moderate and not significant during all stages.

12.9.3.11 Beyond the site boundary, the visual effects for users of public rights way and National Cycle Route 8 with oblique views, partially screened would be moderate adverse and not significant during construction, at completion and after 15 years. At one location on the bridleway overbridge crossing the A4102 effects are assessed as major-moderate and significant adverse after construction because of the close proximity of the site to receptors in this location. For walkers, cyclists and equestrians on public rights of way beyond 1km from the site effects range from moderate-minor adverse to moderate adverse and not significant during construction, at completion, and 15 years after completion.

12.9.3.12 For users of public open space within Merthyr Tydfil visual effects were assessed as moderate adverse and not significant during construction and at completion. This includes visitors to the Memorial, Merthyr Tydfil town centre and Cyfarthfa Castle and Park, where there would be filtered, oblique or partial views of the proposed development. Proposed mitigation measures included within the design of the proposed development would moderate potential effects after construction and reduce the visual effects 15 years after completion for visitors to Merthyr Tydfil town centre to Moderate – minor adverse and not significant.

12.9.3.13 For road users within 2km of the site, the visual effects were assessed as Moderate-minor adverse and not significant during construction, at completion, and 15 years after completion. Road users would typically have oblique or partial views towards the proposed development that would be short in duration with the proposals viewed in context to the surrounding townscape.

12.9.3.14 Within the site boundary, users of PRoW within the north and central areas of the site would experience the most adverse visual effects. Here, views of the proposed development would be unavoidable. Beyond the site boundary, the most adverse visual effects would mainly occur during construction and at completion. During these periods, the removal of vegetation, construction activities, built form would appear within available views from the surrounding townscape/ landscape and add movement to the view. After the completion of the proposed development and after 15 years, adverse visual effects would reduce to Minor adverse - Moderate adverse and not significant for all receptors with the exception of nearby residents with open views where the effects remain as Major -moderate adverse and significant. These large scale and significant visual effects would occur for visual receptors close to the site, but as distance increases from the site, the significance and degree of visual effects would reduce.

12.9.3.15 Weather conditions, as described in paragraph 12.1.3.6 above would limit visibility for receptors as conditions that limit visibility occur due to rainfall (165.5 days on average in the year) and air frost (58.7 days on average in the year).

Designated landscapes

12.9.3.16 The site is located in the Merthyr Tydfil West Flank Special Landscape Area (SLA) as designated within the Merthyr Tydfil Local Development Plan (2016 – 2031). The site is located in the east of the SLA, which covers an expansive area. Recent works has resulted in some disturbance with the removal of some trees and the construction of large boulder line drainage channels, drainage ditches, and the widening of tracks within the central part of the site. Proposals for the site include retaining historic associations of the industrial activity that occurred on the site and retaining the mosaic character, including the different habitats of woodland and some areas of grassland, which contribute to the character of the area. SLA is a local designation and does not preclude development proposals of any sort. The proposed heritage trail will help to raise awareness of the heritage interest of the SLA and create managed and sensitive access to the heritage assets.

12.9.3.17 The Brecon Beacons National Park (BBNP) covers the most northern extent of the study area and is located circa 3.1km from the site at its nearest point. A Future Force for Change[28] is developments to the south of the national park which would potentially affect views, particularly form higher ground. The landscape assessment concluded that 15 years after completion of the proposed development, the key characteristics and special qualities of the BBNP would not be affected by the development proposals. This is because the proposals would be viewed in the context of the built development of Merthyr Tydfil in the distance, beyond 3km at its nearest point, with the establishment of soft landscape features and the treatment north elevation of the snow centre helping the development to integrate with its surroundings. During construction and at completion there would be indirect minor adverse effects with some distant views of the proposed development, but the special qualities of the national park would remain intact. The visual assessment also concluded that effects on visual amenity to visitors to the BBNP would be moderate adverse. The proposed development would form a distant feature viewed in context of the built development.

[28] Brecon Beacons National Park Authority Landscape Character Assessment, August 2012, LCA 8 Profile: www.beacons-npa.gov.uk/wp-content/uploads/LCA-8-PROFILE_final_120930.pdf

12.9.4 Conclusions

12.9.4.1 This Landscape and Visual Impact Assessment has examined the landscape and visual impacts in relation to the development proposals. All impact assessments are based on the proposed design approach, which incorporates mitigation measures. The potential impacts have been thoroughly assessed through a combination of desk study research and walk-over surveys of the site and the surrounding context.

12.9.4.2 The sensitive integration of development at the site represents a significant challenge due to the combination of former mining features, disused railway infrastructure, tips and the distinctive character of the site and its context. Recent works on the site (conducted by Merthyr Council) have aimed to improve the drainage and stability of the tips on site. The vision of the proposed development is centred around what will be the longest indoor snow centre in the UK (incorporating the national training headquarters and facility for Snowsports Cymru Wales and GB Snowsport). The master plan is for a new destination sports, leisure and tourism resort. Central to this is the creation of a high-quality holiday resort destination that focuses on indoor and outdoor activities, wildlife and reinforces the special character of the local environment. The masterplan and landscape strategy respond sensitively to its landscape setting and contribute positively to the local area.

12.9.4.3 The proposals for the site have been formulated through an iterative process with the design evolution responding to the findings of baseline surveys to avoid or moderate adverse effects. The proposals have been informed by comprehensive survey and assessment work. As a result, the potential landscape and visual impacts have been moderated. The proposals therefore satisfy policy requirements relating to the site. Adverse landscape effects are largely constrained to the direct impacts on the site itself, which would undergo disturbance and alterations over time and reflect the scale of the built form and earthworks proposed. The effectiveness of mitigation measures is demonstrated by the reduction in the significance of effects which is assessed following the completion of construction at year 15.

12.9.4.4 Similarly, the indirect effects beyond the site boundary are also reduced following the completion of the construction work as the proposed development becomes integrated into its context.

12.9.4.5 The visual impacts of the development proposals have been assessed through a process of identifying assessment viewpoints, using computer-generated Zone of Theoretical Visibility (ZTV) and accurate visual representation to illustrate the proposed development from a significant proportion of the identified assessment viewpoints. The visual assessment has identified adverse impact for PRoW within the site and areas beyond the site boundary with open views towards the site, particularly from the east within the urban area. Built development within the urban area reduces the extent of areas where uninterrupted views are available. Effects for other visual receptors are generally moderate adverse and there is a reduction in significance of effects for several receptors following construction and after 15 years.

12.9.4.6 The Landscape and Visual Impact Assessment has identified that the site could accommodate the proposed development without resulting in an unacceptable adverse

impact on landscape character and visual amenity experienced within the surrounding landscape/townscape.



13.0 Water, Drainage and Flooding

13.1 Introduction & Executive Summary

13.1.1 This chapter presents an assessment of the likely Water, Drainage and Flooding effects on, and from, the proposed development. Consideration is given within the chapter to changes to drainage and flood flows within the local drainage network and associated implications for the application site, proposed development and elsewhere. The potential for the proposed development to contribute to more sustainable drainage and flood management is also considered, along with the impacts associated with the construction phases.

13.1.2 The chapter provides a summary of relevant legislation, planning policy and guidance, alongside a description of the method of assessment. This is followed by a description of the relevant baseline conditions of the application site and surrounding lands, an assessment of the potential impacts on and from the proposed development during construction and an assessment of the impacts during the operational phase. Mitigation measures are identified, if necessary, to avoid, reduce or offset any adverse impacts. The chapter concludes with a summary of the likely residual effects of the proposed development post-mitigation.

13.1.3 A Flood Consequences Assessment (FCA) has been prepared in support of a SuDS Approving Body (SAB) pre-application for the proposed development. Both documents will be submitted separately to accompany the outline planning application. The FCA contains detailed information on which this chapter is based and is included for ease of reference as Appendix 13.1 of this chapter. The FCA should be referred to for further detail regarding methodology and data sources.

13.1.4 Consultation has been undertaken with the SAB throughout the production of this chapter and the accompanying FCA, SAB Pre-application and Drainage Strategy. This included a meeting with Huw Williams on 23 November 2021. The SAB accepted the concepts presented in the Drainage Strategy, agreed that formal approval for watercourse diversions and discharge consents, including the detail of discharge connections, could be deferred to a formal application after Outline Planning Permission has been granted and accepted that Greenfield Runoff Rates (GFR) are Q_{bar} rates. Furthermore, the SAB accepted permeable paving and a swale as the two levels of treatment required for the car park, and that the current strategy based on no infiltration, i.e. lined swales, was generally acceptable.

13.1.5 In summary, the SAB accepted the principles proposed in this chapter and accompanying documents and raised no material concerns regarding the proposed development from a drainage and flooding perspective.

13.1.6 In conclusion, apart from pluvial flood risk, there is no risk of flooding to or from the proposed development from any of the flood sources explored within this chapter and the FCA. Any potential pluvial flood risk to or from the proposed development will be mitigated using the measures detailed in the accompanying FCA; watercourses will be rerouted subject to appropriate consents and approvals, and a SuDS compliant drainage scheme will be implemented. Furthermore, the proposed development will add betterment in terms of surface water runoff rates for all events greater than Q_{bar}. Accordingly, no objections should be sustained on grounds of flood risk or drainage matters and there is an overall negligible flood risk to the site

13.1.7 This chapter is supported by the following figures and appendices:

- Figures:
  - 13.1.1 – Study Area (Redline Boundary)
  - 13.3.1 – Water Features / Watercourses Summary
  - 13.3.2 – Development Advice Map – Flood Zones (NRW, July 2021)
  - 13.3.3 – River (Fluvial) Flood Risk Map (NRW, July 2021)
  - 13.3.4 – Marine Flood Risk Map (NRW, July 2021)
  - 13.3.5 – Surface Water (Pluvial) Flood Risk Map (NRW, July 2021)
  - 13.3.6 – Reservoir Flood Risk Map (NRW, July 2021)
  - 13.3.7 – Existing Drainage / Waterbody Features
- Appendices:
  - 13.1 – FCA
  - 13.2 – Drainage Strategy Drawings.

13.1.8 The Study Area for this chapter is the study area considered in the FCA. It is shown in Figure 13.1.1 and comprises the application site redline planning application boundary. For information purposes, the blue line applicant ownership boundary is also provided. If necessary, the study area has been extended to consider water features beyond the redline boundary.

13.2 Methodology and Scope

Policy Background

13.2.1 A detailed review and assessment of relevant planning policy specific to Water, Drainage and Flooding is included within the FCA, contained in Appendix 13.1. This section provides a summary of the key Welsh Government and Local Policy which has been considered in preparing this chapter.

National Planning Policy

13.2.2 Planning Policy Wales (Edition 11: published in February 2021 (PPW11) sets out the general planning framework within Wales and is supported, in flood risk terms, by Technical Advice Note 15: Development and Flood Risk, July 2004 (TAN15). Future Wales is the National Development Framework for Wales, with policy 8 providing the government's policy on flooding and flood management infrastructure.

Technical Advice Note 15: Development and Flood Risk

13.2.3 The general approach of PPW11, supported by TAN15, is to advise caution in respect of new development in areas at high risk of flooding by setting out a precautionary framework to guide planning decisions. As stated in PPW11 Paragraph 6.6.22 the overarching aim of the precautionary framework is that planning authorities adopt a precautionary approach of positive avoidance of development in areas of flooding from the sea or from rivers.

13.2.4 In all zones, development should reduce, and must not increase the risk of flooding on site or elsewhere, in accordance with PPW11 Paragraph 6.6.26 and TAN15 Figure 1.

13.2.5 TAN15 states:

- '*Direct new development to areas at minimal risk of flooding – areas in Zone 1*';
- '*Allow resilient development in undefended areas of relatively low risk – areas in Zone 2*'; and,
- '*Only permit water compatible development, essential infrastructure, and less vulnerable developments by exception in areas of higher risk – areas in Zone 3*'.

13.2.6 PPW also states that the priority should be to protect floodplains from development to prevent cumulative effects.

13.2.7 In line with the requirements of PPW11 Paragraph 6.6.27, Development should not cause additional run-off, which can be achieved by controlling surface water as near to the source as possible, using SuDS. The rate of surface water runoff from the development site is to be restricted to the existing greenfield rate of runoff, thereby not increasing flood risk downstream.

Flood and Water Management Act 2010

13.2.8 In accordance with Schedule 3 of the Flood and Water Management Act 2010, as of 7 January 2019, all new development with a construction area of 100m^2 or more requires sustainable drainage to manage on-site surface water. A separate SuDS approval process is required from the SAB before construction work can commence. The new regulations require design option considerations against a SuDS hierarchy summarised, by preference, as follows:

- Re-use of water (water butts, Rainwater Harvesting (RWH) etc.), then…
- Conveyance/mitigation/attenuation at the surface, before…
- Piped or tanked drainage solutions can be considered.

13.2.9 Ultimately, all surface water drainage systems must be designed and built in accordance with the mandatory SuDS Standards to align with TAN15 Figure 1.

CIRIA C753 SuDS Manual

13.2.10 When considering the SuDS design, the Welsh Government SuDS Statutory Guidance should be consulted alongside the CIRIA C753 SuDS Manual for technical design in the hierarchical approach.

Merthyr Tydfill County Borough Council (MTCBC) Flood Risk Management Plan (FRMP)

13.2.11 The MTCBC FRMP highlights how the disposal of surface water is a key consideration even if the site is not in a flood risk area and promotes the use of SuDS to make sure that flood risk is not increased downstream.

13.2.12 The MTCBC FMRP directs development to the local SAB application which states that all SuDS options should be explored in a hierarchical approach, with collection and infiltration the preferred options. SuDS options should be developed preferably in advance of the site layout, so land can be allocated for the effective use of SuDS.

13.2.13 The FCA has been produced in accordance with the PPW11 TAN15 which sets out the Welsh Government policies on different aspects of land use planning in Wales.

Welsh Government Flood Consequences Assessments: Climate change allowances, September 2021

13.2.14 The Climate change allowances document stipulates how climate change is to be accommodated when producing FCAs. It requires that rainfall allowances should be applied when considering surface water flooding and drainage assessments. Drainage systems should be designed to make sure that there is no increase in site run-off when assessed against upper estimates for climate change increases for the pertinent epoch of the proposed development.

13.2.15 This requirement has been incorporated in climate change allowances made both in this chapter and the accompanying FCA.

Scoping Assessment Stage

13.2.16 An EIA Scoping Opinion was submitted to MTCBC for the proposed development. The Scoping Opinion set out the requirement Water, Drainage and Flooding should be assessed within the EIA.

13.2.17 Consultation has also been undertaken with MTCBC via the planning pre-application process. All matters pertaining to flood risk raised in the pre-application letter, 4 October 2022, i.e., the requirement for a SAB pre-application, ordinary watercourse applications, condition and capacity assessments, discharge rates, watercourse diversions and consultation with SAB, have been addressed in this chapter and appended FCA.

13.2.18 Consultation for completion of the assessment has been undertaken with MTCBC, SAB, Dwr Cymru Welsh Water (Welsh Water), Natural Resources Wales (NRW) and Transport for Wales (TfW) in their roles as key consultees in the context of drainage and flood risk. Consultation advise specific to this chapter and associated documents are outlined within the reports contained in Appendix 13.1 and 13.2.

Assessment Methodology

13.2.19 The impact of the proposed development upon Water and Drainage has been assessed in the following manner:

- Investigation of the nature, location and capacity of the existing water and drainage regime and infrastructure in the vicinity of the proposed development including liaison with key stakeholders;
- Determination of potential surface water runoff linkage to the existing water and drainage regime and infrastructure including a site walkover survey;
- Calculation of existing and proposed foul and storm flows and loads emanating from the existing site and proposed development; and
- Consideration of the drainage infrastructure required to facilitate the proposed development and associated mitigation measures. This stage has been informed by the production of the FCA in Appendix 13.1.

13.2.20 The impact of the proposed development upon Flooding has been assessed in the following manner:

- Investigation of the nature, location, capacity and flooding information of existing watercourses in the vicinity of the proposed development including liaison with key stakeholders;
- Assessment of the extent of potential flood sources (i..e fluvial, pluvial, marine, reservoir, groundwater and interurban) in the vicinity of the application site using NRW Development Advice Maps (DAM) supplemented by a site walkover survey;
- Assessment of existing site levels using the site's topographical survey;
- Assessment of proposed development levels using the proposed Masterplan; and
- Assessment of flooding impacts by comparison of flood levels with the site's topography/proposed development levels to assess flood risk. This stage has been informed by the production of the FCA in Appendix 13.1.

Receptor Sensitivity

13.2.21 Receptors are those downstream watercourses that could be impacted by the proposed development. These include the Nant Cannaid and the River Taff. Figures 13.3.2, 13.3.3 and 13.3.5 indicate that these watercourses are sensitive to fluvial and pluvial flooding. Any increase in flow rates discharging from the proposed development could result in increased downstream flood risk.

13.2.22 Furthermore, the application site contains a network of small watercourse and drainage features which, if altered, could be sensitive to increased flood risk which could impact the proposed development and lands elsewhere.



Effect Magnitude

13.2.23 The previously mentioned planning policies dictate effects that are unacceptable in the context of Drainage and Flooding. Any changes arising the from proposed development which could exacerbate downstream flood risk resulting in an increased risk of flooding to properties would be unacceptable. Furthermore, any proposed development on lands that are not categorised as Zone 1 requires careful consideration and development in the context of the constraints imposed by TAN 15.

Effect Significance

13.2.24 Effects on these receptors include increased flows resulting in increased potential flood risk, more extensive floodplains and increased flood water depths and velocities. These effects can be significant, placing assets (e.g. homes and businesses) and human life at greater risk of flooding.

Limitations of the Assessment

13.2.25 The assessments derived within this chapter have been prepared using material contained within the associated FCA (Appendix 13.1). These reports have been prepared in accordance with local and national policy.

13.2.26 Detailed design has not yet been carried out for mitigation measures referenced in this chapter. Indicative designs have been prepared, using desk-based information, to determine pre-existing and proposed development flows. Best practice / industry standard techniques have been adopted using MicroDrainage software to determine flow rates and to design mitigation measures. Outputs are robust and fit for purpose and will be ratified by bespoke onsite data collection at detailed design stage.

13.2.27 Hydraulic modelling has not been carried out at this stage to determine pre- and post-development watercourse flows and to design watercourse realignments. Best practice / industry standard techniques have been adopted using MicroDrainage software to determine flow rates and design mitigation measures. Outputs are robust and fit for purpose and will be ratified by bespoke onsite data collection at detailed design stage.

13.2.28 Infiltration testing has not been conducted at this stage to determine infiltration rates of existing subsoils. This is because significant earthworks operations are required to generate construction platforms for the proposed development. Therefore, it has not been possible to test subsoils at the appropriate levels proposed for SuDS features. Furthermore, information gathered during site walkover surveys suggests that ground conditions may not be conducive to the use of infiltration; the ground surface being waterlogged with evidence of significant incidence of overland flows. Finally, the use of infiltration in this case could risk destabilising the many spoil tips located throughout the application site. Accordingly, infiltration has not been accounted for in the assessment of drainage for the proposed development. Outputs are robust, representing a worst case which it may be possible to improve at detailed design stage, when infiltration testing and associated detailed design can be completed.

13.2.29 The information contained in this chapter is based on several industry standard assumptions which are appropriate for forecasting the impact of and from the proposed development.

13.3 Baseline Environment

Existing baseline

13.3.1 The existing baseline was determined via a review of online material, consultations with key stakeholders and site walkovers survey as detailed in the FCA (Appendix 13.1).

Online material

13.3.2 NRW's DAMs demonstrate flood risk in the area and highlight the consequences of this in line with PPW11 and TAN 15: Development and Flood Risk. The DAM indicates that the entirety of the site is located within Zone 1; land considered to be at little or no significant risk of fluvial or tidal/coastal flooding.

13.3.3 Areas located within Zone C2 and Zone B land, i.e. within areas of the floodplain without significant flood defence infrastructure, are c. 100m beyond the site to the east.

13.3.4 The following extracts from NRWs DAMs demonstrate that the application site is not at flood risk from potential fluvial, marine or reservoir flood sources. Pluvial flooding is, however, shown to be present at the application site, coinciding with topographical low points.

Figure 13.3.2 shows the application site in the context of nearby Flood Zones.

Figure 13.3.3 shows the application site in the context of nearby Fluvial flood risk.

Figure 13.3.4 shows the application site in the context of nearby Marine flood risk.

Figure 13.3.5shows the application site in the context of nearby Pluvial flood risk.

Figure 13.3.6 shows the application site in the context of nearby Reservoir flood risk.

Key stakeholder consultation

13.3.5 Welsh Water provided the following Pre-Development Enquiry (PDE) advice on 19 March 2021 (emphasis added):

- The proposal comprises of a potential windfall development with no allocated status in the Local Development Plan (LDP);
- There is also a mandatory requirement to undertake pre-application consultation with all 'Specialist Consultees', including Dwr Cymru Welsh Water as the statutory water and sewerage undertaker, in accordance with Schedule 4 of Town & Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2016;
- There is no public sewerage system in this immediate locality and therefore any new development will require provision of satisfactory alternative facilities for sewage disposal. Alternatively, ***the site is located approximately 250 metres to the east (the other side of the A470 dual carriageway), of a public sewerage system that drains to Cilfynydd Waste Water Treatment Works, and it may be possible for the Developer to requisition sewers from Dwr Cymru Welsh Water*** under Sections 98 – 101 of the Water Industry Act, 1991;

- Some public sewers and lateral drains may not be recorded on our maps of public sewers because they were originally privately owned and were transferred into public ownership by nature of the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011;

- Under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times;

- Surface Water Drainage – proposed development is subject to Schedule 3 of the Flood and Water Management Act 2010. The development therefore requires approval of Sustainable Drainage Systems (SuDS) features, in accordance with the 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems'. As highlighted in these standards, the developer is required to explore and fully exhaust all surface water drainage options in accordance with a hierarchy which states that discharge to a combined sewer shall only be made as a last resort. ***Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to a surface water drainage body in liaison with the Land Drainage Authority and/or Natural Resources Wales***;

- Please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system;

- Foul Water Drainage – Sewerage Network Whilst there is no immediate sewerage network, we have considered the impact of foul flows generated by the proposed development and concluded that ***flows can be accommodated within the public sewerage system at a point of connection to the 825mm trunk combined sewer at or between manhole SO0542701 and SO05042795 to the east of the site***;

- ***It may be possible to requisition a new sewer under Sections 98 to 101 of the Water Industry Act 1991 from the boundary of the proposed development to the public sewerage system***;

- Foul Water Drainage – Sewage Treatment ***No problems are envisaged with the Wastewater Treatment Works for the treatment of domestic discharges from this site.***

13.3.6 In summary, regarding foul discharges, these can be accommodated in Welsh Water's network via a sewer requisition which is part of a standard process that will be implemented post approval. Regarding surface water discharges these will be to watercourses within the site boundary subject to requisite consents and approvals.

13.3.7 Welsh Water Environmental provided the following response to a general enquiry on 8 September 2021:

- We can confirm that Dŵr Cymru Welsh Water does not hold the information you have requested as we do not have any assets in the area you have requested.

- Watercourses, Culverts and Highway drainage would be the responsibility of the NRW, Local authority, riparian owner, or Highways department. We recommend you contact these who should be able to assist you further with your enquiries.
- Turning to questions 7,8, and 9 of your request, the following Impounding reservoirs are upstream of the proposed development in a northerly direction:
    - Llwynon,
    - Cantref,
    - Beacons,
    - Pontsticill reservoirs
- However, details on the inundation mapping are publicly available information and can be obtained from the Governments website.

13.3.8 In summary, Welsh Water Environmental raised no material concerns regarding the proposed development.

13.3.9 NRW provided several responses to general enquiries throughout 2021, summarised as follows (emphasis added):

- Plant Enquiry – Although Natural Resources Wales is classed as a statutory undertaker, we do not generally have plant equipment or pipelines situated in the public highway;
- If you want to carry out works in, over, under or near a main river or flood defence (including a sea defence), or within a flood plain you will need to apply for Flood Risk Activity Permit;
- ***The watercourses you queried (above attachments) are all ordinary watercourses*** so it's the Local Authority who have powers to carry out works on these watercourses and also consenting responsibility;
- Flood Risk Analysis (FRA), Assets and Reservoir Teams have advised that we have no detailed modelling for the watercourses within your site of interest;
- There are no NRW flood defence measures in place near the proposed site;
- ***NRW holds no historic records of flooding in this area***;
- All nearby main river assets are privately /local authority owned and maintained;
- ***None of the area indicated on your W003(P03) Site Location Plan intersects with reservoir flood outlines that we have***;
- Depth, Velocity, Hazard and travel times are Official-Sensitive data, as is the GIS data that provides the map.

13.3.10 In summary, NRW raised no material concerns regarding the proposed development.

13.3.11 TfW provided the following response to a general enquiry on 20 September 2021:

- Thank you for contacting Transport for Wales (TfW). Upon receipt of your Freedom of Information request, the appropriate TfW SMEs (Subject Matter Experts) were consulted in order to respond. We can now confirm that TfW does not hold the information you require,
- The baseline information questions (Qs 1-11) can be answered by Merthyr Tydfil County Borough Council,
- Regarding the asset information questions (Qs 1-5), we can confirm that we have no assets in the vicinity of the proposed development.

13.3.12 In summary, TfW raised no material concerns regarding the proposed development.

13.3.13 The following summarises outcomes from a formal meeting the SAB on 23 November 2021 (emphasis added):

- ***SAB's private development interest was in making sure that SAB requirements have been incorporated into the proposed development***. A SAB Pre-app is required based on site area. Operation and maintenance of drainage features will remain the responsibility of the site owner unless offered for adoption to the local authority;
- It was agreed that the ***concepts presented in the Drainage Strategy are generally acceptable***. The ***SAB was satisfied for green roofs not to be incorporated***;
- Formalising the drainage channel adjacent to the Scheduled Ancient Monument (SAM) was agreed not to be a SAB matter;
- ***Formal approval for watercourse diversions, including the detail of discharge connections, could be deferred to a formal application after Outline Planning Permission has been granted***;
- Ordinary Watercourse Discharge Applications have been lodged for the two proposed discharge locations which were noted to be at GFR. ***Formal applications for discharge are not required at this stage; these can be deferred and addressed at the same time as watercourse diversions. The SAB was content to send a response accepting proposed discharge rates and locations***;
- GFR are Qbar rates. Rates of 73.98l/s and 46.2l/s stated on the Drainage Strategy issued with the Consent to Discharge are corrected to 60.65l/s and 62.65l/s;
- 2-levels of treatment are required for the car park drainage; these will be permeable paving and swale;
- It was noted that the Cyfarthfa Balance Pond may be considered a reservoir and that this is currently being explored;

- Ponding to the Outdoor Activity and Forest Lodges areas to the south was noted. ***It was generally acceptable that, owing to the nature of development in these areas, mitigation measures are limited to raising proposed development out of potential ponding area, i.e. on stilts / boardwalks, raised accesses with cross-drainage to allow passage of water***;

- The current ***strategy is based on no infiltration, i.e. lined swales, since infiltration rates will not be known until earthworks have been completed. This was generally acceptable***.

13.3.14 In summary, the SAB accepted the principles proposed in the Drainage Strategy and raised no material concerns regarding the proposed development.

13.3.15 As part of the planning application process, a pre-application discussion was undertaken with MTCBC. MTCBC issued a pre-application response by letter dated 4 October 2022. Matters raised by MTCBC, and responses to each are presented in this section (MTCBC matters shown in italics and responses in non-italics):

13.3.16 **Matter:** *The Councils Drainage Engineer has considered the Hydrogeology and Hydrology Assessment and strongly advises that your clients submit a SAB pre-application in order to understand the overall drainage strategy and allow the Council to provide informed, constructive feedback. He has also point out:*

13.3.17 **Response:** During a meeting with Huw Williams on 23 November 2021, he confirmed that a SAB pre-application is required. A draft SAB pre-application had been prepared at the time of the planning pre-application, with its issue pending outcomes of the planning pre-application process. The SAB pre-application has now been lodged along with the key accompanying document; the FCA (see Appendix 13.1).

13.3.18 **Matter:** *The proposal indicates two surface water discharge locations. Formal ordinary watercourse applications would need to be submitted to the Lead Local Flood Authority (LLFA) for approval where discharge rates, flood mitigation measures and risk assessment measures are agreed.*

13.3.19 **Response:** Ordinary watercourse applications were lodged by Tetra Tech. However, during a meeting with Huw Williams on 23 November 2021, he confirmed that no applications are required at this stage and that these could be deferred to a formal application after Outline Planning Permission has been granted.

13.3.20 **Matter:** *A capacity and condition of receiving water bodies in unknown at this stage. A hydrology assessment would be required for downstream waterbodies to ensure the LLFA is satisfied that flood risk doesn't increase as result of additional flows from the development. It is possible that improvement work to these watercourses may be required, pending the results of the hydrology assessment.*

13.3.21 **Response:** During the meeting with Huw Williams, he confirmed that condition and capacity assessments will be required prior to agreement of the ordinary watercourse applications, but that no applications are required at this stage and that these could be deferred to a formal application after Outline Planning Permission has been granted.

13.3.22 **Matter:** *Discharge rates must be limited to "greenfield" rates up to a 1in100+40% storm event.*

13.3.23 **Response:** this chapter and the accompanying FCA confirm that discharges will be restricted to Greenfield Runoff Rates as required. Detailed designs have not been completed at this stage but will be completed to fully design attenuation systems to comply with this restricted runoff rate. Following the meeting with Huw Williams, he confirmed that discharges to the two proposed locations reduced to greenfield rates would be acceptable in principle (subject to Ordinary watercourse applications as mentioned before).

13.3.24 **Matter:** *The proposal indicates that a watercourse within the development area needs to be diverted to facilitate the development. An ordinary watercourse application will be required for this work.*

13.3.25 **Response:** During the meeting with Huw Williams, it was agreed that formal approval for watercourse diversions, including the detail of discharge connections, could be deferred to a formal application after Outline Planning Permission has been granted.

13.3.26 **Matter:** The Drainage Engineer is Huw Williams and his e-mail address is Huw.Williams@merthyr.gov.uk.

13.3.27 **Response:** As mentioned before, consultations have taken place with Huw Williams, as recorded in in this chapter and accompanying FCA.

13.3.28 In summary, all matters raised by MTCBC pertaining to drainage and flooding matters have been addressed in this chapter and accompanying FCA.

Site walkover surveys

13.3.29 Findings of the walkover surveys completed at the site are summarised below with Area numbers depicted on Figure 13.3.7. A fuller description of the hydrogeology of the area, including these features, is also included in Chapter 11: Hydrogeology of the environmental statement.

13.3.30 The various areas discussed are presented in Figure 13.3.7, and summarised as follows:

- Area 1:Cwm Pit and associated stream
- Area 2: Marshy Outdoor Activity Area and associated Cyfarthfa Balance Pond and Tub Boat Canal
- Area 3: Glyndyrus Tip Spring (West)
- Area 4: Glyndyrus Tip Spring (East)
- Area 5: Glyndyrus Tip / A470 Tip Springs
- Area 6: Tunnel

Area 1: Cwm Pit And Associated Stream

13.3.31 Cwm Pit is located to the southwest of the proposed development. At this location, two existing streams combine and spill to flow in an informal drainage channel alongside a retaining / boundary wall which was a feature of the historical mining activities in the area. The wall has been classified as a SAM. The flow terminates alongside the wall where it appears to sink into a pre-existing culvert where it flows to connect to the Nant Cannaid. The informal channel alongside the SAM is causing erosion.

Area 2: Cyfarthfa Balance Pond And Tub Boat Canal

13.3.32 This feature is also to the southwest of the proposed development. The Pond receives water from the surrounding lands to the west and discharges to the Canal which flows south to north alongside lands proposed for an Outdoor Activity area. Flows then spill from the Canal and pond to the southern end of the Outdoor Activity area before exiting the site via and existing culvert.

13.3.33 The Pond is the subject of a separate assessment referenced in the FCA (Appendix 13.1), which describes the implications of failure.

Area 3: Glyndyrus Tip Spring (West)

13.3.34 This feature is in the central part of the application site on lands proposed for a Forrest Lodges area. Surface water in this area gathers from surrounding ground and ponds to the west side of the tip.

Area 4: Glyndyrus Tip Spring (East)

13.3.35 This feature is towards the east of the proposed Forrest Lodges area. Surface water in this area springs from the base of the tip and flows through to Glyndyrus Pond to the east of the application site boundary.

Area 5: Glyndyrus Tip / A470 Tip Springs

13.3.36 This feature is located to the north of the proposed development. It is a linear feature that appears to collect water emerging from the base of the tip and convey this to the south, possibly to Glyndyrus Pond.

Area 6: Tunnel

13.3.37 The tunnel emerges to the south of the application site together with a steady flow of water. It is understood that restoration of this tunnel is being considered.

13.3.38 There are three tributaries to the Nant Cannaid apparent from the NRW DAMs and the site walkover survey. These collect surface water from lands to the north of the application site boundary and transfer flows to the Nant Cannaid via some of the aforementioned features. For ease of reference, these watercourses have been named Nant Cannaid Tributary 1 (northwest), Tributary 2 (north northwest) and Tributary 3 (north tributary).

New baseline – MTCBC Tip Works

13.3.39 During spring 2022, tip drainage works were undertaken by MTCBC. A site visit was completed on Friday 10 June 2022 to survey the works. It is understood that the works were undertaken to enhance pre-existing drainage provisions and improve stability of tips across the site. The works were undertaken without the relevant permissions and permits and are currently on hold, leaving them incomplete. The works present a new baseline for the site. The key findings of the site visit are as follows:

13.3.40 The recent drainage works have been implemented to mitigate against known drainage issues at the site, namely;

- Water discharge from the Nant Meline Canaid Stream which ponds behind the A470/ Glyndyrus Tip,
- Spring emergence of this ponded water at the base of A470/ Glyndyrus Tip,
- Discharge of water from the railway tunnel entrance and areas of flooding.

13.3.41 Although the works completed thus far are likely to have a beneficial impact on the site drainage, the network is incomplete, and its effectiveness is yet to be tested in the absence of any significant rainfall / storm events at the time of the site visit.

13.3.42 Water from the Nant Melin Canaid is still collecting within the 'Hollow' area behind the A470 / Glyndyrys tip. This area continues to act as a natural soakaway, with water flowing through and re-emerging at the base of the tip to the east; although no water was found to be discharging within the newly installed constructed capture drain which could suggest that water from the 'Hollow' is lost to ground / below mine-workings.

13.3.43 Water was not largely found to be flowing within the new drainage network other than from water emerging from the cast iron pipe at the former tunnel entrance.

13.3.44 Based on the findings of the site visit, it is concluded that the new baseline is not materially different from the pre-existing baseline in terms of drainage and flooding matters and provisions. That is, both the pre-existing and new baselines comprise a number of informal (and now more formal) drainage channels and features which collected and transferred water through the site with ponding of surface water at key locations described previously. Since there is no material change, this chapter compares the pre-existing baseline with the future baseline outlined in the following section.

Future baseline

13.3.45 The future baseline is the proposed development described in other chapters of this environmental statement. The proposed development comprises an indoor snow centre, indoor water park, outdoor water park, hotel, outdoor activity area, indoor activity area and a forest lodges area.

13.3.46 The proposed development, 'Rhydycar West', located in Merthyr Tydfil, Wales is situated on a 30.42 ha site, which was historically used for coal mining. It is located to the west of the A470 in Merthyr Tydfil as shown in Figure 13.1.1 at National Grid Reference (NGR) of 303834,

205496. The nearest postcode to the application site is CF48 1UN. The application site is defined as greenfield land (in terms of flood risk and planning policy).

13.3.47 In the context of Water, Drainage and Flooding, the future baseline includes the following:

Potable Water: currently the application site has no potable water demand. The future baseline includes potable water demand to serve the proposed development.

Drainage: currently drainage at the application site is via informal water storage (ponds) and conveyance features (minor watercourse, drainage channels and below ground flow paths) which transfer surface water from high to low elevations. The future baseline includes:

- Modifications to existing water features
- Surface water drainage
- Foul drainage

13.3.48 Flooding: except for pluvial flooding, no flooding is identified on NRWs DAMs; the site is categorised as being in Zone 1, areas at minimal risk of flooding, from a flood risk perspective. Pluvial flooding is that associated with informal water storage and conveyance features. The future baseline will include development areas which must take account of these pre-existing features.

13.4 Mitigation within the Submitted Design

Design

13.4.1 To satisfy legislation, surface water discharges from the proposed development will be restricted to a Greenfield Runoff (GFR[1]) equivalent rate. The proposed development layout has been prepared to facilitate the need for detention basins to attenuate controlled surface water flows. Detention basins are noted in the Drainage Strategy included as an appendix to the FCA report included in Appendix 13.1.

13.4.2 GFR equivalent rates have been determined using MicroDrainage software based on the proposed impermeable areas for the proposed development. Detention basin volumes have been determined using MicroDrainage's quick-storage estimator facility for up to and including a 100-year return period event plus 40% climate change. Climate change allowance is in accordance with Table 2 of 'Welsh Government Flood Consequences Assessments: Climate change allowances' document. Discharge rates, impermeable areas and detention basin volumes are summarised in the following tables.

[1] GFR is taken as Q_{bar} as greed with the SAB

Table 13.3.1: Discharge Rates

Condition	Q_{bar}
Pre-development	287.5
Post-development	123.9

Table 13.3.2: Pre-and Post-Development Areas

Condition	Permeable Area (ha)	Impermeable Area (ha)
Pre-development	30.42	0.00
Post-development	21.19	9.23

Table 13.3.3: Detention Basin Volumes

Basin Ref.	Volume (m^3)
1	2,695
2	928
3	230
4	193
5	3,222
Car Park Sub-base Storage	2,844
Total	**10,112**

13.4.3 Because surface water discharge rates will be restricted to a GFR equivalent rate, the proposed development will add betterment in terms of surface water runoff rates for all events greater than Q_{bar}.

13.4.4 Ordinary Watercourse Discharge Applications have been submitted to MTCBC, SAB seeking consent to discharge the GFR equivalent rate of 123.9 l/s to two existing watercourses within the application site boundary. However, MTCBC has advised that formal applications are not

required at this stage; these can be deferred and addressed at the same time as watercourse diversion consents. On 24 January 2022, the SAB confirmed that discharges to the two proposed locations, reduced to GFR equivalent rates, would be acceptable, subject to completion of ordinary watercourse applications accompanied by downstream condition and capacity assessments.

13.4.5 A SAB pre-application has been submitted to MTCBC to satisfy the requirements of Schedule 3 of the Flood and Water Management Act 2010. A FCA was submitted to inform the PAD process, along with a proposed drainage strategy. The proposed drainage strategy incorporates RWH, along with the swales and detention basins, to discharge surface water run-off at controlled rates to two watercourses within the site boundary. It is assumed infiltration is not possible based on the findings of site walkover surveys, confirming the ground to be waterlogged with extensive overland flow, and due to the risk of soil destabilisation. Furthermore, it has not been possible to conduct bespoke infiltration tests at this stage owing to the need for extensive excavation to establish appropriate test locations. However, once onsite earthworks have been completed appropriate site investigation works will commence to determine if infiltration is possible. The detailed drainage design will be developed based on the results of the site investigation.

Construction

13.4.6 No mitigation measures are included in the design for the construction stage from a Water, Drainage and Flooding perspective since mitigation measures are included in the design stage as detailed previously.

13.5 Likely Significant Environmental Effects of the Scheme

Construction Phase Effects

13.5.1 Water, Drainage and Flooding impacts will be those associated with construction personnel. Whilst the numbers of construction personnel involved in such an extensive development will be large, they will not exceed the numbers of users anticipated for the final proposed development. Accordingly, impacts are a pro-rata of those impacts anticipated during operation of the proposed development.

Water

13.5.2 The impact on water supply will be that associated with increased demand arising from construction personnel. In its PDE response, Welsh Water has confirmed that there are water supply issues in the area. A hydraulic modelling assessment is necessary to determine requirements to serve the proposed development. On completion of the model, a solution will be implemented to supply the proposed development with potable water. Accordingly, there is an impact arising from the construction phase which will be addressed by measures that must be undertaken to facilitate the operational phase,

Foul Drainage

13.5.3 The impact on foul drainage will be that associated with increased flow and load arising from sanitary facilities provided for construction personnel. In its PDE response, Welsh Water has

confirmed that there is ample capacity in its treatment facility to facilitate full, un-attenuated discharge from the proposed development. The construction phase is likely to have a neutral impact from a foul drainage perspective.

Storm Drainage

13.5.4 The storm drainage impact will increase progressively from construction commencement to completion as elements of the proposed development are constructed and connected to the new storm drainage network. Initially, the impact will be that associated with discharges from roof drainage associated with construction site offices, access roads and storage areas.

13.5.5 It has been established that there are no existing storm drainage facilities to serve the proposed development. Therefore, temporary construction stage drainage will take the form of either temporary connections to existing watercourses, subject to necessary consents and approvals, or discharges into permanent parts of the storm drainage network constructed at an early stage in the process, or a combination of the two.

13.5.6 Potential impacts are increased discharge to receiving watercourses with associated flooding impacts as discussed in the following section, and contamination of the environment with inert (e.g. silt and grit) and chemical residues.

Flooding

13.5.7 Flooding impacts are explored in detail for the operational stage of the proposed development in the following section. During the construction stage potential impacts are similar, i.e. the potential for flooding to the proposed construction site, including temporary site offices and compounds and the potential for increased discharges from the construction site to receiving watercourses resulting in increased flood risk downstream of the application site. There will also be effects associated with existing water features which will require diversion and management throughout, and as the construction stage progresses.

13.5.8 Regarding groundwater flood risk, the proposed development involves a significant amount of earth moving to form development platforms and foundations. Accordingly, the proposed development could have a significant impact on groundwater flood risk.

Operational Phase Effects

Water

13.5.9 Via its PDE response, Welsh Water has confirmed that that there are currently water supply problems in the vicinity of the proposed development, and that modelling is required to determine how the proposed development can be served. Infrastructure works will be undertaken to connect the proposed development to existing water supply infrastructure pending modelling works and subsequent Welsh Water consent.

13.5.10 Given there is currently no adequate water supply to serve the proposed development, and that there will be an increase in overall water demand from the proposed development, the impact on the pre-existing environment will be moderate.

Foul Drainage

13.5.11 Welsh Water has confirmed in its PDE response, that both WwTW and public foul sewer infrastructure has capacity to serve the proposed development. Available foul sewer infrastructure is located northeast of the application site. Welsh Water has indicated that the developer could requisition a sewer extension to serve the site. Should a foul sewer be requisitioned, flows from the proposed development would be collected and transferred via a suitably sized network to Welsh Water's requisitioned foul sewer extension.

13.5.12 Although there would be an impact on the receiving WwTW and foul sewer infrastructure owing to, inter-alia, increases in energy consumption to treat additional flow and load, the increases would be insignificant compared with the total size of the catchment of the WwTW. Furthermore, as the WwTW approaches its design Population Equivalent (PE), it will operate more efficiently, thus offsetting a portion of the impact associated with additional flows and loads. Therefore, the impact upon receiving foul sewer and WwTW is considered to be neutral.

13.5.13 Furthermore, it may be assumed that when people are attending the proposed development and increasing local demand on WwTW facilities, they are not placing a demand on WwTW facilities in their normal place of occupation. Accordingly, there may be assumed to be no net increase in overall demand on WwTW facilities because of the proposed development.

Storm Drainage

13.5.14 The nature of stormwater from the proposed development is likely to be that generated by a standard mixed-use development, i.e. stormwater run-off from buildings, roads and car park areas. The impact of the introduction of drainage from road and car parks has the potential to contaminate stormwater with petrol residues and sediment, in addition to increasing run-off rate and volumes. Mitigation of stormwater contamination will be required as an integral part of the proposed development.

13.5.15 Welsh Water has confirmed in its PDE response that there is no public storm sewer available to serve the proposed development. They advised that the applicant should liaise with the determining SAB to determine if discharge would be possible to any local watercourses, or to apply for a new sewer to serve the proposed development.

13.5.16 Proposed development includes the construction of access roads, car parks, a large leisure facility comprising of a snow centre, hotel and waterparks. The increase in impermeable surface area from 0 ha to 9.25 ha will increase the stormwater discharge from the application site to surrounding watercourses. This impact has been addressed by design as discussed in the preceding section resulting in a neutral impact on nearby watercourses.

13.5.17 Surface water run-off may also lead to flooding caused by local water-logging at the application site and its close environs. Potential for flooding is examined in detail in this section.

Flooding

13.5.18 A review of NRW's DAMs has confirmed that the application site is in Zone 1, areas at minimal risk of flooding. However, pluvial flooding is present, and the proposed development could have a significant impact from a pluvial flood risk perspective.

13.5.19 Although it is in flood Zone 1, as described previously, the application site is in the vicinity of three minor watercourses as well as several informal water features that traverse the subject lands. Notwithstanding proposals to limit stormwater runoff to a GFR equivalent rate, the proposed development will sever some of these existing features, having a potential significant impact which could include increasing flood risk to the proposed development and elsewhere.

13.5.20 Regarding groundwater, there will be no permanent unusual incursions into the site's sub-soil to provide basements etc. Accordingly, there will be no flood risk to or from the proposed development in terms of groundwater.

13.6 Additional Mitigation, Compensation and Enhancement Measures

Construction Phase

Water

13.6.1 Measures to be employed during the construction phase are the same as those to be employed during the operational phase as discussed in the following section.

Foul Drainage

13.6.2 Foul discharges during the construction phase will be removed from the site by a licensed waste carrier to a designated Wastewater Treatment Works (WwTW). Given that Welsh Water has confirmed that the receiving WwTW is adequately sized to serve the proposed development, discharge of lesser foul flows during the construction phase to these assets will have a neutral impact.

Storm Drainage

13.6.3 It is stressed that, in consideration of the nature of the works and the measures outlined herein, the potential for pollution from the works included in the proposed development will be no different to that expected from any civil and structural engineering construction project. Such works will be completed in accordance with an appropriate specification, e.g. the National Building Specification for other works, with cross-reference to the Specification For Highway Works and Pollution Prevention Guidance Notes, or PPGs, and particularly PPG 5: Works And Maintenance In Or Near Water.

13.6.4 Close and regular liaison between Statutory Undertakers, the designer and contractor will be employed throughout construction to make sure that potential stormwater drainage impacts have been identified and that all possible design and construction measures and precautions are implemented to safeguard the environment.

13.6.5 The following section outlines the mitigation measures that will be employed during the construction of the works.

- Planning – the contractor will produce a Construction Stage Earthworks/Environmental Management Plant (EMP), Pollution Prevention Plan and Incident Response Plan (in compliance with relevant PPGs) including daily inspection of watercourses at the start and end of each working day. All mitigation measures detailed herein will be subject to periodic inspection and maintenance;
- Drainage – new drainage infrastructure will be bunged at the end of each working day to prevent water ingress and accidental contamination. Final connections will be made post-completion of road construction;
- Drainage – wheel washes will be used by the contractor, and a road brush will be employed, to avoid pollution of existing drainage systems;
- Excavation and Stockpiling – the contractor will use silt-traps, cut off trenches and vegetated corridors to prevent silty water from entering adjacent watercourses;
- Deliveries – the contractor will allocate a dedicated area for material deliveries separated a minimum of 10m from adjacent watercourses, manage the same and ensure that over-ordering and stockpiling is kept to a minimum;
- Deliveries – the contractor will provide a dedicated area for vehicle wash-out, particularly in relation to concrete deliveries. No wash water shall be permitted to enter the ground or adjacent watercourses;
- Oil Storage and Refuelling – the contractor will dedicate specific areas for oil storage and refuelling, separated a minimum of 10m from adjacent watercourses and comply with legislation, including providing bunds sized 10 contain 110% of fuel storage capacity;
- Oil Storage and Refuelling – the contractor will use fill point drip trays, bunded pallets and secondary containment units;
- Oil Storage and Refuelling – the site will be enclosed and secured and fuel storage areas will be secondarily secured;
- Waste Management – the contractor will develop a Site Waste Management Plan (SWMP) in accordance with PPG 6, including the retention of packaging by suppliers and the use of covered skips for any site waste; and
- Incident Response – the contractor will develop a site-specific Incident Response Plan in accordance with PPG6, appoint a responsible person and train operatives in implementation and testing of the Plan periodically throughout construction of the works.

13.6.6 The contractor will be required to prepare and agree a statement of works and associated mitigation measures with appropriate Statutory Undertakers prior to commencement of construction activities.

Flooding

13.6.7 Mitigation measures for addressing flooding impacts are explored in detail for the operational stage of the proposed development in the following section. During the construction stage requisite mitigation measures are similar, although, given the short-term nature of the construction stage, it is possible that the more onerous flow control requirements associated with the completed project may be relaxed subject to appropriate consents and approvals being obtained.

13.6.8 As discussed previously, the immediate impact from construction activities takes the form of increased stormwater runoff rate and volume arising from construction accommodation, site offices and compounds. These will add to the stormwater discharging from the pre-existing application site. This impact will increase as various elements of the proposed development are constructed, creating increased areas of impermeable surfaces and increasing the associated stormwater runoff.

13.6.9 To address the issue of increased stormwater discharges during construction, it will be necessary to convey stormwater discharges from structures that are under construction. This could either be achieved by constructing temporary conveyance features, or by advancing construction of the permanent features to accord with the construction phase. Construction of the permanent features is preferred given that this will avoid nugatory expenditure.

13.6.10 Given that the impact during the construction stage will increase gradually, a phased approach to mitigation will be employed. Measures will be implemented to make sure that discharges from construction accommodation are controlled and attenuated to a rate that will not exacerbate existing flood risk. Flow control and attenuation at this stage of the development may take the form of engineered basins with an appropriately sized outlet or formal flow control device to limit discharges.

13.6.11 As works progress, the flow control mitigation measures associated with final development, i.e. flow control and attenuation, will be constructed at an early stage to facilitate discharges from constructed elements of the proposed development. Discharges will be restricted to the pre-existing GFR rate, yielding a neutral impact on the pre-existing environment for all events up to Q_{bar}, and a positive impact on the pre-existing environment for all events greater than Q_{bar}. Discussions regarding permissible discharge rates and volumes are presented in the previous section.

13.6.12 Regarding the impact associated with existing flood risks arising from watercourses in the vicinity of the construction site, this impact can simply be addressed by making sure that construction accommodation, storage compounds and accesses are positioned beyond the extent of pluvial floodplains determined in the FCA (Appendix 13.1).

13.6.13 Temporary excavations into the subsoil will be made to create development platforms and foundations, with the risk of temporary subsurface flooding. Well established operational processes will be employed to manage groundwater during this temporary condition.

Operational Phase

13.6.14 Mitigation measures associated with the operational phase are detailed below and shown pictorially on the drainage strategy drawings included in the FCA at Appendix 13.1. The drainage strategy drawings are also reproduced in Appendix 13.2 for ease of reference.

Water

13.6.15 Although water demand will increase with increased population served, this increase will be offset to some degree by implementing water usage reduction measures, including RWH and water efficient appliances.

13.6.16 Welsh Water has confirmed that there is no water supply available to serve the proposed development. Following planning approval, an application will be made, and a hydraulic modelling assessment will be commissioned to determine requirements to serve the proposed development. On completion of the model, a solution will be implemented to supply the proposed development with potable water. This is part of a standard process that will be implemented post approval.

Foul Drainage

13.6.17 Welsh Water has confirmed that foul infrastructure (sewers and WwTW) is available to serve the proposed development. Following planning approval, a sewer requisition application will be lodged. On completion of the application process, a sewer will be constructed to the site boundary, to which the sewer constructed to serve the proposed development will be connected. This is part of a standard process that will be implemented post approval. No further mitigation measures are required.

Storm Drainage

13.6.18 Impacts associated with surface water discharge are addressed by deign as discussed previously.

13.6.19 The following additional measures will be employed during the operational phase to mitigate storm drainage impacts:

13.6.20 RWH: four RWH tanks have been proposed to collect rainwater from roofed areas for grey / non-potable water applications. In addition to reducing stormwater flows emanating from the proposed development, this will also reduce water demand to part-mitigate the water impact.

13.6.21 Swales: swales have been designed as the primary means of conveying stormwater from source to discharge location. Infiltration has not been included in the swale design at this stage because it has not been possible to determine infiltration rates and owing to the risk of destabilising spoil heaps around the application site. Accordingly, swales are lined to prevent water egress. The inclusion of swales mimics existing drainage features as closely as possible and directs flood waters back into downstream pre-existing receptors. Swales also enhance ecology, present biodiversity benefits and provide contamination treatment along with downstream detention basins.

13.6.22 Porous asphalt: porous asphalt, including subgrade storage has been proposed to manage stormwater at source. This will measure will contribute to limiting discharges from the proposed development to a GRF equivalent rate.

13.6.23 Pipelines: as a last resort, short lengths of pipeline are proposed to convey stormwater beneath roads and over deep cuttings.

13.6.24 During the operational phase of the proposed development, petrochemical residue and sediment from car parks and roads may be washed into the storm drainage system. This has the potential to adversely affect receiving watercourses. Where present, swales and detention ponds will address this potential impact. Elsewhere, the following mitigation measures will be employed to make sure there is no negative impact from the proposed development:

- Use of bunded fuel storage areas and compliance with the PPG to safeguard against potential impact on water quality;
- Provision of trapped gullies and silt trap manholes to capture sediment runoff; and
- Implementation of agreements for regular maintenance of pollution control measures

Flood Risk

13.6.25 Fluvial Flooding: there is no fluvial flood risk identified on the NRW DAMs; accordingly, no mitigation measures are required. However, there are existing water features at the application site with the potential cause flooding. Mitigation measures for these features are detailed below using the Areas notation from the section 13.3:

Area 1: Cwm Pit And Associated Stream

13.6.26 It is proposed to formalise the existing ad-hoc drainage channel to offset it from the historical wall / SAM and use excavated material to replace the eroded material. This will help to restored pre-existing erosion and prolong the life of the SAM as an indirect benefit from the proposed development.

Area 2: Cyfarthfa Balance Pond And Tub Boat Canal

13.6.27 It is proposed to add a lined impermeable swale to this area, which will flow along the eastern boundary of the Outdoor Activity area to provide an escape vector for ponding water. This will be directed back to the pre-existing receptor along the application site's southern boundary. The flow path from any flood waters will closely match that of the existing outlet from the Cyfarthfa Balance Pond. No other measures are proposed; ponding will be allowed to persist since the proposals for this part of the application site, i.e. retention of pre-existing conditions and possible addition of high-ropes and associated elevated boardwalks, allowing flood waters to flow through the area unhindered.

13.6.28 The Pond is the subject of a separate assessment referenced in the FCA (Appendix 13.1), which describes the implications of failure. The anticipated destination of flood water is as per the current operation of the Pond, whereby, the proposed development in this area will not be materially affected.

Area 3: Glyndyrus Tip Spring (West)

13.6.29 No intervention is planned for this area; existing flow paths will be retained, and Forrest Lodge accommodation will be positioned to suit and elevated on stilts to allow water to pass beneath.

Area 4: Glyndyrus Tip Spring (East)

13.6.30 No intervention is planned for this area; existing flow paths will be retained. Forest Lodges accommodation will be built on stilts to allow flood waters to flow under the structures. This will make sure that there is no negative impact on pre-existing flood conditions. The area will be served by permeably surfaced roads with regular pipe crossings beneath to allow pluvial waters to pass unhindered.

13.6.31 To the north of this area extensive earthworks is proposed to facilitate other features of the proposed development. An earth bank is proposed on adjacent lands to the north, which will be drained using land drainage. To address the risk that earthworks and development to the north could reduce flow to the Glyndyrus Pond, a valve is included in the swale to the north of the earth bank so that, if necessary, flows can be diverted to the Glyndyrus Pond from the swale and the land drainage.

Area 5: Glyndyrus Tip / A470 Tip Springs

13.6.32 Since this feature is in the location of extensive earthworks and construction activities of the proposed development, it will be replaced by the swales and detention basins proposed. No other mitigation measures are required.

Area 6: Tunnel

13.6.33 Since this feature is outside the application site boundary and does not have an impact upon it, no mitigation measures are proposed.

Nant Cannaid Tributary 1, 2 and 3

13.6.34 Failure to accommodate these watercourses in the proposed development design could lead to increased fluvial flood risk to the proposed development and lands elsewhere. Accordingly, it is proposed to collect and reroute each watercourse around proposed development features to discharge back into the pre-existing receptor. Routing will primarily be in open channels with two short piped sections to transfer the watercourses beneath proposed development access roads.

13.6.35 Pluvial Flooding: pre-existing pluvial flooding of the application site emanates from the various water features detailed previously. To mitigate pluvial flood risk, proposed development will be constrained to locations beyond the pluvial floodplain extents wherever possible. Where this approach is not possible, development levels and gradients will be set to optimise the collection and transfer of stormwater runoff to the receiving watercourses, subject to MTCCB formal approval. Any such discharges will be restricted to GFR equivalent rates.

13.6.36 There is also the risk of pluvial flooding from overland surface water from lands to the north. Overland flows are intercepted and transferred via Nant Cannaid Tributary 1. However, there remains a small catchment between the application site boundary and Tributary 1 which could

direct surface water toward the application site. The proposed development will feature a boundary cut-off swale to intercept offsite flows and discharge these back to the pre-existing receptor.

13.6.37 There are no other flood risk sources to the proposed development whereby no further mitigation measures are proposed.

13.7 Assessment Summary and Likely Significant Residual Environmental Effects

Construction Phase

Water

13.7.1 Water supply will be brought to the site subject to Welsh Water hydraulic modelling and a water supply requisition. Additional water treatment and distribution facilities may be required at Welsh Water's Water Treatment Works (WTW) and additional pipelines will be required to transport the water to the proposed development. Since works within the application site boundary will be completed as part of the construction phase there is likely to be a neutral in the context of the overall earth moving operation.

Foul Drainage

13.7.2 Since foul water is likely to be removed from site by a licensed waste carrier to a designated WwTW with sufficient capacity, foul drainage will have a neutral impact.

Storm Drainage

13.7.3 Stormwater discharges from the proposed development can be adequately managed throughout the construction phase by employing the best practice measures outlined previously. Accordingly, stormwater drainage will have a neutral impact.

Flooding

13.7.4 Flooding impacts from the proposed development can be adequately managed throughout the construction phase by employing the best practice measures outlined previously. Accordingly, flooding will have a neutral impact.

Operational Phase

Water

13.7.5 Residual water supply impacts for the operational phase are the same as for the construction phase.

Foul Drainage

13.7.6 Foul drainage provisions will be brought to the site subject to Welsh Water foul sewer requisition. Additional sewer provisions will be required between the application site and the discharge location, and pipelines will be required to transport the foul water from the proposed development. Since works within the application site boundary will be completed as part of

the construction phase, there is likely to be a neutral in the context of the overall earth moving operation. Furthermore, as the receiving WwTW will operate closer to its designed PE capacity it will operate more efficiently, whereby, there could be a slight positive impact.

Storm Drainage

13.7.7 Stormwater discharges from the proposed development can be adequately managed throughout the operational phase from a flow and contamination perspective. Betterment is expected for events exceeding Q_{bar} because surface water discharges will be restricted to GFR equivalent rates. Ecological and biodiversity benefits can also be derived from the use of SuDS in the form of swales and detention basins. Accordingly, stormwater drainage could have a positive impact.

Flood Risk

13.7.8 Since there is no non-pluvial flood risk to the proposed development, there is no residual impact from non-pluvial sources.

13.7.9 Water features on site, namely Nant Cannaid tributaries and minor sheughs/drainage ditches will either be retained, removed, or culverted to facilitate the proposed development as part of the overall drainage strategy. Accordingly, there is no flood risk to the proposed development, hence no residual impact.

13.7.10 Pluvial flood risk arising from overland flows have been addressed by locating proposed development beyond the pluvial floodplain extents wherever possible, designing development levels and gradients to optimise the collection/transfer of stormwater runoff, obtaining MTCBC approval for development proposals and restricting discharges to a GFR equivalent rate. In consideration of these measures, there will be a neutral/positive residual impact arising from the proposed development.

13.7.11 Regarding flood risk arising from the proposed development, this has been addressed under the Storm Drainage section via implementing flow control and attenuation measures to match pre-development stormwater runoff rates and volumes.

13.7.12 In summary, it is almost inevitable that the proposed development will have some adverse environmental impact on the application site and its environs, in terms of Water, Drainage and Flood risk, as detailed in this chapter. However, by employing careful design techniques, in combination with construction site good practice, the overall impact resulting from the proposed development will be reduced to acceptable levels and become positive in some areas.

13.8 Cumulative impacts

Design

13.8.1 The outline drainage strategy for the proposed development makes sure that from a Water, Drainage and Flooding perspective all impacts within the application site boundary are mitigated to the extent that there will be no cumulative impact in the context of other developments.

13.8.2 Cumulative offsite impacts associated with implementing a water supply and foul discharge route and suitable discharge location are a possibility.

13.8.3 At this stage a water supply solution has not been determined through modelling and a water supply requisition has not been lodged. This is part of a standard process that will be implemented post approval. It is possible that a more onerous solution may be required should other developments be brought forward in the area. However, these impacts will be addressed by Welsh Water as part of their business as usual.

13.8.4 At this stage a foul sewer connection is not guaranteed, although a suitable connection point has been determined that can serve the proposed development. Neither has a foul sewer requisition been lodged to start the process of acquiring a sewer into which the proposed development can discharge. This is part of a standard process that will be implemented post approval. Again, it is possible that a more onerous solution may be required should other developments be brought forward in the area. However, these impacts will be addressed by Welsh Water as part of their business as usual.

Construction

13.8.5 There expected to be no cumulative impacts in the context of Water, Drainage and Flooding during the construction phase, other than those outlined previously regarding the design phase.

Operation

13.8.6 There expected to be no cumulative impacts in the context of Water, Drainage and Flooding during the operation phase, other than those outlined previously regarding the design phase.

13.9 Summary

Water

13.9.1 From a water perspective, the proposed development will have a minimal impact. Water supply will be secured from Welsh Water by means of a hydraulic model and water supply requisition process which is part of a standard process that will be implemented post approval.

Foul Drainage

13.9.2 From a foul drainage perspective, the proposed development will have a minimal impact. A foul water discharge location has been identified and a sewer between the proposed development and discharge location will be secured from Welsh Water by means of a sewer requisition process which is part of a standard process that will be implemented post approval.

Storm Drainage

13.9.3 From a storm drainage perspective the drainage strategy for the proposed development has been developed in accordance with the mandatory SuDS standards to align with TAN15 Figure 1 and using a hierarchical approach of:

- Re-use of water (RWH);
- Conveyance/mitigation/attenuation at the surface (swales and detention basins);
- Piped or tanked drainage solutions as a last resort.

13.9.4 Therefore, the proposed development will have a minimal impact.

Flood Risk

13.9.5 From a flood risk perspective, the proposed development is in Zone 1, minimal risk of flooding, in accordance with the preference indicated in TAN15. Furthermore, existing water features have been considered and accommodated in the proposed development. Therefore, the proposed development will have a minimal impact.

Table 13.9.1: Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Water – increased demand	To be determined via hydraulic modelling and water supply requisition	To be determined via hydraulic modelling and water supply requisition	To be determined via hydraulic modelling and water supply requisition	• Commission Welsh Water hydraulic modelling assessment; • Lodge Welsh Water water supply requisition	Negligible (expected) – water supply is Welsh Water business as usual	Negligible (expected) – water supply is Welsh Water business as usual	Medium
Foul Drainage – increased flow and load	Negligible	Negligible	Negligible	• Removal by licensed waste carrier to adequate WwTW	Negligible	Negligible	High
Storm Drainage – risk of contamination	Negligible	Minor Adverse	Minor Adverse	• Comply with NBS, cross-reference to SHW and PPGs; • Close and regular liaison between Statutory Undertakers; • Produce a CEMP, PPP, IRP and SWMP; • Daily inspection of watercourses; • Bung new drains at the end of each working day; • Use wheel washes and road brush; • Use silt-traps, cut off trenches and vegetated corridors; • Separate material deliveries minimum of 10m from adjacent watercourses, avoid over-ordering and stockpiling; • Use dedicated area for vehicle wash-out; • Use specific areas for oil storage and refuelling, separated a minimum of 10m from adjacent watercourses, provide bunds sized 10 contain 110% of fuel storage capacity; • Use fill point drip trays, bunded pallets and secondary containment units; • Enclose and secure site and fuel storage areas; • Appoint a responsible person and train operatives in implementation and testing of plans periodically throughout construction of the works	Negligible	Negligible	High
Flooding – increased flows	High	Minor Adverse	Minor Adverse	• Phased temporary or permanent conveyance measures including flow control and attenuation to a GFR equivalent rate	Negligible	Positive	High
Flooding – flood risk to construction	Negligible	Minor Adverse	Minor Adverse	• Position construction accommodation, storage compounds and accesses beyond the extent of pluvial floodplains;	Negligible	Negligible	High

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
				• Well established operational processes to manage groundwater, e.g. sumps and pumps			
Operation							
Water – increased demand	To be determined via hydraulic modelling and water supply requisition	To be determined via hydraulic modelling and water supply requisition	To be determined via hydraulic modelling and water supply requisition	• Provide RWH to offset demand; • Commission Welsh Water hydraulic modelling assessment; • Lodge Welsh Water water supply requisition; • Provide water supply to proposed development.	Negligible (expected) – water supply is Welsh Water business as usual	Negligible (expected) – water supply is Welsh Water business as usual	Medium
Foul Drainage – increased flow and load	Negligible	Negligible	Negligible	• Lodge Welsh Water sewer requisition; • Provide sewer from proposed development to Welsh Water sewer at site boundary.	Negligible (expected) – wastewater disposal is Welsh Water business as usual	Negligible (expected) – wastewater disposal is Welsh Water business as usual	High
Storm Drainage – risk of contamination	Negligible	Minor Adverse	Minor Adverse	• Provide swales to convey stormwater and provide treatment and enhance ecology and biodiversity; • Provide porous asphalt to control and store flows and provide treatment; • Use bunded fuel storage areas; • Provide trapped gullies and silt trap manholes; • Implement agreements for regular maintenance of pollution control measures	Negligible / Positive (SuDS)	Negligible / Positive (SuDS)	High
Flooding – increased flows	High	Significant Adverse	Significant Adverse	• Provide detention basins and flow control to limit flows and store stormwater, provide treatment and enhance ecology and biodiversity; • Provide porous asphalt to control and store flows and provide treatment; • Apply for consents to discharge and SAB approval	Negligible / Positive (SuDS)	Negligible / Positive (SuDS)	High
Flooding – flood risk to proposed development…							
Area 1: Cwm Pit And Associated Stream	High	N/A	N/A	• Formalise existing ad-hoc drainage channel to offset it from SAM and use excavated material to replace the eroded material	Positive	Positive	High

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Area 2: Cyfarthfa Balance Pond And Tub Boat Canal	High	N/A	N/A	• Provide lined impermeable swale directed back to the pre-existing receptor along the application site's southern boundary to provide an escape vector for ponding water.	Positive	Positive	High
Area 3: Glyndyrus Tip Spring (West)	Negligible	Minor Adverse	Minor Adverse	• Retain existing flow paths; • Provide Forrest Lodge accommodation on stilts to allow water to pass beneath; • Provide permeable access roads with regular cross-drains.	Negligible	Negligible	High
Area 4: Glyndyrus Tip Spring (East)	Negligible	Minor Adverse	Minor Adverse	• Retain existing flow paths; • Provide Forrest Lodge accommodation on stilts to allow water to pass beneath; • Provide permeable access roads with regular cross-drains. • Provide valve in the swale to the north to divert flows to the Glyndyrus Pond if required to prevent drying.	Negligible	Negligible	High
Area 5: Glyndyrus Tip / A470 Tip Springs	Negligible	Minor Adverse	Minor Adverse	• Replace with swales and detention basins.	Positive	Positive	High
Area 6: Tunnel	Negligible	N/A	N/A	• None	N/A	N/A	N/A
Nant Cannaid Tributary 1, 2 and 3	High	Minor Adverse	Minor Adverse	• Collect and reroute each watercourse around proposed development features to discharge back into the pre-existing receptor	Negligible	Negligible	High
Pluvial Flood Risk	High	Minor Adverse	Minor Adverse	• Constrain proposed development location beyond pluvial floodplain extents wherever possible; • Select development levels and gradients to optimise collection and transfer of stormwater.	Negligible	Negligible	High
Pluvial flooding from overland surface water from lands to the north	Negligible	Minor Adverse	Minor Adverse	• Provide boundary cut-off swale to intercept offsite flows and discharge back to the pre-existing receptor.	Negligible	Negligible	High

Table 13.9.2: Means by which Additional Mitigation Measure may be Secured

Identified Effect where additional mitigation (Not design mitigation) has been identified	Type of mitigation measures (avoidance, reduction, compensation, enhancement)	Means by which mitigation measure may be secured
Construction		
Water Supply	Enhancement	Welsh Water hydraulic model requisition or planning condition
Water Supply	Enhancement	Welsh Water water supply requisition or Planning Condition
Surface Water Discharge	Avoidance	MTCBC Consent to Discharge or Planning Condition
Surface Water Discharge	Avoidance	Infiltration testing at detailed design stage
Operation		
Water Supply	Enhancement	Welsh Water hydraulic model requisition or planning condition
Water Supply	Enhancement	Welsh Water water supply requisition or Planning Condition
Wastewater Disposal	Enhancement	Welsh Water sewer requisition or Planning Condition
Surface Water Discharge	Avoidance	MTCBC Consent to Discharge or Planning Condition
Surface Water Discharge	Avoidance / Compensation / Enhancement	SAB Application

13.10 Conclusion

13.10.1 In conclusion, apart from pluvial flood risk, there is no risk of flooding to or from the proposed development from any of the flood sources explored within this chapter and the FCA. Any potential pluvial flood risk to or from the proposed development will be mitigated using the measures detailed in the accompanying FCA; watercourses will be rerouted subject to appropriate consents and approvals, and a SuDS compliant drainage scheme will be implemented. Furthermore, the proposed development will add betterment in terms of surface water runoff rates for all events greater than Q_{bar}. Accordingly, no objections should be sustained on grounds of flood risk or drainage matters and there is an overall negligible flood risk to the site.

13.11 Glossary

13.11.1 The following table provides a summary of terms used throughout this chapter.

Term	Definition
CEMP	Construction Environmental Management Plan
DAM	Development Advice Map
FCA	Flood Consequences Assessment
FRMP	Flood Risk Management Plan
IRP	Incident Response Plan
LDP	Local Development Plan
MTCBC	Merthyr Tydfil County Borough Council
NBS	National Building Specification
NGR	National Grid Reference
NRW	Natural Resources Wales
PDE	Pre-Development Enquiry
PPG	Pollution Prevention Guidance
PPP	Pollution Prevention Plan

Term	Definition
PPW	Planning Policy Wales
RWH	Rainwater Harvesting
SAM	Scheduled Ancient Monument
SHW	Specification for Highway Works
SuDS	Sustainable Urban Drainage Systems
SWMP	Site Waste Management Plan
TAN	Technical Advice Note
TfW	Transport for Wales
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works

14.0 Noise

14.1 Introduction & Executive Summary

14.1.1 This chapter has been prepared by Tetra Tech. It considers the impact of the development on the noise at and within the vicinity of the proposed mixed-use leisure development at Rhydycar West, Merthyr Tydfill.

14.1.2 The chapter sets out the methodology followed in undertaking the assessment and provides a review of the noise climate of the development site and surrounding area. Within this Chapter an assessment of noise from the construction phase and operational phase from building services plant, outdoor leisure activities and road traffic noise has been undertaken.

14.1.3 A separate technical report is presented in Appendix 14.1 which considers sleep disturbance and amenity with regard to future proposed guests from surrounding noise sources such as off-site road traffic noise.

14.1.4 The extent of the study area for the site is comparable to that assessed within the Transport and Access Chapter (Chapter 9). With regard to the impact of existing noise sources on receptors, the assessment is based on the overall study area although, in reality, only localised noise sources are expected to have an influence on the assessment presented in the technical report (Appendix 14.1).

14.1.5 Where relevant, mitigation measures are proposed to minimise the impacts of the proposed development during both the construction and operational phases of the scheme. The expected residual effects of the proposals are then stated.

14.1.6 The results of the noise assessments presented within this chapter identify that any effects in relation to noise associated with the construction and operation of the proposed leisure facility are expected to be negligible. There are a number of best-practice mitigation measures that will be included within the construction-phase CEMP that will further reduce the potential for adverse impacts in relation to construction noise and operational noise sources such as building services plant will be subject to detailed design considerations that are outlined within the accompanying technical report.

14.2 Methodology and Scope

Policy Background

14.2.1 Future Wales: The National Plan 2040 and Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. They are supplemented by a series of Technical Advice Notes (TANs) which together with PPW provide the national planning policy framework for Wales. The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation. Technical guidance with respect to noise is found in Technical Advice Note (Wales) 11 Noise – October 1997 (TAN).

14.2.2 The TAN provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.

Local Policy

14.2.3 Policy EnW4 of the Merthyr Tydfil County Borough Council Replacement Local Development Plan (2016-2031) relates to noise, in particular:

14.2.4 *"Environmental Protection Development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and / or the natural environment from either:*

- *Pollution of land, surface water, ground water and the air;*
- *Land contamination;*
- *Hazardous substances;*
- *Land stability;*
- *Noise, vibration, dust, odour nuisance and light pollution; or*
- *Any other identified risk to public health and safety. Where impacts are identified the Council will require applicants to demonstrate that appropriate measures have been incorporated to reduce, or minimise the impact identified to the lowest possible acceptable level."*

Scoping Assessment Stage

14.2.5 An EIA scoping report was submitted to Merthyr Tydfil County Borough Council (MTCBC) which identified the extent of the baseline noise monitoring undertaken to inform the noise assessment. The scoping document identified that assessments of construction noise would be undertaken in accordance with the requirements of BS 5228, road traffic noise would be assessed against the criteria presented within the Design Manual for Roads and Bridges LA 111 (DMRB) and sources such as building services plant assessed against the criteria presented within BS 4142 Due to the significant distance between the development site and existing sensitive receptors, the consideration of noise intrusion within the proposed hotel and lodges and effects of vibration were scoped out of this chapter.

14.2.6 The following response was received from MTCBC in relation to the scoping document, dated 4th May 2021:

14.2.7 *"The EIA scoping report appears to cover all the areas Environmental Health would consider a potential problem for the proposed site. Specifically the Geoenvironmental Assessment, Air Quality Assessment, Noise Impact Assessment and Lighting Report. I shall wait on this information for further comments."*

14.2.8 The technical report presented in Appendix 14.1 was submitted to MTCBC in July 2022 as part of pre-application engagement with the Local Planning Authority (LPA). The LPA's response raised no issues in respect of noise matters.

Assessment Methodology

14.2.9 The EIA Regulations require the description of the forecasting methods used to assess the effect on the environment. Therefore, the EIA has been based on a widely used and accepted 'significance matrix assessment approach' which is based on the characteristics of the impact (magnitude and nature) and the sensitivity of the receptor. This allows the relative significance of effects to be determined on a scale and ultimately the significant effects determined, as explained in the following sub sections. Where a deviation from the approach has been undertaken, reference has been made in the appropriate sections.

14.2.10 The noise level criteria detailed below have been derived from standards and design guidance:

- IEMA (Institute for Environmental Management and Assessment) 'Guidelines for Environmental Noise Impact Assessment October 2014'i; and,
- Tables 3.54a and 3.54b of LA 111 published in May 2020 (Design Manual for Roads and Bridges)
- BS 5228: 2009 +A1:2014 'Code of Practice for noise and vibration control on construction and open sites – Part 1 Noise'
- BS 4142:2014+A1:2019 'Methods for and assessing industrial and commercial sound'
- BS 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

14.2.11 This report considers a worst-case scenario with respect to construction (simultaneously across the site), operational (predicted worst-case noise levels) and road traffic noise (predicted 'Do Something' 2031 scenario) from the site.

Receptor Sensitivity

14.2.12 Key receptors to noise generally include individual or groups of residential properties, hospitals and schools. Table 14.1 provides examples of the difference sensitivities which can be assigned to different receptors according to the assessment methodology:

Table 14.1 Methodology for Assessing Sensitivity of Noise

Sensitivity	Example of Receptor
High	Residential properties (Permanent tenants) and schools and hospitals
Medium	Transient residential receptors such as users of hotels
Low	Commercial premises

14.2.13 Within the assessment of the likely significant effects of the Proposed Scheme, most identified receptors have been considered as having high sensitivity based upon the professional judgement of the assessors as they represent permanent residential receptors. The exception is two receptors as they represent transient residential receptors in the form of hotel and holiday home occupiers (medium sensitivity).

14.2.14 Guidance with regard to assessing the magnitude of noise effect is available within the Guidelines for Environmental Noise Impact Assessment, published by IEMA in 2014. The guidance indicates broad parameters with respect to categorising the significance of the basic noise change. For the purpose of this ES, the categories outlined in Table 14.2 below form a broad basis to present the impact magnitude.

14.2.15 For the purposes of this EIA, an Operational effect identified as being defined as Moderate or greater and/or a Construction effect identified as being defined as Major/Moderate is considered to be significant in EIA terms. The assessment follows this approach.

Table 14.2: Significance Matrix

Magnitude of Impact	Sensitivity of Receptor			
	High	Medium	Low	Very Low
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible

Construction Assessment

14.2.16 The effects of construction noise associated with the project have been assessed in accordance with BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites'.

14.2.17 This has been chosen as a suitable assessment method for noise and vibration control, relating to construction and open sites, where work activities/operations generate significant noise levels. The standard also provides guidance concerning methods of predicting and measuring noise and assessing its impact on those exposed to it.

14.2.18 Based upon the guidance within BS 5228, levels of noise associated with the construction of the development have been predicted at local residential receptors using CADNA (Computer-Aided Design for Noise Abatement) model. Noise emissions from equipment used during the construction phase, have been obtained from the BS522 Annex C of BS 5228-1 and included within the assessment.

14.2.19 On construction sites, noise limits from construction works are generally set with reference to the need to avoid speech interference, disturbance of work or leisure activities, disturbance of sleep, annoyance and possible effects on mental and physical health. BS 5228-1:2008 gives advice on maximum levels of construction site noise throughout all periods of the day. However, it is understood that construction on this site will typically be limited to the daytime period (07:00 – 19:00 hours) only.

14.2.20 BS 5228-1 (Ref.E.3.2) contains several example methodologies for identifying significant construction noise effects based on fixed thresholds or noise level changes. For the purposes of this assessment the 'ABC' method has been adopted. This approach is based on setting the threshold for the onset of potentially significant adverse effects. Receptors with low existing ambient noise levels (Category A) have a lower threshold than those with high existing ambient noise levels (Category C). Higher thresholds are set for normal daytime construction working hours, compared to the more sensitive evening/weekend and night-time periods.

14.2.21 As a conservative approach, the threshold for the onset of adverse effect is set at a construction noise level based on the existing ambient. Construction noise levels above the threshold levels have the potential to result in adverse effects but would not normally be classed as significant adverse effects. However, best-practice noise mitigation measures are still considered in such locations to seek to keep all effects to a minimum. Table 14.1, which is taken from Table E.1 in BS 5228, sets out the construction noise threshold values to derive the magnitude of impact at sensitive receptors.

Table 14.3 Construction Noise Threshold values for all Receptors

Time of Day	Threshold Value $L_{Aeq,T}$ dB (façade)		
	A[1]	B[2]	C[3]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings (19:00 – 23:00 weekdays) and Weekends (13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays)	55	60	65
Night-time (23:00 – 07:00)	45	50	55

[1] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values

[2] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as the category A values

[3] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than the category A values

14.2.22 Once the ABC method has been used to define the appropriate criteria, a Magnitude of Impact scale is recommended based around the proposed criteria.

Table 14.4 Magnitude of Impact – Construction Noise

Magnitude of Impact	Construction Noise Criteria
Very Low	≤10dB below ABC Noise Threshold Value
Low	0 - 10 dB below ABC Threshold Value
Medium	0 - 10 dB above ABC Threshold Value
High	Greater than 10 dB above ABC Threshold Value

14.2.23 For High sensitivity receptors (i.e. residential properties), it is recommended that construction noise is no greater than equal to the recommended ABC criterion. Construction noise no greater than equal to the criterion derived using the ABC method would equate to either a Negligible or Minor Adverse Effect and would not be considered significant.

Operational Phase: Assessment of Change in Noise Levels

14.2.24 Guidance with regard to assessing the magnitude of noise impact is available within the Guidelines for Noise Impact Assessment issued by the Institute of Environmental Management and Assessment (IEMA) October 2014. The guidance indicates broad parameters with respect to categorising the significance of the basic noise change. For the purpose of this ES, the categories outlined in Table 14.5 below form a broad basis to present the impact magnitude. However, the guidance does not specify what a negligible impact is. However, as a change in noise level of less than 1 dB(A) is imperceptible, changes in noise levels of between 0.1 – 0.9 will refer to a very low impact.

14.2.25 **Table 14.5 Method for Assessing the Magnitude of the Impact**

Change in ambient noise level (dB(A))	Impact Magnitude
0.0	No Change
0.1 – 0.9	Very Low
1.0 – 2.9	Low
3.0 – 4.9	Medium
5.0	High

14.2.26 The IEMA/IOA guidance stipulates that the noise level categories should not be used strictly to define the description of the noise change as there is no simple formulaic approach for relating noise change to a verbal description such as ‘slight’ or ‘moderate’. Therefore, the magnitude of

noise impact should be stated as the predicted dB(A) level and not simply as an impact category.

Road Traffic Noise Assessment

14.2.27 With regard to road traffic noise, Tables 3.54a and 3.54b of DMRB LA 111 present examples classification of the magnitude of noise impacts in the short and long-term suitable for the assessment of changes in traffic noise levels; Table 3.54b of LA 111 has the same numerical thresholds to define the magnitude of change as those presented in Table 14.6. Therefore, the magnitude of road traffic noise impacts in the long-term is based on the method presented in Table 14.6; to ensure consistency of terminology, the DMRB descriptors have been translated into Tetra Tech terminology.

Table 14.6 Classification of Magnitude of Road Traffic Noise Impacts in the Long-term

Long-term Change in noise level (dB(A))	Impact Magnitude
0.0	No Change
0.1 – 2.9	Very Low
3.0 – 4.9	Low
5.0 – 9.9	Medium
10.0+	High

Building Services Plant Noise Assessment

14.2.28 With regard to building services plant, details of the finalised layout and specification of building service plant associated with the proposed leisure facilities and hotel are yet to be determined, however an assessment of potential noise breakout from building services plant has been undertaken to identify noise emission limits that would represent a 'Very Low' impact magnitude.

14.2.29 A comparison of operational noise from the proposed development with existing background noise levels has been undertaken with reference given to the guidance provided within BS 4142:2014+A1:2019, 'Methods for rating and assessing industrial and commercial sound'. This standard sets out criteria based upon the difference between the measured background noise level and the rating level of the source under consideration, refer to Table 14.7 below.

Table 14.7 Method for Assessing the Magnitude of Impact (Operation)

Noise Level Criteria	Impact Magnitude
BS 4142 score of zero or lower	Very Low
BS 4142 score of 5 or lower	Low
BS 4142 score of greater than 5	Medium
BS 4142 score of 10 or higher	High

Limitations of the Assessment

14.2.30 Construction noise levels are based on typical fixed and mobile plant noise levels presented within BS5228-1:2009+A1:2014. The assessment is considered worst-case with construction operations located at the shortest distance to the noise sensitive receptor and all assessed plant operating simultaneously.

14.2.31 The results of the traffic noise assessment in this ES chapter are based on traffic flows provided by transport consultants. As such any limitations found in these numbers would affect the conclusions found in the traffic noise assessment.

14.2.32 As specific details of building services plant are yet to confirmed, an assessment has been undertaken which presents the maximum permissible limits to achieve a 'very low impact', in terms of the criteria outlined within this ES and guidance presented within BS4142:2014 + A1:2019, at the closest sensitive receptor locations. The permissible limits for the building services plant are controllable via a suitably worded planning condition.

14.3 Baseline Environment

Existing baseline

14.3.1 A baseline monitoring survey was undertaken at twenty-one locations (as specified in the following table and shown in Figure 14.1) from Thursday 23rd March 2017 to Wednesday 29th March 2017. Attended short term measurements were undertaken at ten locations during the day, evening and night-time periods with an additional location attended during only the evening and night-time periods. Three attended traffic source measurements were undertaken for 15 mins per hour in three consecutive hours, with an additional location monitored unattended for three hours. Six additional locations were measured, unattended, over a 144-hour period.

14.3.2 Measurements were taken in general accordance with BS 7445-1:2003 The Description and Measurement of Environmental Noise: Guide to quantities and procedures.

Table 14.8 Noise Monitoring Locations

Ref	Description
LT1	South eastern corner of the site, adjacent to A470
LT2	To West of development site, 970m west of A470
LT3	Eastern boundary of the site, adjacent to A470/A4102 roundabout
LT4	To north of development site, approx. 470m west of A470
LT5	To north of development site, approx. 470m south oh Heolgerrig
LT6	Adjacent to A470/Upper Colliers' Row
ST1	At southern end of Upper Colliers' Row
ST2	North of the site at southern end of Parc Cwm Pant Bach
ST3	North-west of the site at Germant Lane at junction with off road track
ST4	North of the site at junction between branches of Penlan View
ST5	North of the site, approx. 380m west of A470
ST5a	Approx. 200mm north of ST5
ST6	North-East of the site, approx. 180m north of A470/A4102 junction
ST7	Northern boundary of the site, approx. 470m west of A470/A4102 junction
ST8	West of the site, approx. 400m of A470
ST9	Southern boundary of the site, approx. 950m west of A470
ST10	End of Lewis Square adjacent to A470
T1	Germant Lane approx. 140m south of Hoelgerrig
T2	Hoelgerrig adjacent to Calfaria Capel Y Bedyddwyr
T3	Hoelgerrig, approx. 200m west of A470
T4	Upper Colliers' Row adjacent to ST1

14.3.3 The nearest sensitive receptors to the site have been chosen for noise assessment and have been allocated sensitivity based on the uses of the buildings described in Table 14.9 (see also Figure 14.2).

14.3.4 Existing ambient noise levels around the site are characterised by road traffic noise from the A470 with localised contributions from minor roads and sources including the railway and existing industrial and commercial facilities to the east of the site. Full details of the baseline noise monitoring are presented in the accompanying technical report.

Table 14.9 Sensitive Receptor Locations

Receptor	Location	Sensitivity
R01	Bunkhouse Ty Wern on Cae'r Wern	**Medium**
R02	Travelodge Merthyr Tydfil on the A1402	**Medium**
R03	74 Clare Street	**High**
R04	62 Clare Street	**High**
R05	42 Clare Street	**High**
R06	2 Railway Terrace	**High**
R07	22 Railway Terrace	**High**
R08	The Cabin Park Home on Glyndyrus Close	**High**
R09	9 Lewis Square	**High**

Future baseline

14.3.5 The traffic assessment confirms that the future baseline at identified receptors will be broadly similar to the existing baseline given their proximity/relationship to the local road network and permanent location of the closest roads to residential dwellings. An assessment has been made of the change in road traffic noise during the 2031 future year at identified sensitive receptors in Table 14.9 above.

14.4 Mitigation within the Submitted Design

Construction

14.4.1 A suitable Construction and Environmental Management Plan will be adopted, details of which are outlined in Chapter 3 and provided in the CEMP submitted alongside the planning application.

Operation

14.4.2 A glazing and ventilation strategy has been provided which achieves both ventilation and internal ambient noise level requirements of L_{Aeq} daytime 35 dB and L_{Aeq} night-time of 30 dB in all sensitive spaces of the proposed development. The composite sound reduction of the building envelope of the hotel and lodges (inclusive of glazing and ventilation) will be up to R_w + C_{tr} 31 dB.

14.5 Likely Significant Environmental Effects of the Scheme

Construction Phase Effects

14.5.1 Noise levels from potential construction activity associated with the development of the Site have been assessed in accordance with BS 5228-1+ A1 2014 criteria which indicate if a significant effect is likely to occur at noise sensitive properties. Point sources representing all likely items of plant have been represented in the model, and in the case of mobile plant, these have been placed in worst case locations with respect to nearby noise sensitive receptors.

14.5.2 Table 14.10 sets out the appropriate BS 5228 'ABC' noise threshold categories at each residential receptor for the daytime period when works are expected to take place and predicted construction noise levels. The ABC threshold at all existing receptors have been based upon the verified noise models of baseline 2017 ambient noise levels. An additional comparison against measured baseline noise levels monitoring at location LT4 (that is a comparable distance from the A470 as the majority of residential receptors for this assessment) similarly identifies that ambient noise levels were around 57dB L_{Aeq} and therefore the applicable ABC category value would be 'Category A'.

14.5.3 It is likely that the construction for the development will be completed in a sequence of stages , however for the purposes of this worst-case assessment, construction activities across the development site have been assumed to be and assessed as occurring simultaneously across the site. This results in evaluating a worst case scenario as the number of simultaneous activities is expected to be significantly lower than those assumed and presented in the assessment below.

Table 14.10 Construction Noise Emission Category based upon the ABC Methods Criteria

Ref	Receptor	Daytime 07:00 – 19:00 and Saturdays 07:00 – 13:00			Predicted Sound pressure level at Receptor (dB)	Comparison Against Criteria	Impact Magnitude	Impact Significance
		Baseline $L_{Aeq,T}$ dB	ABC Category	Criteria Daytime 07:00 – 19:00 and Saturdays 07:00 – 13:00 (dBA)				
R01	Bunkhouse Ty Wern – Cae'r Wern	57.6	A	65	51.6	-13.4	Very Low	**Negligible**
R02	Travelodge Merthyr Tydfil – A1402	50.1	A	65	53.7	-11.3	Very Low	**Negligible**
R03	74 Clare Street	51.6	A	65	49.1	-15.9	Very Low	**Negligible**
R04	62 Clare Street	52.5	A	65	53.3	-11.7	Very Low	**Negligible**
R05	42 Clare Street	53.3	A	65	53.4	-11.6	Very Low	**Negligible**
R06	2 Railway Terrace	53.9	A	65	55.7	-9.3	Low	**Minor**
R07	22 Railway Terrace	54.2	A	65	51.9	-13.1	Very Low	**Negligible**
R08	The Cabin Park Home – Glyndyrus Close	57.3	A	65	52.4	-12.6	Very Low	**Negligible**
R09	9 Lewis Square	62.8	A	65	51.9	-13.1	Very Low	**Negligible**

14.5.4 The summary of the results shown in Table 14.10 indicate that noise associated with the indicative construction noise assessment is that noise levels are expected to have negligible or minor adverse impacts at existing residential receptors within the area. Predicted levels are below the existing ambient noise level thus below the Construction Noise Threshold recommended in Table 14.3.

14.5.5 Therefore, indicative noise levels associated with construction noise should be considered to be either **Negligible** or **Minor Adverse** Effect and not significant.

Operational Phase Effects

14.5.6 Proposed building services plant were assessed at worst-case positions associated with the proposed leisure facilities, including roof mounted plant. The assessment compares the predicted worst-case breakout noise levels from the plant with the existing measured average background noise L_{A90} at the closest proposed residential receptors. Further details are provided in Appendix 14.1.



14.5.7 As no data is available for the proposed plant, a series of predictions were made by defining different sound power levels at point sources. When the sound pressure levels are set as shown in Appendix 14.1 (which are considered to be achievable) at the Proposed Building Services Plant location, the noise Rating Levels at all the existing receptors are predicted to be at least 5 dB below existing background L_{A90} levels during the daytime and night-time therefore expected to a low impact.

14.5.8 The rating noise level at the existing sensitive residential receptors are predicted to be below background noise levels. The magnitude of impact is assessed as **Very Low** and the sensitivity of the receptors have been assessed as high, therefore the effect will be **Negligible** and therefore **Not Significant**.

Change in Ambient Noise Levels

14.5.9 An overall change in noise level assessment has been undertaken in order to assess the effects of the introduction of the Development. External noise levels, at nearby existing sensitive receptors in the current existing baseline noise climate and with the addition of combined noise sources from the Development have been assessed. The combined noise sources include contributions from external activity areas and waterpark, access road and building services plant (refer to Appendix 14.1). The noise level criteria for this assessment are detailed in Table 14.5.

14.5.10 The difference between the 'existing' and the 'proposed' development scenarios are presented below in the table below.

Table 14.11 Difference Between the 'Existing Noise Levels' and 'Proposed' Scenarios

Ref.	Description	Existing $L_{Aeq\ 16\ Hour}$ (baseline ambient noise levels) (dB)	Combined L_{Aeq} (baseline ambient noise levels + proposed sources) (dB)	Contribution	Impact Magnitude	Impact Significance
R01	Bunkhouse Ty Wern – Cae'r Wern	59.5	59.5	0.0	No Change	**Negligible**
R02	Travelodge Merthyr Tydfil – A1402	55.7	55.9	0.2	Very Low	**Negligible**
R03	74 Clare Street	52.1	52.4	0.3	Very Low	**Negligible**
R04	62 Clare Street	53.0	53.5	0.5	Very Low	**Negligible**

Ref.	Description	Existing $L_{Aeq\ 16\ Hour}$ (baseline ambient noise levels) (dB)	Combined L_{Aeq} (baseline ambient noise levels + proposed sources) (dB)	Contribution	Impact Magnitude	Impact Significance
R05	42 Clare Street	53.8	54.3	0.5	Very Low	**Negligible**
R06	2 Railway Terrace	54.4	54.8	0.4	Very Low	**Negligible**
R07	22 Railway Terrace	54.9	55.2	0.3	Very Low	**Negligible**
R08	The Cabin Park Home – Glyndyrus Close	59.1	59.1	0.0	No Change	**Negligible**
R09	9 Lewis Square	66.1	66.1	0.0	No Change	**Negligible**

14.5.11 When compared with the criteria in Table 14.5 of this ES, daytime noise levels are predicted to experience a worst-case change in noise level of up to 0.6 dB (noise level changes of up to ± 3 dB are generally imperceptible to the human ear). As such, the proposed development is expected to result in negligible and insignificant in ambient noise levels at existing dwellings that is not expected to be readily distinguishable and the magnitude of impact is assessed as **No Change** to **Very Low** and the sensitivity of the receptors have been assessed as medium and high, therefore the effect will be **Negligible** and therefore **Not Significant**.

14.5.12 Noise from the existing ambient noise climate have been assessed with respect to the proposed hotel and lodges (refer to Appendix 14.1). It is considered that the proposed hotel receptors sensitivity have been assessed as medium, therefore the effect will be **Negligible** and therefore **Not Significant**.

Road Traffic Noise Levels

14.5.13 In terms of road traffic noise, relatively sizeable changes in traffic levels are required to cause perceptible increases in noise levels; a change in noise level of 1 dB(A), which represents the lowest change perceptible to the human ear, would be produced by an increase in traffic flow of approximately 25%. This assumes that other factors remain broadly unchanged (i.e. average speed and % HGVs using the road)

14.5.14 Traffic data has been provided by Transport Consultants in 18hr Annual Average Weekday Traffic (AAWT). Noise modelling was undertaken between scenarios for the 2019 baseline year and 2031 assessment year to establish the maximum change in noise level at identified receptors. The noise modelling has been undertaken using the Cadna-A software in accordance with the guidance provided with CTRN. A summary of the findings and associated effects of the proposals in EIA terms is presented below.

14.5.15 The traffic assessment presented below incorporates cumulative impacts from the committed developments which are outlined in Chapter 9 of this ES.

14.5.16 Table 14.12 below shows the key receptors which are affected by the change in traffic noise. The noise criteria for this assessment are detailed in Table 14.6.

Table 14.12 Difference in Traffic Noise (Long-term)

Location	Baseline 2021 Noise Levels $L_{A10,18hour}$	Do Something (DS) 2031 Noise Levels $L_{A10,18hour}$	Difference in Noise Levels	Impact Magnitude	Effect Significance
R01	61.8	62.5	0.7	Very Low	**Negligible**
R02	57.8	58.8	1.0	Very Low	**Negligible**
R03	53.1	54.2	1.1	Very Low	**Negligible**
R04	53.8	55.0	1.2	Very Low	**Negligible**
R05	54.6	55.7	1.1	Very Low	**Negligible**
R06	55.4	56.5	1.1	Very Low	**Negligible**
R07	55.8	56.8	1.0	Very Low	**Negligible**
R08	60.1	60.2	0.1	Very Low	**Negligible**
R09	66.1	67.2	1.1	Very Low	**Negligible**

14.5.17 The results of the short-term assessment in Table 14.12 show that traffic noise levels, associated with the 2019 baseline year and the 'do something' 2031 future year and will increase at properties around the site by up to 1.2 dB, which is of **Very Low** magnitude at receptors of high sensitivity and it is considered that the overall effect will be **Negligible** and therefore **Not Significant**.

14.6 Additional Mitigation, Compensation and Enhancement Measures

14.6.1 No additional mitigation measures have been identified within this EIA with respect to noise.

14.7 Assessment Summary and Likely Significant Residual Environmental Effects

Construction Phase

14.7.1 In terms of construction noise levels, the results of the assessments indicate that with best-practice measures within the Construction Environmental Management Plan, the noise impact is expected to result in effects with a **Very Low to Low** impact magnitude and the sensitivity of the receptors have been assessed as medium to high, therefore the effect will be **Negligible** to **Minor Adverse** and therefore **Not Significant**.

Operational Phase

14.7.2 In terms of the impact of operational noise generated from the operational phase of the development, noise levels will increase at properties around the site by up to 0.5 dB which is of **Very Low** impact magnitude at receptors of medium to high sensitivity and it is considered that the overall effect will be **Negligible** and therefore **Not Significant** in EIA terms.

14.7.3 Similarly, in terms of the impact of increases in road traffic during the operational phase of the development, noise levels will increase at properties around the site by up to 1.2 dB which is of **Very Low** impact magnitude at receptors of medium to high sensitivity and it is considered that the overall effect will be **Negligible** and therefore **Not Significant** in EIA terms.

14.8 Cumulative impacts

Construction

14.8.1 There are not expected to be any simultaneous, large-scale construction projects within 1km of the development site. As such, there are not expected to be any cumulative impacts relating to noise during the construction phase of the development.

Operation

14.8.2 Building Services Plant have been assessed to be -5dB below existing background levels. Operational noise levels of the proposed development are predicted to result in a very low/negligible impact. The traffic assessment presented above incorporates cumulative impacts from the committed developments which are outlined in Chapter 9, of this ES. On the basis of the above, it is considered that cumulative noise levels would not increase to an extent that previously insignificant noise effects would be deemed significant with the operation of the proposed development.

14.9 Summary

14.9.1 The results of the noise assessments presented within this chapter identify that any effects in relation to noise associated with the construction and operation of the proposed leisure facility are expected to be negligible. There are a number of best-practice mitigation measures that will be included within the construction-phase CEMP that will further reduce the potential for adverse impacts in relation to construction noise. With regard to the operational phase noise sources such as building services plant will be subject to detailed design considerations (including emission limits) and proposed receptors to a minimum glazing and ventilation specification that are outlined within the accompanying technical report (Appendix 14.1).

Table 14.13 Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Construction Noise	High / Medium	Very Low to Low	Negligible to Minor adverse	N/A	Very Low to Low	Negligible to Minor Adverse	High
Operation							
Building Services Plant	High	Very Low	Negligible	N/A	Very Low	Negligible	High
Overall Change in Ambient Noise Levels Operational noise associated with external noise sources and building services plant	High / Medium	Very Low	Negligible	N/A	Very Low	Negligible	High
Overall Change in Traffic Noise Levels	High / Medium	Very Low	Negligible	N/A	Very Low	Negligible	High

Table 14.14 Means by which Additional Mitigation Measure may be Secured

Identified Effect where additional mitigation (Not design mitigation) has been identified	Type of mitigation measures (avoidance, reduction, compensation, enhancement)	Means by which mitigation measure may be secured
Construction		
Noise during construction phase	Good working practices	CEMP
Operation		
Noise associated with building services plant	Suitable location and specification of equipment to reduce noise emissions	Consented condition

14.10 Summary

14.10.1 The results of the noise assessments presented within this chapter identify that any significant effects in relation to noise associated with the construction and operation of the proposed leisure facility are expected to be negligible. There are a number of best-practice mitigation measures that will be included within the construction-phase CEMP that will help to further reduce the potential for adverse impacts in relation to construction noise and operational noise sources such as building services plant will be subject to detailed design considerations that are outlined within the accompanying technical report. There are not anticipated to be any significant increases in noise levels resulting from any increase in noise levels

14.11 Refences

i. Planning Policy Wales, Edition 11 February 2021

ii. HMSO (2011), The Town and Country Planning (Environmental Impact Assessment) Regulations 2011

iii. BS 4142: 2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'

iv. BS 5228: 2009 +A1:2014 'Code of Practice for noise and vibration control on construction and open sites – Part 1 Noise'

v. LA 111 published in May 2020 (Design Manual for Roads and Bridges)

vi. Guidelines for Environmental Noise Impact Assessment – IEMA (Institute of Environmental Management & Assessment) October 2014

14.12 Glossary

Term	Definition
CADNA	Computer Aided Noise Abatement
DMRB	Design Manual for Roads and Bridges
HGV	Heavy Goods Vehicle
CTRN	Calculation of Road Traffic Noise
UKAS	United Kingdom Accreditation Service



15.0 Air Quality

15.1 Introduction

15.1.1 This chapter presents the approach and findings of the Air Quality Assessment. The chapter sets out the methodology followed and provides a review of the baseline air quality in the vicinity of the proposed development and surrounding area, and then presents the results of the assessment of air quality associated with the proposed development in order to determine the anticipated magnitude and significance of effects.

15.1.2 This chapter is supported by a technical appendix contained in Appendix 15.1.

15.1.3 The study area incorporated within this assessment comprises sections of the A470, A4120, A4054, Bike Park Wales Access, High Street, Court Street and Court Terrace. The spatial extent of the study area is shown within Figure A-1 of the Air Quality Assessment presented in Technical Appendix 15.1.

15.1.4 The potential effects of the proposed development on existing receptors have been established based on an assessment of the scheme. Where relevant, mitigation measures are proposed to minimise any adverse effects of the proposed development during the construction and operational phases. The likely significant residual effects of the Development are then stated.

15.1.5 Prior to the implementation of appropriate mitigation measures, the potential impact description of dust emissions associated with the construction phase of the proposed development is 'medium risk' at the worst affected receptors without mitigation. However, appropriate site-specific mitigation measures have been proposed based on Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition, Earthworks, Construction and Trackout. It is anticipated that with these appropriate mitigation measures in place, the risk of adverse effects due to dust emissions from the construction phase will be negligible and will not be significant.

15.1.6 Using the provided traffic data, the effect of the development is predicted to be 'negligible' at all receptors in both assessment year of 2026 and 2031 which is considered not significant.

15.1.7 A full nitrogen deposition assessment was undertaken for ecological receptors Cwm Glo A Glyndyrys (E1) and Rhydycar West (E5-E7). There were no predicted significant impacts on nitrogen deposition at E1, E5-E7 as a result of the proposed development and the impacts are considered to be negligible.

15.2 Methodology and Scope

Air Quality Legislation, Guidance and Policy Context

15.2.1 Reference has been made to the following legislation which is relevant to the proposed development:

- Planning Policy Wales, Welsh Government, Edition 11, February 2021[i];
- Future Wales, The National Plan 2040, February 2021[ii];
- The Air Quality Standards (Wales) Regulations, 2010[iii];

- The Air Quality Standards Regulations (Amendments), 2016[iv];
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Defra, 2007[v];
- The Environment Act, 1995[vi];
- The Environment Act, 2021[vii];
- Local Air Quality Management Technical Guidance LAQM.TG16, Defra, 2021[viii];
- Land-Use Planning & Development Control: Planning for Air Quality, EPUK & IAQM, 2017[ix];
- Well-being of Future Generations (Wales) Act, 2015[x];
- Guidance on the Assessment of Dust from Demolition and Construction, IAQM, 2014[xi];
- A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.1), IAQM, May 2020[xii];
- Ecological Assessment of Air Quality Impacts, CIEEM, January 2021[xiii].
- Merthyr Tydfil County Borough Council, 2020 Air Quality Annual Report[xiv]; and,
- Merthyr Tydfil County Borough Council Replacement Local Development Plan (2016 - 2031) (Adopted January 2020)[xv].

Air Quality Assessment Methodology

15.2.2 The construction phase assessment uses the IAQM Guidance on the Assessment of Dust from Demolition and Construction (February 2014)xi and section 3.45 of the Volume 11 Section 3 of the Design Manual for Roads and Bridges[xvi]. In total four processes are considered, namely demolition, earthworks, construction and trackout. For each of these phases, the significance of the potential significant dust impacts is derived following the determination of a dust emission class and the distance of activities to the nearest sensitive receptor, therefore assessing worst case likely significant impacts.

15.2.3 With regards to development traffic on the surrounding road network, the operational phase assessment consists of the quantified predictions of the change in:

- NO_2
- PM_{10}
- $PM_{2.5}$

Predictions of air quality at the proposed development site have been undertaken for the operational phase of the development using Atmospheric Dispersion Modelling Software (ADMS) 5.0.0.1 ADMS software is used to model NO_2, PM_{10} and $PM_{2.5}$ emitted from traffic emissions, which predicts the changes in levels of pollutants experienced due to the changes in traffic levels and distribution in traffic as a result of the proposed development. Baseline data for the above pollutants has been sourced from Defra and Merthyr Tydfil County Borough Council.

15.2.4 The significance of the effects during the operational phase of the development is based on the latest guidance produced by EPUK and IAQM in in January 2017 ‘Land-Use Planning & Development Control: Planning for Air Quality’[ix] and June 2020 ‘A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites’. The guidance lays a basis for a consistent approach that could be used by all parties associated with the planning process to

professionally judge the overall significance of the air quality effects based on severity of air quality impacts.

15.2.5 Different 'scenarios' have been assessed for the purposes of the development. The assessed anticipated opening year was 2026 and the future year was 2031.

- Baseline Scenario – to compare the modelling with the monitoring data.
- Future Baseline Scenario ('Do Minimum') – to account for committed developments and changes in emissions over the years.
- Future Scenario with the Development ('Do Something') – as above but inclusive of the development. The difference between the 'Do Minimum' and 'Do Something' informs what effect the development will have with regards to Air Quality.

15.2.6 Levels have been compared against the long-term limit of NO_2 as this is the criteria which is breached within the AQMAs.

Receptor Sensitivity

15.2.7 Receptors can demonstrate different sensitivities to changes in their environment. For the purpose of this assessment sensitivity is determined as Very High, High, Medium or Low as detailed in Table 15-1 for both the construction and operational phase of the development.



Table 15-1. Methodology for Assessing Sensitivity of Receptor

Sensitivity	Criteria
Very High	• 'Do Minimum' pollutant concentrations are 110% and greater than 110% of the relevant AQO (Emissions). • Receptors of very high sensitivity to dust and odour, such as: hospitals and clinics, retirement homes, painting and furnishing, hi-tech industries and food processing (Construction). • Densely populated areas – more than 100 dwellings within 20m of the development site (Construction).
High	• 'Do Minimum' pollutant concentrations between 103 - 109% of the relevant AQO (Emissions). • Receptors of high sensitivity to dust and odour, such as: schools, residential areas, food retailers, glasshouses and nurseries, horticultural land and offices (Construction). • Densely populated areas – 10-100 dwellings within 20m of the development site (Construction).
Medium	• 'Do Minimum' pollutant concentrations between 95 - 102% of the relevant AQO (Emissions). • Receptors of medium sensitivity to dust and odour, such as: farms, outdoor storage, light and heavy industry (Construction). • Suburban or edge of town areas (Construction).
Low	• 'Do Minimum' pollutant concentrations between 75-90% of the relevant AQO (Emissions) • All other dust/odour sensitive receptors not identified above (Construction). • Rural/Industrial areas (Construction).
Negligible	• 'Do Minimum' pollutant concentrations less than 75% of the relevant AQO (Emissions) • Receptor more than 350m away (construction)

Effect Magnitude

15.2.8 The significance of the effects during the operational phase of the proposed development is based on the latest guidance produced by EPUK and IAQM in January 2017[ix]. The guidance lays a basis for a consistent approach to professionally judge the overall significance of the air quality effects based on severity of air quality impacts.

15.2.9 Table 15-2 provides the criteria used for the classification of the magnitude of the likely significant air quality impacts.

Table 15-2. Method for assessing Magnitude of likely significant impacts on Air Quality

Magnitude	Description	Examples
Large	Impact resulting in a considerable change in baseline environmental conditions with severe undesirable/desirable consequences on the receiving environment.	• Air quality varies between the do minimum and do something by more than 10% of the air quality criterion (Emissions). • Substantial risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Medium	Impact resulting in a discernible change in baseline environmental conditions with undesirable/desirable conditions	• Air quality varies between the do minimum and do something by 5 - 10% of the air quality criterion (Emissions). • Moderate risk that emissions will generates statutory nuisance complaints, resulting in formal action (Construction).
Small	Impact resulting in a discernible change in baseline environmental conditions with undesirable/desirable conditions that can be tolerated.	• Air quality varies between the do minimum and do something by 1 - 5% of the air quality criterion (Emissions). • Slight risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Imperceptible	Very low discernible change in baseline environmental conditions.	• Air quality varies between the do minimum and do something by less than 1-2% of the air quality criterion (Emissions). • Little or no cause for nuisance complaints to be made (Construction).
Neutral	No change in baseline conditions	• Air quality varies between the do minimum and do something by less than 0.5% of the air quality criterion (Emissions).

15.2.10 It is recognised that likely significant air quality impacts can operate over a range of geographical areas and therefore a geographical scale may be taken into account in describing the scale/magnitude of the likely significant impact.

Effect Significance

15.2.11 The level of significance is determined by combining the likely significant impact risk with the sensitivity of the receptor during the operational phase. Table 15-3 shows how the interaction of magnitude and sensitivity results in the significance of an environmental impact. If the scale of the impact magnitude is negative, then the resulting impact is adverse. If the scale of the impact magnitude is positive, then the resulting impact is beneficial. If the impact is Moderate to Substantial then the change is considered to have a significant effect on the local air quality, whether positive or negative.

15.2.12 The table has been developed by the authors, but the matrix combinations and terms used correlate with the significance matrix recommended by Land-Use Planning & Development Control: Planning for Air Quality (2017).

Table 15-3. Impact Significance Matrix

Sensitivity of Receptor	Magnitude of Impact				
	Large	Medium	Small	Imperceptible	Neutral
Very High	Substantial	Substantial	Substantial	Moderate	Negligible
High	Substantial	Substantial	Moderate	Moderate	Negligible
Medium	Substantial	Moderate	Moderate	Slight	Negligible
Low	Moderate	Moderate	Slight	Negligible	Negligible
Negligible	Moderate	Slight	Negligible	Negligible	Negligible

Limitations of the Assessment

15.2.13 The Construction Phase assessment has been undertaken using Professional Judgement as per the IAQM Guidance, which states:

"Because the diverse range of projects that are likely to be subject to dust impact assessments mean that it is not possible to be prescriptive as to how to assess the impacts. Also, a wide range of factors affects the amount of dust that may arise, and these are not readily quantified."

15.2.14 The above guidance ensures that a full range of potential impacts are considered. Additionally, the impacts associated with the construction assessment are considered to be minimal compared to the operational phase assessment.

15.3 Baseline Environment

Existing baseline

15.3.1 Baseline air quality in the vicinity of the proposed development site has been defined from a number of sources, as described in the following sections.

Air Quality Review and Assessment

15.3.2 As required under section 82 of the Environment Act 1995[vi] Merthyr Tydfil County Borough Council (MTCBC) has conducted an ongoing exercise to review and assess air quality within its area of jurisdiction. MTCBC has one designated Air Quality Management Area.

15.3.3 The closest AQMA to the development is the Twynyrodyn Road AQMA, declared in 2017 for NO_2. This AQMA is located 0.79 km north-east of the site boundary.

15.3.4 Background concentrations used within the prediction calculations were referenced from the UK National Air Quality Information Archive database based on the National Grid Co-ordinates of 1 x 1 km grid squares nearest to the development site. In August 2020 Defra issued revised 2018 based background maps for NO_X, NO_2, PM_{10} and $PM_{2.5}$ which incorporate updates to the input data used for modelling. NO_x and $PM_{2.5}$ are included in the AQA Technical Report for reference, however, there are no air quality objectives for NO_x and there are modelling limitations for $PM_{2.5}$. As a result, NO_2 and PM_{10} are the pollutants considered most relevant for this assessment and therefore have been modelled in the assessment. 2019 background maps have been utilised for the model verification and baseline operational phase assessment.

Air Quality Monitoring

1.1.1 An EIA scoping report was submitted to Merthyr Tydfil County Borough Council (MTCBC). Air Quality Monitoring within MTCDC is conducted via non-continuous monitoring methods. The most recently available monitoring data is presented in Table 15-4 and



Table 15-5 below.**Table 15-4. Non-Continuous Monitoring**

Site ID	Location	Site Type	Distance from Kerb (m)	Inlet Height (m)	2019 Annual Mean NO_2 Concentration ($\mu g/m^3$)
4	15 Lower High Street	Urban Centre	3.6	2.50	24.9
6	11 Mardy Terrace, Plymouth Street	Roadside	5.1	2.50	25.3
11*	11 Alexandra Terrace lamppost	Roadside	1.3	3.00	35.0
18*	91 Twynyrodyn Road	Roadside	2.3	2.50	24.1
20*	17 Court Terrace	Roadside	1.5	2.30	25.9
21*	51 Twynyrodyn Road	Roadside	1.5	2.50	38.2
22*	15 Arfryn Terrace	Roadside	4.9	2.30	26.0
24*	64 Gilfach Cynon	Roadside	2.7	2.70	23.8
31	Caedraw Flat Downpipe	Roadside	5.7	2.10	22.1
*Located within AQMA					

Traffic Emission Sources

15.3.5 Desktop assessment has identified that traffic movements are likely to be the most significant local source of pollutants affecting the site and its surroundings. The principal traffic derived pollutant likely to impact local receptors is nitrogen dioxide (NO_2).

Meteorology

15.3.6 Meteorological conditions have significant influence over air pollutant concentrations and dispersion. Pollutant levels can vary significantly from hour to hour as well as day to day, thus any air quality predictions need to be based on detailed meteorological data. The ADMS model calculates the dispersion of pollutants on an hourly basis using a year of local meteorological data. The meteorological data used in the assessment is derived from Sennybridge Met Station, which is considered representative of the development site conditions, with all the complete parameters necessary for the ADMS model.

Sensitive Receptors for Air Quality Assessment

15.3.7 Receptors that are considered as part of the air quality assessment are primarily those existing receptors that are situated along routes predicted to experience significant changes in traffic flow as a result of the proposed development. These have been identified in the following sections.

15.3.8 The Design Manual for Roads and Bridges (DMRB) considers any receptor within 200m of a road source to be potentially affected by that operation. The AQOs only apply at locations where the public may be exposed to pollution for a sufficient period for there to be any measurable health impact. The averaging period and AQO involved will determine which locations are considered to be sensitive receptors. For annual mean NO_2 and particulate matter with mean hydraulic diameter of less than 10o poll10) AQOs, LAQM.TG (16)[viii] considers typical locations for sensitive receptors to include:

- Residential properties;
- Hospitals;
- Schools; and,
- Care homes.

15.3.9 The IAQM Land Use Planning for Development Control: Planning for Air Quality, states those receptors located on road networks where there is expected to be an increase of more than 500AADT or 100HGV movements will required assessment.

Table 15-5. Modelled Sensitive Receptor Locations

Existing Sensitive Receptor		X	Y	Receptor Height (m)
R1	9 Llwyncelyn Lane	304253	205860	1.5
R2	Residential Property at Lewis Square	305085	204307	1.5
R3	57 Graig Road	305327	203843	1.5
R4	1 to 12 Morlais Court at Lower High Street	304977	205722	1.5
R5	1 to 12 Hywel House at A4054	304874	205710	1.5
R6	Education Facility	304632	206025	1.5
R7	1 Lincoln Terrace	305237	205618	1.5
R8	1 Mardy Terrace	305436	205191	1.5
R9*	19 Davies Terrace	305147	205900	1.5
R10	20 Arfyn Terrace	305486	205832	1.5
Proposed Sensitive Receptor		**X**	**Y**	**Receptor Height (m)**
PR1	Proposed Sensitive Receptor	304845	205082	1.5
PR2	Proposed Sensitive Receptor	304654	205132	1.5
PR3	Proposed Sensitive Receptor	304169	204781	1.5
PR4	Proposed Sensitive Receptor	304533	204853	1.5
PR5	Proposed Sensitive Receptor	304516	204492	1.5
PR6	Proposed Sensitive Receptor	304324	204320	1.5
PR7	Proposed Sensitive Receptor	305001	204404	1.5



Existing Sensitive Receptor		X	Y	Receptor Height (m)
PR8	Proposed Sensitive Receptor	304805	204678	1.5
PR9	Proposed Sensitive Receptor	304745	204984	1.5

15.3.10 Proposed residential sensitive receptors have been assessed to determine the effect of air quality, associated with the proposed development. The location of receptors is shown in the Air Quality Assessment presented in Technical Appendix 15.1

Ecological Receptors

15.3.11 Air quality impacts associated with the proposed re-development have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The IAQM guidance on 'Air Quality Impacts on Designated Nature Conservation Sites' (2020) document outlines the types of designated nature sites within 2 km of the proposed development which require air quality assessment. These are inclusive of:

- Sites of Special Scientific Interest (SSSIs);
- Special Areas of Conservation (SACs);
- Special Protection Areas (SPAs);
- Ramsar Sites;
- Areas of Special Scientific Interest (ASSIs);
- National Nature Reserves (NNRs);
- Local Nature Reserves (LNRs);
- Local Wildlife Sites (LWSs); and,
- Areas of Ancient Woodland (AW).

15.3.12 The Conservation of Habitats and Species Regulations (2019) additionally requires competent authorities to review planning applications and consents that have the potential to impact on European designated sites (e.g. Special Protection Areas).

Table 15-6. Ecological Sensitive Receptor Locations

Site ID	Site	Designation	UK NGR (m)		Distance from Site (km)	Distance from Nearest Affected Road (m)
			X	Y		
E1	Cwm Glo A Glyndyrys	SSSI	304751	205129	<0.01	14
E2	Cwm Glo A Glyndyrys	SSSI	304154	204887	<0.01	656

Site ID	Site	Designation	UK NGR (m)		Distance from Site (km)	Distance from Nearest Affected Road (m)
			X	Y		
E3	Cwm Glo A Glyndyrys	SSSI	303992	204400	0.33	1,029
E4	Cwm Glo A Glyndyrys	SSSI	304934	204454	0.04	87
E5	Rhydycar West	SINC	304840	205082	<0.01	12
E6	Rhydycar West	SINC	304959	204495	0.04	64
E7	Rhydycar West	SINC	305017	204705	0.19	18

15.3.13 It should be noted that the IAQM Guidance only requires the assessment of ecological receptors which are located within 200 m of the affected road network. It should be noted that E2 and E3 are far away from the affected road but within the site. Therefore, all ecological receptors have been considered in this assessment. The location of receptors is shown in the Air Quality Assessment presented in Technical Appendix 15.1

Future baseline

15.3.14 The future baseline is predicted to increase as a result of the committed developments, as detailed in Chapter 9 Traffic and Transport. This is accounted for in the modelled 'Do Minimum' scenarios which takes into account the future baseline in 2026 and 2031 without the Proposed development.

15.3.15 It should be noted that over time, the number of petrol/diesel cars are predicted to reduce as a result of initiatives to combat air pollution and so emissions associated with vehicles will reduce over time. This will be as a result of greater numbers of electric vehicles making up the fleet and there being fewer older more polluting vehicles on the road. This change has been calculated using Defra's Emissions Factor Toolkit. The change is shown between the 'Baseline' results and the 'Do Minimum' results.

15.4 Mitigation within the Submitted Design

Design

15.4.1 There are no design features of note regarding Air Quality within the submitted design.

Construction

15.4.2 The following good practice mitigation measures presented in Table 15-7 will be adopted and should become part of the approved Construction Environmental Management Plan (CEMP) for the proposed development.

Table 15-7. IAQM Guidance on the Assessment of Dust from Demolition and Construction 'Highly Recommended' Mitigation Measures

Communications
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
Display the head or regional office contact information.
Dust Management
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real time PM_{10} continuous monitoring and/or visual inspections.
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
Make the complaints log available to the local authority when asked.
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.

Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
Avoid site runoff of water or mud.
Keep site fencing, barriers and scaffolding clean using wet methods.
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
Cover, seed or fence stockpiles to prevent wind whipping.
Ensure all vehicles switch off engines when stationary - no idling vehicles.
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.

Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
Use enclosed chutes and conveyors and covered skips.
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Avoid bonfires and burning of waste materials.
Earthworks
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
Only remove the cover in small areas during work and not all at once.
Construction

Avoid scabbling (roughening of concrete surfaces) if possible.
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
Trackout
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
Avoid dry sweeping of large areas.
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
Record all inspections of haul routes and any subsequent action in a site log book.
Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
Access gates to be located at least 10m from receptors where possible.



15.5 Likely Significant Environmental Effects of the Scheme

Construction Phase Effects

15.5.1 The main emissions during construction are likely to be dust and particulate matter generated during earth moving (particularly during dry months), or from construction materials. In respect of fires on site it should be noted that suitable management strategies will be in place to prevent burning of any material during the construction phase. The main potential impacts of particulates/dust are:

- Visual – dust plume, reduced visibility, coating and soiling of surfaces leading to annoyance, loss of amenity, the need to clean surfaces;
- Physical and/or chemical contamination and corrosion of artefacts;
- Coating of vegetation and soil contamination; and,
- Health impacts due to inhalation e.g. asthma or irritation of the eyes.

15.5.2 A number of other factors such as the amount of precipitation and other meteorological conditions will also influence the amount of particulate matter generated.

15.5.3 Construction activities can give rise to short term elevated dust/PM_{10} concentrations in neighbouring areas. This may arise from vehicle movements, soiling of the public highway, demolition or windblown stockpiles.

Particulate Matter

15.5.4 The UK Air Quality Standards seek to control the health implications of respirable particulate matter PM_{10} and $PM_{2.5}$ (less than 10 micrometres and 2.5 micrometres in diameter respectively). However, the majority of particles released from construction will be greater than this in size.

15.5.5 Construction works on site have the potential to elevate localised PM_{10} concentrations in the area. On this basis, mitigation measures should be taken to minimise these emissions as part of good site practice.

Dust

15.5.6 Particles greater than 10µm are likely to settle out relatively quickly and may cause annoyance due to their soiling capability. Although there is no formal standards or criteria for nuisance caused by deposited particles, the IAQM 'Guidance on Monitoring in the Vicinity of Demolition and Construction Sites' (October 2018) and the Environment Agency Technical Guidance Note (TGN) M17[xvii] states that dust is usually compared with a 'complaints likely' guideline of 200mg/m^2/day. Therefore, a deposition rate of 200mg/m^2/day is often presented as a threshold for serious nuisance though this is usually only applied to long term exposure as people are generally more tolerant of dust for a short or defined period. Significant nuisance is likely when the dust coverage of surfaces is visible in contrast with adjacent clean areas, especially when it happens regularly. Severe dust nuisance occurs when the dust is perceptible without a clean reference surface.



15.5.7 Construction activities have the potential to suspend dust, which could result in annoyance of residents surrounding the site. Measures will be taken to minimise the emissions of dust as part of good site practice. Recommended mitigation measures proportionate to the risk associated with the development and based on best practice guidance are discussed in earlier in this chapter.

Sensitivity of the Area to Different Construction Activities

15.5.8 The sensitivity of the surrounding area to each construction process has been determined following stage 2B of the IAQM guidance. The assessment has determined the area sensitivities as shown in the Table 15-8.

Table 15-8. Impact Description of Construction Activities without Mitigation

Source	Summary Risk of Impacts Prior to Mitigation		
	Dust Soiling	Health Effects of PM_{10}	Ecological
Demolition	N/A	N/A	N/A
Earthworks	Medium	Low	High
Construction	Medium	Low	High
Trackout	Low	Low	Medium

15.5.9 Based on the methodology detailed in the AQA Technical Report, the potential impact significance of dust emissions associated with the construction phase of the proposed development presented is considered to be **negligible**.

15.5.10 The effects during the construction phase are predicted with regard to the potential for dust nuisance complaints and surface soiling events due to deposition, as opposed to the risk of exceeding any AQOs. All dust impacts are considered to be **direct**, **temporary**, **short-term** and **reversible** in nature. The impacts are determined to be direct as they occur as a result of activities associated with the development, temporary as they will only potentially occur during the construction phase, short-term because these will only arise at particular times when certain activities and meteorological conditions for creating the level of magnitude predicted combine, and reversible as conditions will return to baseline upon cessation of construction phase activities. With the construction mitigation measures in place detailed below, dust soiling and PM_{10} during construction are considered **negligible** in EIA terms.

Operational Phase Effects

15.5.11 Additional vehicle movements associated with the proposed development will generate additional exhaust emissions, such as NO_2, PM_{10} and $PM_{2.5}$, on the local and regional road networks. In order to quantify potential impacts of these emissions in the vicinity of the site, a detailed dispersion modelling assessment has been undertaken using the ADMS-Roads software package. This model is routinely used in the UK for environmental assessment work.

15.5.12 The likely significant impacts of road vehicle exhaust emissions have been undertaken for the following assessment years:

- 2021 Baseline = Existing baseline conditions (2019);
- 2026 'Do Minimum' = Baseline conditions + committed development flows;
- 2026 'Do Something' = Baseline conditions + committed development flows + Proposed development Flows;
- 2031 'Do Minimum' = Baseline conditions + committed development flows; and,
- 2031 'Do Something' = Baseline conditions + committed development flows + Proposed development Flows.

2026 Scenario

Nitrogen Dioxide

15.5.13 Predicted annual mean NO_2 concentrations were assessed against the AQO of 40 µg/m^3. Reference should be made to the AQA Technical Report and

15.5.14 Table **15-9**, below, for detailed results tables of predicted annual mean NO_2 concentrations at each receptor.

15.5.15 The effects without additional mitigation are predicted to be **negligible** and therefore **not significant** at all sensitive receptors.

15.5.16 The maximum predicted concentration at any ground floor proposed receptor is not predicted to exceed the AQO for NO_2 and therefore, no further mitigation is required.



Table 15-9. Significance at the Identified Sensitive Receptors (NO_2)

Receptor		NO_2 (µg/m³)						
		Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R1	9 LLwyncelyn Lane	20.35	20.93	Negligible	0.58	1%	Imperceptible	Negligible
R2	Residential Property at Lewis Square	17.85	18.35	Negligible	0.50	1%	Imperceptible	Negligible
R3	57 Graig Road	13.41	13.83	Negligible	0.42	1%	Imperceptible	Negligible
R4	1 to 12 Morlais Court at Lower High Street	18.95	19.08	Negligible	0.13	0%	Neutral	Negligible
R5	1 to 12 Hywel House at A4054	17.48	17.58	Negligible	0.10	0%	Neutral	Negligible
R6	Education Facility	10.55	10.60	Negligible	0.05	0%	Neutral	Negligible
R7	1 Lincoln Terrace	15.82	15.91	Negligible	0.09	0%	Neutral	Negligible
R8	1 Mardy Terrace	17.45	17.55	Negligible	0.10	0%	Neutral	Negligible
R9*	19 Davies Terrace	21.01	21.08	Negligible	0.07	0%	Neutral	Negligible
R10	20 Arfyn Terrace	15.03	15.08	Negligible	0.05	0%	Neutral	Negligible
PR1	Proposed Sensitive Receptor	-	29.88	-	-	-	-	-

Receptor		NO_2 (µg/m^3)						
		Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
PR 2	Proposed Sensitive Receptor	-	11.63	-	-	-	-	-
PR 3	Proposed Sensitive Receptor	-	6.87	-	-	-	-	-
PR 4	Proposed Sensitive Receptor	-	7.40	-	-	-	-	-
PR 5	Proposed Sensitive Receptor	-	7.05	-	-	-	-	-
PR 6	Proposed Sensitive Receptor	-	6.83	-	-	-	-	-
PR 7	Proposed Sensitive Receptor	-	22.29	-	-	-	-	-
PR 8	Proposed Sensitive Receptor	-	7.90	-	-	-	-	-
PR 9	Proposed Sensitive Receptor	-	9.18	-	-	-	-	-
Annual Mean AQO		40 µg/m^3						
*Located in the AQMA								

15.5.17 All impacts are considered to be direct**, permanent, long-term** and **irreversible** in nature. The impacts are determined to be **direct** as they occur as a result of vehicles travelling to and from the proposed development, **permanent** as they will occur throughout the operational phase, **long-term** because these occur during the entire operational phase, and **irreversible** as conditions will not return to baseline conditions.

15.5.18 Confidence in these predictions is **high** given that a detailed dispersion modelling assessment has been undertaken using traffic data provided by transport consultants and modelling results have been verified by comparing the modelled and monitored NO_2 concentrations which were shown to be within the margin for error as required by the Technical Guidance, which is considered to be a robust approach.

15.5.19 The effect of increased vehicle emissions is considered **negligible** and therefore **not significant** with regards to increased NO_2 concentrations for all receptors listed above**.**

Particulate Matter (PM_{10} & $PM_{2.5}$)

15.5.20 Predicted annual mean ground level PM_{10} concentrations were assessed against the AQO of 40µg/m^3. Reference should be made to the AQA Technical Report and Table 15-10, below, for detailed results tables of predicted annual mean PM_{10} concentrations.

15.5.21 The likely significant impact on annual mean PM_{10} concentration from the development traffic flows is predicted to be **negligible** and therefore **not significant** at all identified receptors.

15.5.22 The maximum predicted concentration at any ground floor proposed receptor is not predicted to exceed the AQO for PM_{10} and therefore, no additional mitigation is required, and the effect is considered **negligible** and therefore **not significant**.

Table 15-10. Significance at the Identified Sensitive Receptors (PM_{10})

Receptor		PM_{10} (µg/m^3)						
		Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R1	9 LLwyncelyn Lane	14.04	14.17	Negligible	0.14	0%	Neutral	Negligible
R2	Residential Property at Lewis Square	13.20	13.31	Negligible	0.11	0%	Neutral	Negligible
R3	57 Graig Road	12.20	12.30	Negligible	0.09	0%	Neutral	Negligible

Receptor		PM_{10} ($\mu g/m^3$)						
		Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R4	1 to 12 Morlais Court at Lower High Street	14.81	14.85	Negligible	0.04	0%	Neutral	Negligible
R5	1 to 12 Hywel House at A4054	14.75	14.78	Negligible	0.03	0%	Neutral	Negligible
R6	Education Facility	12.42	12.43	Negligible	0.01	0%	Neutral	Negligible
R7	1 Lincoln Terrace	14.59	14.61	Negligible	0.02	0%	Neutral	Negligible
R8	1 Mardy Terrace	15.23	15.26	Negligible	0.03	0%	Neutral	Negligible
R9*	19 Davies Terrace	15.65	15.67	Negligible	0.02	0%	Neutral	Negligible
R10	20 Arfyn Terrace	14.11	14.12	Negligible	0.01	0%	Neutral	Negligible
PR1	Proposed Sensitive Receptor	-	16.72	-	-	-	-	-
PR2	Proposed Sensitive Receptor	-	12.34	-	-	-	-	-
PR3	Proposed Sensitive Receptor	-	10.85	-	-	-	-	-
PR4	Proposed Sensitive Receptor	-	10.96	-	-	-	-	-
PR5	Proposed Sensitive Receptor	-	10.88	-	-	-	-	-
PR6	Proposed Sensitive Receptor	-	10.84	-	-	-	-	-

Receptor		PM_{10} ($\mu g/m^3$)						
		Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
PR7	Proposed Sensitive Receptor	-	14.10	-	-	-	-	-
PR8	Proposed Sensitive Receptor	-	11.06	-	-	-	-	-
PR9	Proposed Sensitive Receptor	-	11.35	-	-	-	-	-
Annual Mean AQO	40 $\mu g/m^3$							
*Located in the AQMA								

15.5.23 Predicted annual mean ground level $PM_{2.5}$ concentrations were assessed against the AQO of 20$\mu g/m^3$ as shown in Table 15-11 below.

Table 15-11. Significance at the Identified Sensitive Receptors ($PM_{2.5}$)

Receptor		$PM_{2.5}$ (µg/m^3)						
		Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R1	9 LLwyncelyn Lane	8.99	9.07	Negligible	0.08	0%	Neutral	Negligible
R2	Residential Property at Lewis Square	8.45	8.52	Negligible	0.07	0%	Neutral	Negligible
R3	57 Graig Road	8.03	8.09	Negligible	0.05	0%	Neutral	Negligible
R4	1 to 12 Morlais Court at Lower High Street	9.37	9.39	Negligible	0.02	0%	Neutral	Negligible
R5	1 to 12 Hywel House at A4054	9.32	9.34	Negligible	0.02	0%	Neutral	Negligible
R6	Education Facility	8.32	8.32	Negligible	0.01	0%	Neutral	Negligible
R7	1 Lincoln Terrace	9.50	9.51	Negligible	0.01	0%	Neutral	Negligible
R8	1 Mardy Terrace	9.86	9.87	Negligible	0.02	0%	Neutral	Negligible
R9*	19 Davies Terrace	10.12	10.13	Negligible	0.01	0%	Neutral	Negligible
R10	20 Arfyn Terrace	9.24	9.25	Negligible	0.01	0%	Neutral	Negligible
PR1	Proposed Sensitive Receptor	-	10.59	-	-	-	-	-

Receptor		$PM_{2.5}$ (µg/m^3)						
		Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
PR2	Proposed Sensitive Receptor	-	7.99	-	-	-	-	-
PR3	Proposed Sensitive Receptor	-	7.19	-	-	-	-	-
PR4	Proposed Sensitive Receptor	-	7.26	-	-	-	-	-
PR5	Proposed Sensitive Receptor	-	7.21	-	-	-	-	-
PR6	Proposed Sensitive Receptor	-	7.18	-	-	-	-	-
PR7	Proposed Sensitive Receptor	-	8.98	-	-	-	-	-
PR8	Proposed Sensitive Receptor	-	7.31	-	-	-	-	-
PR9	Proposed Sensitive Receptor	-	7.48	-	-	-	-	-
Annual Mean AQO	20 µg/m^3							

Receptor	$PM_{2.5}$ (µg/m^3)						
	Do Minimum 2026	Do Something 2026	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
*Located in the AQMA							

15.5.24 As indicated in the AQA Technical Report, the likely significant impact on annual mean $PM_{2.5}$ concentration from the development traffic flows is predicted to be **negligible** and therefore **not significant** at all identified receptors.

15.5.25 The maximum predicted concentration at any ground floor proposed receptor is not predicted to exceed the AQO for $PM_{2.5}$ and therefore, no additional mitigation is required, and the effect is considered **negligible** and therefore **not significant.**

2031 Scenario

Nitrogen Dioxide

15.5.26 Predicted annual mean NO_2 concentrations were assessed against the AQO of 40 µg/m^3. Reference should be made to the AQA Technical Report and Table 15.12, below, for detailed results tables of predicted annual mean NO_2 concentrations at each receptor.

15.5.27 The effects without additional mitigation are predicted to be **negligible** and therefore **not significant** at all sensitive receptors.

15.5.28 The maximum predicted concentration at any ground floor proposed receptor is not predicted to exceed the AQO for NO2 and therefore, no further mitigation is required.

Table 15-12. Significance at the Identified Sensitive Receptors (NO_2)

Receptor		NO_2 (µg/m³)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R1	9 LLwyncelyn Lane	16.24	16.60	Negligible	0.37	1%	Imperceptible	Negligible
R2	Residential Property at Lewis Square	15.53	15.84	Negligible	0.31	1%	Imperceptible	Negligible
R3	57 Graig Road	11.49	11.75	Negligible	0.26	1%	Imperceptible	Negligible
R4	1 to 12 Morlais Court at Lower High Street	15.63	15.72	Negligible	0.09	0%	Neutral	Negligible
R5	1 to 12 Hywel House at A4054	14.59	14.66	Negligible	0.07	0%	Neutral	Negligible
R6	Education Facility	10.07	10.10	Negligible	0.03	0%	Neutral	Negligible
R7	1 Lincoln Terrace	13.50	13.55	Negligible	0.05	0%	Neutral	Negligible
R8	1 Mardy Terrace	14.62	14.68	Negligible	0.06	0%	Neutral	Negligible
R9*	19 Davies Terrace	17.09	17.14	Negligible	0.05	0%	Neutral	Negligible
R10	20 Arfyn Terrace	12.96	12.99	Negligible	0.03	0%	Neutral	Negligible
PR1	Proposed Sensitive Receptor	-	23.31	-	-	-	-	-
PR2	Proposed Sensitive Receptor	-	10.53	-	-	-	-	-

Receptor		NO_2 (µg/m^3)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
PR3	Proposed Sensitive Receptor	-	6.70	-	-	-	-	-
PR4	Proposed Sensitive Receptor	-	7.05	-	-	-	-	-
PR5	Proposed Sensitive Receptor	-	6.82	-	-	-	-	-
PR6	Proposed Sensitive Receptor	-	6.68	-	-	-	-	-
PR7	Proposed Sensitive Receptor	-	18.27	-	-	-	-	-
PR8	Proposed Sensitive Receptor	-	7.37	-	-	-	-	-
PR9	Proposed Sensitive Receptor	-	8.24	-	-	-	-	-
Annual Mean AQO	40 µg/m^3							
*Located in the AQMA								

15.5.29 All impacts are considered to be direct**, permanent, long-term** and **irreversible** in nature. The impacts are determined to be **direct** as they occur as a result of vehicles travelling to and from the proposed development, **permanent** as they will occur throughout the operational phase, **long-term** because these occur during the entire operational phase, and **irreversible** as conditions will not return to baseline conditions.

15.5.30 Confidence in these predictions is **high** given that a detailed dispersion modelling assessment has been undertaken using traffic data provided by transport consultants and modelling results have been verified by comparing the modelled and monitored NO_2 concentrations which were shown to be within the margin for error as required by the Technical Guidance, which is considered to be a robust approach.

15.5.31 The effect of increased vehicle emissions is considered **negligible** and therefore **not significant** with regards to increased NO_2 concentrations for all receptors listed above**.**

Particulate Matter (PM_{10} & $PM_{2.5}$)

15.5.32 Predicted annual mean ground level PM_{10} concentrations were assessed against the AQO of 40µg/m^3. Reference should be made to the AQA Technical Report and Table 15-13, below, for detailed results tables of predicted annual mean PM_{10} concentrations.

15.5.33 The likely significant impact on annual mean PM_{10} concentration from the development traffic flows is predicted to be of a **negligible** at all identified receptors.

15.5.34 The maximum predicted concentration at any ground floor proposed receptor is not predicted to exceed the AQO for PM_{10} and therefore, no additional mitigation is required, and the effect is considered **negligible** and therefore **not significant**.

Table 15-13. Significance at the Identified Sensitive Receptors (PM_{10})

Receptor		PM_{10} (µg/m^3)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R1	9 LLwyncelyn Lane	14.12	14.25	Negligible	0.13	0%	Neutral	Negligible
R2	Residential Property at Lewis Square	13.24	13.36	Negligible	0.11	0%	Neutral	Negligible
R3	57 Graig Road	12.24	12.33	Negligible	0.09	0%	Neutral	Negligible

Receptor		PM_{10} (µg/m^3)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R4	1 to 12 Morlais Court at Lower High Street	14.92	14.96	Negligible	0.04	0%	Neutral	Negligible
R5	1 to 12 Hywel House at A4054	14.86	14.89	Negligible	0.03	0%	Neutral	Negligible
R6	Education Facility	12.43	12.45	Negligible	0.01	0%	Neutral	Negligible
R7	1 Lincoln Terrace	14.68	14.70	Negligible	0.02	0%	Neutral	Negligible
R8	1 Mardy Terrace	15.35	15.38	Negligible	0.03	0%	Neutral	Negligible
R9*	19 Davies Terrace	15.77	15.79	Negligible	0.02	0%	Neutral	Negligible
R10	20 Arfyn Terrace	14.18	14.20	Negligible	0.01	0%	Neutral	Negligible
PR1	Proposed Sensitive Receptor	-	16.88	-	-	-	-	-
PR2	Proposed Sensitive Receptor	-	12.36	-	-	-	-	-
PR3	Proposed Sensitive Receptor	-	10.85	-	-	-	-	-
PR4	Proposed Sensitive Receptor	-	10.97	-	-	-	-	-
PR5	Proposed Sensitive Receptor	-	10.89	-	-	-	-	-
PR6	Proposed Sensitive Receptor	-	10.84	-	-	-	-	-

Receptor		PM_{10} (µg/m³)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
PR7	Proposed Sensitive Receptor	-	14.16	-	-	-	-	-
PR8	Proposed Sensitive Receptor	-	11.07	-	-	-	-	-
PR9	Proposed Sensitive Receptor	-	11.36	-	-	-	-	-
Annual Mean AQO	40 µg/m³							
*Located in the AQMA								

15.5.35 Predicted annual mean ground level $PM_{2.5}$ concentrations were assessed against the AQO of 20µg/m³ as shown in Table 15-14 below.

Table 15-14. Significance at the Identified Sensitive Receptors ($PM_{2.5}$)

Receptor		$PM_{2.5}$ (µg/m³)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R1	9 LLwyncelyn Lane	9.03	9.11	Negligible	0.08	0%	Neutral	Negligible
R2	Residential Property at Lewis Square	8.47	8.53	Negligible	0.06	0%	Neutral	Negligible
R3	57 Graig Road	8.05	8.10	Negligible	0.05	0%	Neutral	Negligible

Receptor		$PM_{2.5}$ ($\mu g/m^3$)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
R4	1 to 12 Morlais Court at Lower High Street	9.42	9.44	Negligible	0.02	0%	Neutral	Negligible
R5	1 to 12 Hywel House at A4054	9.38	9.39	Negligible	0.02	0%	Neutral	Negligible
R6	Education Facility	8.32	8.33	Negligible	0.01	0%	Neutral	Negligible
R7	1 Lincoln Terrace	9.54	9.55	Negligible	0.01	0%	Neutral	Negligible
R8	1 Mardy Terrace	9.91	9.93	Negligible	0.02	0%	Neutral	Negligible
R9*	19 Davies Terrace	10.17	10.18	Negligible	0.01	0%	Neutral	Negligible
R10	20 Arfyn Terrace	9.27	9.28	Negligible	0.01	0%	Neutral	Negligible
PR1	Proposed Sensitive Receptor	-	10.66	-	-	-	-	-
PR2	Proposed Sensitive Receptor	-	8.00	-	-	-	-	-
PR3	Proposed Sensitive Receptor	-	7.19	-	-	-	-	-

Receptor		$PM_{2.5}$ (µg/m^3)						
		Do Minimum 2031	Do Something 2031	Sensitivity	Dev Contribute	% Change of AQO	Impact Magnitude	Significance of Effect
PR4	Proposed Sensitive Receptor	-	7.26	-	-	-	-	-
PR5	Proposed Sensitive Receptor	-	7.21	-	-	-	-	-
PR6	Proposed Sensitive Receptor	-	7.19	-	-	-	-	-
PR7	Proposed Sensitive Receptor	-	9.00	-	-	-	-	-
PR8	Proposed Sensitive Receptor	-	7.32	-	-	-	-	-
PR9	Proposed Sensitive Receptor	-	7.49	-	-	-	-	-
Annual Mean AQO	20 µg/m^3							
*Located in the AQMA								

15.5.36 As indicated in the AQA Technical Report, the likely significant impact on annual mean $PM_{2.5}$ concentration from the development traffic flows is predicted to be of a **negligible** and therefore **not significant** at all identified receptors.

15.5.37 The maximum predicted concentration at any ground floor proposed receptor is not predicted to exceed the AQO for $PM_{2.5}$ and therefore, no additional mitigation is required, and the effect is considered **negligible** and therefore **not significant.**

15.5.38 Background concentrations at each of the ecologically sensitive sites were determined through a review of the NO_X pollutants published on the APIS website.

15.5.39 Table 15-15 presents a summary of the predicted change in NO_X concentrations at relevant receptor locations, due to changes in traffic flow associated with the development, based on modelled 'Do Minimum' and 'Do Something' scenarios.

Table 15-15. Predicted Annual Average Concentrations of NO_X at Ecological Receptor Locations

Ecological Receptor		Predicted Maximum Annual Mean Concentration (µg/m³)				
		Do Minimum 2026 NO_X	Do Something 2026 NO_X	Process Contribution (PC)	PC as %age of AQO	Background
E1	Cwm Glo A Glyndyrys	23.79	24.92	1.13	3.77	11.61
E2	Cwm Glo A Glyndyrys	12.51	12.56	0.05	0.16	11.61
E3	Cwm Glo A Glyndyrys	12.13	12.16	0.03	0.09	11.61
E4	Cwm Glo A Glyndyrys	16.49	16.86	0.37	1.23	11.61
E5	Rhydycar West	42.67	50.02	7.36	24.53	8.3
E6	Rhydycar West	14.82	18.62	3.81	12.70	8.3
E7	Rhydycar West	27.07	31.84	4.77	15.89	8.3
Annual Mean AQO/Critical Level (CL)		**30 µg/m³**				

15.5.40 The maximum predicted increase in the annual average exposure to NO_X at any ecological receptor, due to changes in traffic movements associated with the development, is 7.36 µg/m^3 at Rhydycar West (E5) which is above the 0.40 µg/m^3 development contribution stated within the guidance of 'A Guide to the Assessment of Air Quality Impacts in Designated Nature Conservation Sites', IAQM 2020.

15.5.41 A full nitrogen deposition assessment was undertaken for ecological receptor Cwm Glo A Glyndyrys (E1) and Rhydycar West (E5-E7) due to a development NO_x contribution above 0.40 µg/m^3. There were no predicted significant impacts on nitrogen deposition at E1, E5-E7 as a result of the proposed development.

15.6 Additional Mitigation, Compensation and Enhancement Measures

Construction Phase

15.6.1 With the standard good practice measures included above in Table 15-7, it is not considered that any additional mitigation within the construction phase will be required.

Operational Phase

15.6.2 No additional mitigation is required.

15.7 Assessment Summary and Likely Significant Residual Environmental Effects

Construction Phase

15.7.1 Despite the favourable assessment, mitigation measures to reduce pollutant emission from the proposed development including the promotion of sustainable transport options will be implemented at the site. During the construction and operational phases of the Proposed development residual likely significant impacts are anticipated to be **negligible**, which is considered **not significant**.

Operational Phase

15.7.2 Using the provided traffic data, the effect of the development is predicted to be '**negligible'** at all receptors in both assessment year of 2026 and 2031 which is considered **not significant**.

15.8 Cumulative impacts

Construction

15.8.1 Following the implementation of the standard mitigation measures discussed earlier, there will be no effects from the development that could combine with effects from other developments to lead to cumulative effects during the construction phase. The development will implement best practise mitigation measures in a CEMP for its respective construction phases.

Operation

15.8.2 Using the provided traffic data, the effect of the development is predicted to be '**negligible'** at all receptors in both assessment years of 2026 and 2031, which is considered **not significant**.

15.9 Summary

15.9.1 Prior to the implementation of appropriate mitigation measures, the potential impact description of dust emissions associated with the construction phase of the proposed development is 'medium risk' at the worst affected receptors. However, appropriate site-specific mitigation measures have been proposed based on Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition, Earthworks, Construction and Trackout. It is anticipated that with these appropriate mitigation measures in place, the risk of adverse effects due to dust emissions from the construction phase will be negligible and will not be significant.

15.9.2 Using the provided traffic data, the effect of the development is predicted to be '**negligible'** at all receptors in both assessment year of 2026 and 2031 which is considered **not significant**.



Table 15.16 Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Earthworks	Medium	Large	Negligible	IAQM Guidance on the Assessment of Dust from Demolition and Construction 'Highly Recommended Mitigation Measures'	Negligible	Negligible	High
Construction	Medium	Large	Negligible		Negligible	Negligible	High
Trackout	Medium	Medium	Negligible		Negligible	Negligible	High
Operation							
Impact of NO_2 emissions generated by road vehicles movements during operational phase	Negligible	Neutral	Negligible	None	Neutral	Negligible	High

Impact of PM_{10} emissions generated by road vehicle movements during operational phase	Negligible	Neutral	Negligible	None	Neutral	Negligible	High
Impact of $PM_{2.5}$ emissions generated by road vehicle movements during operational phase	Negligible	Neutral	Negligible	None	Neutral	Negligible	High

Table 15.17 Means by which Additional Mitigation Measure may be Secured

Identified Effect where additional mitigation (Not design mitigation) has been identified	Type of mitigation measures (avoidance, reduction, compensation, enhancement)	Means by which mitigation measure may be secured
Construction		
Fugitive dust emissions from earthworks, construction and trackout.	Avoidance of dust emissions through good working practices.	Adherence to the CEMP.
Operation		
Impact of NO2 emissions generated by road vehicles movements during operational phase	Reduction of road traffic emissions.	Travel Plan measures.
Impact of PM10 emissions generated by road vehicle movements during operational phase	Reduction of road traffic emissions.	Travel Plan measures.
Impact of PM2.5 emissions generated by road vehicle movements during operational phase	Reduction of road traffic emissions.	Travel Plan measures.

15.10 Summary

15.10.1 Prior to the implementation of appropriate mitigation measures, the potential impact description of dust emissions associated with the construction phase of the proposed development is 'medium risk' at the worst affected receptors. However, appropriate site-specific mitigation measures have been proposed based on Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition, Earthworks, Construction and Trackout. It is anticipated that with these appropriate mitigation measures in place, the risk of adverse effects due to dust emissions from the construction phase will be negligible and will not be significant.

15.10.2 Using the provided traffic data, the effect of the development is predicted to be '**negligible'** at all receptors in both assessment year of 2026 and 2031 which is considered **not significant**.

15.10.3 A full nitrogen deposition assessment was undertaken for ecological receptors Cwm Glo A Glyndyrys (E1) and Rhydycar West (E5-E7). There were no predicted significant impacts on nitrogen deposition at E1, E5-E7 as a result of the proposed development and the impacts are considered to be negligible.

15.11 Refences

15.12 Glossary

Term	Definition
ADMS	Atmospheric Dispersion Modelling Software
AQMA	Air Quality Management Area
AQO	Air Quality Objective
ASSI	Areas of Special Scientific Interest
AW	Areas of Ancient Woodland
CLRTAP	Convention on Long-range Transboundary Air Pollution
DM	Do Minimum
DMRB	Design Manual for Roads and Bridges
DS	Do Something
EC	European Commission
LA	Local Authority
LAQM	Local Authority Management Area
LNR	Local Nature Reserves
LWS	Local Wildlife Sites
MTCBC	Merthyr Tydfil County Borough Council
NNR	National Nature Reserves
NO_2	Nitrogen dioxide
NPPF	National Planning Policy Framework

PM	Particulate Matter
PPG	Planning Practice Guidance
SAC	Special Areas of Conservation
SPA	Special Protection Areas
SSSI	Sites of Special Scientific Interest
WHO	World Health Organization

[i]Planning Policy Wales, Welsh Government, Edition 11, February 2021, https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf
[ii] Future Wales: The National Plan 2040, February 2021, Update to Future Wales - The National Plan 2040 (gov.wales)
[iii] The Air Quality Standards (Wales) Regulations, 2010, https://airquality.gov.wales/about-air-quality/standards-and-objectives
[iv] The Air Quality Standards Regulation (2016) https://www.legislation.gov.uk/uksi/2016/1184/contents/made
[v] Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland
[vi] UK Legislation (1995). Environment Act
[vii] UK Legislation (2021). Environment Act
[viii] Local Air Quality Management Technical Guidance LAQM. TG16, DEFRA, 2021
[ix] Institute of Air Quality Management, (2017). Land-Use Planning & Development Control: Planning For Air Quality v1.2.
[x] Well-being of future generations (Wales) Act 2015, https://gov.wales/sites/default/files/publications/2019-08/well-being-of-future-generations-wales-act-2015-the-essentials.pdf#:~:text=The%20Well-being%20of%20Future%20Generations%20%28Wales%29%20Act%20is,prevent%20problems%20and%20take%20a%20more%20joined-up%20approach.
[xi] Institute of Air Quality Management (2014). Guidance on the assessment of dust from demolition and construction.
[xii] Institute of Air Quality Management (2020). A guide to the assessment of air quality impacts on designated nature conservation sites.
[xiii] Ecological Assessment of Air Quality Impacts, CIEEM, January 2021, https://cieem.net/wp-content/uploads/2020/12/Air-Quality-advice-note.pdf
[xiv] Merthyr Tydfil County Borough Council, 2020 Air Quality Annual Report, https://www.merthyr.gov.uk/media/6247/air-quality-progress-report-2020.pdf
[xv] Merthyr Tydfil County Borough Council Replacement Local Development Plan (2016 - 2031) (Adopted January 2020, https://www.merthyr.gov.uk/media/5642/replacement-ldp-written-statement-final-composite-version-140120.pdf
[xvi] Highways Agency et al. (2007) Design Manual for Roads and Bridges (DMRB) Volume 10 Environmental Design and Management.

16.0 Lighting

16.1 Introduction

16.1.1 This chapter considers the impact of the development from lighting at and within the vicinity of the proposed mixed-use leisure development at Rhydycar West, Merthyr Tydfill.

16.1.2 The chapter sets out the methodology followed in undertaking the assessment and provides a review of existing lighting in the area of the development site and surrounding area. Within this Chapter an assessment of lighting from the operational phase from both internal and external lighting has been undertaken. Lighting within the construction phase is also discussed.

16.1.3 A separate technical report is presented in Appendix 16.1 which considers the detailed results at sensitive residential and ecological receptors as well as the indicative lighting design.

16.1.4 Where relevant, mitigation measures are proposed to minimise the impacts of the proposed development during both the construction and operational phases of the scheme. The expected residual effects of the proposals are then stated. However, the assessment has also detailed the measures taken at the design stages to limit the requirement for further mitigation.

16.2 Executive Summary

16.2.1 This assessment has considered the lighting impacts on the surrounding residential, ecological and dark sky receptors based on an indicative lighting design developed to the relevant British Standards and guidance.

16.2.2 The technical assessment has concluded that the risk of the proposed development resulting in exceedances of either the ILP pre-curfew or post-curfew obtrusive light limitations at sensitive ecological receptors and local residential receptors will be low, and overall, the impact on surrounding residential and ecological receptors will be negligible.

16.2.3 The indicative lighting scheme has been developed in accordance with the lighting design standards and design mitigation measures to ensure minimal effect on the surrounding sensitive residential, ecological and dark sky receptors. It is considered that any detailed lighting scheme will consider these standards and receptors.

16.2.4 Given the construction and operational design mitigation measures, which are best practice measures in accordance with the British Standard and guidance, the overall effects will be negligible upon sensitive residential, ecological and dark sky receptors.

16.2.5 With implementation of the design mitigation measures in Section 16.5, it is considered that the overall effects during the operational phase of the Proposed Development at the sensitive residential, ecological and dark sky receptors will be ‘negligible and the magnitude of impact ‘negligible’.

16.3 Methodology and Scope

Legislative Framework

16.3.1 Light pollution was introduced within the Clean Neighbourhoods and Environment Act (2005) as a form of statutory nuisance under the Environmental Protection Act (1990), which was amended to include the following definition:

"[…] (fb) artificial light emitted from premises so as to be prejudicial to health or a nuisance […]"

16.3.2 Although light was described as a statutory nuisance, no prescriptive limits or rules have been set. Guidance within the national guidance with regards to Light pollution has been referred to while producing this assessment as well as documents produced by the International Commission on Illumination (CIE), Institution of Lighting Professionals (ILP) and the Chartered Institute of Building Services Engineers (CIBSE).

National Standards

16.3.3 The appropriate lighting design criteria for the scheme are contained within:

- BS EN 12464-2: Lighting of Work Places – Outdoor Work Places, 2014;
- BS 5489-1: Code of Practice for the Design of Outdoor Lighting – Lighting of Roads and Public Amenity Areas, 2013; and,
- BS EN 13201-2: Road Lighting – Performance Requirements, 2020.
- Good lighting design also includes luminaires that have been selected to minimise light intrusion and glare to pedestrians and drivers, as discussed within the ILP document "Guidance Notes for the Reduction of Obtrusive Light". And the ILP 'Guidance note 08/18 Bats and Artificial Lighting in the UK.'

National Guidance

16.3.4 The Institute of Lighting Professionals (ILP) 'Bats and artificial lighting in the UK Guidance Note 08/18 details the sensitivity of bats and what lux levels should be achieved for specific species of bats and how to mitigate effects of obtrusive light on bats.

16.3.5 The Institute of Lighting Professionals (ILP) 'Guidance Note for the Reduction of Obtrusive Light' GN01/2021 is designed to aid the understanding and assessment of obtrusive light at local planning level.

16.3.6 The document explains the various forms of obtrusive light, including light spill, light trespass, sky glow and glare. The document defines five environmental zones, E0~E4, and provides limitations on the various forms of obtrusive light according to each zone.

16.3.7 The ILP has developed an Environmental Zone classification system for the categorisation of residential (human) receptor within ILP Guidance Note GN01/21 'The Reduction of Obtrusive Light'. This is summarised in Table 16.1.

Table 16.1 Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5+)	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 t 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town/city centres with high levels of night-time activity

16.3.8 For each Environmental Zone, recommended obtrusive light limits for exterior lighting installations have also been determined. These are summarised in Tables 16.2 to 16.4. Table 16.2 shows the maximum allowable illuminance in the vertical plane for each Environmental Zone for pre-curfew scenarios (after 07:00 hours) and post-curfew scenarios (after 23:00). Table 16.3 shows the maximum allowable luminous intensity emitted by the luminaires relative to the position of each luminous intensity receptor location depending on what the Environmental Zone is. Table 16.4 shows the maximum allowable Upward Light Ratio (ULR) for each Environmental Zone. If the modelled maximum values of vertical illuminance, the modelled maximum luminous intensity and the ULR are below the criteria in the tables below, they pass the assessment.

Table 16.2 Maximum Values of Vertical Illuminance on Properties

Light technical parameter	Application conditions	Environmental Zone				
		E0	E1	E2	E3	E4
Illuminance in the vertical plane (Ev)	Pre-curfew	n/a	2 lx	5 lx	10 lx	25 lx
	Post-curfew	n/a	<0.1 lx*	1 lx	2 lx	5 lx

Table 16.3 Limits for the Luminous Intensity of Bright Luminaires

Light technical parameter	Application conditions		Luminaire group (projected area Ap in m^2)					
			$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p>0.5$
Maximum luminous intensity emitted by luminaire (I in cd)	E0	Pre-curfew	0	0	0	0	0	0
		Post-curfew	0	0	0	0	0	0
	E1	Pre-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	2,500
		Post-curfew	0	0	0	0	0	0
	E2	Pre-curfew	0.57 d	1.3 d	2.5 d	5.0 d	10 d	7,500
		Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	500

Light technical parameter	Application conditions		Luminaire group (projected area Ap in m^2)					
			$0<A_p \leq 0.002$	$0.002<A_p \leq 0.01$	$0.01<A_p \leq 0.03$	$0.03<A_p \leq 0.13$	$0.13<A_p \leq 0.50$	$A_p>0.5$
	E3	Pre-curfew	0.86 d	1.9 d	3.8 d	7.5 d	15 d	10,000
		Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	1,000
	E4	Pre-curfew	1.4 d	3.1 d	6.3 d	13 d	26 d	25,000
		Post-curfew	0.29 d	0.63 d	1.3 d	2.5 d	5.1 d	2,500
Aid to gauging Ap			2 to 5cm	5 to 10cm	10 to 20cm	20 to 40cm	40 to 80cm	>80cm
Geometric mean of diameter (cm)			3.2	7.1	14.1	26.3	56.6	>80
Corresponding AP representative area (m2)			0.0008	0.004	0.016	0.063	0.251	>0.5

16.3.9 NOTE:

'd' is the distance between the observer and the glare source in meters;

A luminous intensity of 0 cd can only be realised by a luminaire with a complete cut off in the designated directions;

P is the apparent surface of the light source seen from the observer position;

For further information refer to Annex C of CIE 150

Upper limits for each zone shall be taken as those with column Ap>0.5

Table 16.4 Maximum Values of Upward Light Ratio (ULR) of Luminaires

Light technical parameter	Environmental Zone				
	E0	E1	E2	E3	E4
Upward light ratio (ULR)/%	0	0	2.5	5	15

16.3.10 The assessment has determined the lighting levels and Environmental Zone classification in the vicinity of the proposed development. Modelling of the indicative lighting scheme was undertaken and the predicted obtrusive light values compared with the relevant guidelines, as detailed within Tables 16.2 to 16.4.

16.3.11 The roads have been illuminated in accordance with the relevant legislation from the BS 5489-1 'Code of Practice for the Design of Outdoor Lighting – Lighting of Roads and Public Amenity Areas'. Table 16.5 shows the relevant guidance when lighting roads and pedestrianised areas.

Table 16.5 P Lighting Class

Class	Horizontal Illuminance		E_0 GR_L	
	$\bar{E}$ a [minimum maintained] lx	$Emin$ [maintained] lx	$Evmin$ [maintained] lx	$Escmin$ [maintained] lx
P1	15,0	3,00	5,0	5,0
P2	10,0	2,00	3,0	2,0
P3	7,50	1,50	2,5	1,5
P4	5,00	1,00	1,5	1,0
P5	3,00	0,60	1,0	0,6
P6	2,00	0,40	0,6	0,2

P7	Performance not determined	Performance not determined		
a – To provide for uniformity, the actual values of the maintained average illuminance shall not exceed 1,5 times the minimum E value indicated for the class				

Best Practice Design

16.3.12 As well as meeting the statutory design standards outlined in section 16.3.3 and within Section 2.3 of Technical Appendix 16.1, the indicative lighting scheme has sought to meet a number of criteria to ensure that the environmental effects of artificial lighting are managed to a high standard. These criteria are:

- All external lighting schemes must not have an upward lighting ratio (ULR) of more than 0.0%;
- All new column mounted luminaires shall be fitted with flat glass where appropriate to aid 0.0% upward light discharge;
- Where appropriate, luminaires on the site boundary will be fitted with light baffles to prevent light spill.
- Where possible, lighting will be controlled via Central Management System (CMS) time and light level sensors with controls capable of being adjusted and remotely set to adapt to local needs as required.

National and Local Policy Background

16.3.13 Well-being of Future Generations (Wales) Act provides legislative requirement to achieve sustainable development.

16.3.14 The Development Plan for the area comprises Future Wa–es - The National Plan 2040 and the Merthyr Tydfil Replacement Local Development Plan 2016 – 2031. Future Wales is the national development framework, setting the direction for development in Wales to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonization and climate-resilience, developing strong ecosystems and improving the health and well-being of our communities.

16.3.15 Planning Policy Wales (PPW) (Edition 11) updated February 2021 provides national policy guidance for Wales.

16.3.16 Following a review of the Well-being of Future Generations (Wales) Act 2015 and Future Wales, no relevant lighting policies were identified.

16.3.17 Following a review of the adopted Merthyr Tydfil Replacement Local Development Plan 2–16 - 2031, the following policies were identified as being relevant to potential light impacts associated with the proposed scheme:

"Policy SW11: Sustainable Design and Placemaking
Planning permission will be granted…where it has been demonstrated that:

[…]and create good quality townscape; not result in an unacceptable impact on local amenity, loss of light or privacy, or visual impact, and incorporate a good standard of landscape design […]

Policy ENW4: Environmental Protection

Development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and / or the natural environment from either:

[…] Noise, vibration, dust, odour nuisance and light pollution […]"

Planning conditions may be imposed, or legal obligation entered into, to secure any necessary mitigation and monitoring processes.

16.3.18 Planning Policy Wales (PPW) (Edition11) updated February 2021 sets out land use planning policies of the Welsh Government. In regard to lighting, Paragraph 6.8 states that:

"There is a need to balance the provision of lighting to enhance safety and security to help in the prevention of crime and to allow activities like sport and recreation to take place with the need to:

- *protect the natural and historic environment including wildlife and features of the natural environment such as tranquillity;*
- *retain dark skies where appropriate; Distinctive & Natural Places Planning Policy Wales | Edition 11 p.160*
- *prevent glare and respect the amenity of neighbouring land uses; and*
- *reduce the carbon emissions associated with lighting.*

Dark sky reserves exist in various parts of Wales, including Snowdonia, Brecon Beacons and the Elan Valley. Dark sky reserves can contribute positively to an area in economic and environmental terms and their characteristics should be taken into account when preparing development plan strategies and policies and when considering individual development proposals.

Lighting to provide security can be particularly important in rural areas or for specific purposes such as defence or to create calming environments. Where this is the case, planning authorities should adopt policies for lighting, including the control of light pollution, in their development plans.

Planning authorities can attach conditions to planning permissions for new developments that include the design and operation of lighting systems, for example, requiring energy-efficient design and to prevent light pollution.

Scoping Assessment Stage

16.3.19 A Scoping opinion was received on the 16th of July 2021, as shown in Appendix 2.2. The Scoping opinion included the following statement:

"Planning Policy Wales (PPW) (Edition11) Paragraph 6.8 also needs to be addressed in the ES. Given the extremely sensitive setting and location of the development, vertical and horizontal light spillage diagrams/details (both within and outside the site) need to be provided. Light spillage not only needs to be assessed from external sources but also internally from the buildings/structures themselves. A night/sky glow assessment would also be required. As PPW points out there is also a need to reduce carbon emissions associated with lighting. Therefore, this assessment needs to be undertaken and included in the 'Sustainability and Climate Change' topic area."

Assessment Methodology

Receptor Sensitivity

16.3.20 Receptors can demonstrate different sensitivities to changes in their environment. Sensitivity has been determined as High, Medium or Low, as detailed in Table 16.6

16.3.21 During the site survey, key residential dwellings were identified which have the potential to be affected by obtrusive light from the proposed development. These receptors are considered worst-case as they are the closest residential receptors to the site that have the potential to be affected by the proposed development. (Figure 16.2)

16.3.22 Following consultation with the project Ecologists, it has been determined that the main bat flight corridors in the baseline conditions are located east-west along the stream courses and dismantled railway/mineral lines and north-south following the downslope sides of tips and the corresponding woodland edges. There are no known bat flight paths through the proposed development area, therefore, the bats will continue to use the existing flight paths around the boundary of the site. The lighting design has taken this into account by limiting the amount of light spill outside of the red line area.

16.3.23 Ecological receptor locations were confirmed by the project ecologist and have been included at 34 points and within the boundary of the site as well as dark corridor zones (Figure 16.1). Ecological receptors include locations where there are potential bat roosts.

16.3.24 Dark Skies have also been assessed to determine the potential impacts of upward light from the development on the surrounding areas landscapes. These Dark Sky Zones have been assessed by calculating the overall proportion of upward light from the site, also known as Sky Glow.

Table 16.6 Criteria for Assessing Sensitivity of Receptors to Light

Sensitivity	Example of Receptor
High	Residential properties within ILP Environmental Zone E0 & E1. Ecological receptors. Intrinsically dark landscapes (ILP Environmental Zone E0 & E1).
Moderate	Residential properties within ILP Environmental Zone E2. Low district brightness area (ILP Environmental Zone E2) e.g. small town centres or urban locations.
Low	Residential properties within ILP Environmental Zone E3 & E4. High district brightness area (ILP Environmental Zone E3 & E4) e.g. Town/city centres with high levels of night-time activity.
Negligible	All other premises that fall outside of the scope described above

Magnitude of Impact

16.3.25 Magnitude (scale of change) is determined by considering the predicted deviation from approved baseline conditions and relation to relevant guidelines. Quantifiable assessment of magnitude has been undertaken using the criteria detailed in Table 16.7.

Table 16.7 Criteria for Assessing the Magnitude of Light Impact

Magnitude of Impact	Assessed Effect Level
Major	Major increase in the level of light spill and glare on to surrounding areas and illuminance levels at the windows of residential receptors, and would result in a major effect on baseline conditions significantly in excess of the recommended ILP guidance levels.
Moderate	An increase in the level of light spill and glare on to surrounding areas and illuminance levels at the windows of residential receptors that would still result in a noticeable effect on baseline conditions in excess of the recommended ILP guidance



	levels. Lighting levels at ecology receptors above 1.0lux
Minor	Minor increase in the level of light spill and glare on to surrounding areas and illuminance levels at the windows of residential receptors, would cause a minor perceptible change in baseline conditions which are slightly above recommended ILP guidance levels but where current uses could still be maintained.
Negligible	No increase or decrease in the level of light spill and glare onto surrounding areas and illuminance levels at the windows of residential receptors and would cause no discernible effect to current baseline conditions. Lighting levels at ecology receptors below 1.0lux

Significance Criteria

16.3.26 The interaction of magnitude and sensitivity is used to determine the significance of an environmental effect, as illustrated in Table 16.8

Table 16.8 Significance of Effects Matrix

Magnitude of Impact	Sensitivity of Receptor			
	High	Medium	Low	Very Low
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible

16.3.27 A lighting effect will be considered to be significant in EIA terms where the significance of effect is assessed to be ‘moderate’ or ‘major’.

Assumptions and Limitations

16.3.28 The indicative lighting scheme for the Proposed Development has been designed in accordance with the previously outlined standards, following consultation with project architects for the Proposal.

16.3.29 The indicative design of the lighting has been undertaken in a manner such as to address two potentially conflicting needs; to provide a safe and secure environment for the visitors to the site and staff, with optimum lighting of the proposal when the natural lighting levels fall; and, to meet the light obtrusion limitations as stated within the relevant standards and minimise detrimental impacts on local ecological receptors.

16.3.30 As the proposals are in outline, the lighting scheme designed is an indicative scheme and is expected to be revised once the final lighting supplier is confirmed. However, it is deemed sufficient to use in the assessment of impacts on surrounding receptors as it will highlight areas of potential conflict. Any additional luminaires introduced in a revised scheme will follow the lighting design measures outlined in section 16.3.3 as well as the indicative design elements detailed within Appendix 16.1, and will therefore not result in a change of the overall lighting significance.

16.3.31 The lighting model is only able to accurately represent the effects of solid structures such as buildings and walls on light spill. Non-solid barriers such as trees and hedges cannot be accurately modelled and therefore the effects of these are dealt with qualitatively outside the model calculations. This is undertaken through consideration of the potential effects the hedges and trees would have in reducing the amount of light spill in the event of exceedances of the ILP criteria.

16.3.32 Internal lighting from the proposed sport and leisure centre and hotels have also been included. At this stage, full details of internal layouts have yet to be developed, as such a worst-case assessment has been undertaken assessing an internal LED light on the external façade where a window would be located. Full details of internal lighting and location would be required for a more detailed assessment.

16.4 Baseline Environment

Existing baseline

16.4.1 Baseline lighting conditions were determined during a site survey of the assessment area. A visual assessment of the existing artificial lighting within the assessment area was undertaken in order to identify the locations of lighting columns, their estimated heights and luminaire/lamp types currently employed.

16.4.2 A baseline light survey was undertaken on the 12th of March 2018. An initial survey was undertaken between 19:30 hours and 22:30 hours to establish the existing pre-curfew lighting conditions and a further survey was undertaken after 23:00 to determine existing post curfew conditions. It should be noted that conditions were not expected to change between the pre-curfew and post-curfew periods.

16.4.3 A recent review of the area has concluded that the site surroundings and existing lighting has remained unchanged, and therefore the 2018 baseline results are still considered to be robust and representative of current conditions.

16.4.4 The main existing light sources surrounding the site are from road and vehicle lighting along the A470 to the east of the proposed site and further existing lighting from nearby residential buildings and streetlights.

Table 16.8 Baseline Light Monitoring Locations

Reference	Monitoring Location
L1	Northern boundary of site
L2	Northern boundary of site
L3	North-west within site boundary
L4	North-west within site boundary
L5	Within site boundary
L6	Within site boundary
L7	Eastern boundary of site
L8	Within site boundary
L9	Eastern boundary of site
L10	Eastern boundary of site
L11	Within site boundary
L12	Within site boundary
L13	South-west outside site boundary

L14	South-west outside site boundary
L15	South-west along site boundary
L16	Southern boundary outside of site
L17	Southern boundary outside of site
L18	Southern boundary of site
L19	Eastern boundary of site
L20	East of site boundary

Future baseline

16.4.5 For the purpose of this report and the development of the indicative lighting design, the future site baseline will be considered an Environmental Zone E1 – Dark area with the potential for pockets of low district brightness (Zone E2) on areas adjacent to the hotel and restaurants. However the assessment has been based on the E1 criteria.

16.4.6 It is considered that the future baseline at the identified receptors will be broadly similar to the existing baseline given the proximity / relationship of residential dwellings to the local road network and associated lighting columns.

16.5 Mitigation within the Submitted Design

Construction

16.5.1 During the construction phase of the Proposed Development, it is highly likely that temporary illumination will be required for the purpose of site safety and security during the hours of darkness, for both site operatives and the general public. Typically, this may include bulkhead type luminaires mounted to fencing and hoardings around the perimeter of the site, together with building or column mounted area floodlights lighting the main site area.

16.5.2 The Construction Industry Research and Information Association (CIRIA) provide good practice guidance documents noting that lighting on construction sites is typically required as part of on-site health and safety requirements. The document also highlights the potential adverse impacts upon surrounding sensitive receptors and the need to minimise these effects through the controlled application of lighting, in accordance with current standards.

16.5.3 BS EN 12464-2 provides the British standards to be achieved for construction lighting in outdoor spaces. The lighting required is based on visual comfort, visual performance, and safety.

16.5.4 The temporary lighting should be treated as a permanent installation, with regards to the design process and adopted design guidance, to ensure that potential obtrusive light related issues are avoided. In general, the ILP GN01:2021 guidance on obtrusive light should be adhered to, thereby limiting the amount of upward light (ULR) to prevent sky glow, spill light into neighbouring properties and to avoid light trespass.

16.5.5 The type of equipment employed, including lamp type and optics, should be carefully selected to provide a controlled distribution of light, within the site boundary, whilst limiting the luminous intensity to below 2,500 cd, as required for an Intrinsically Dark zone (Zone E1).

16.5.6 Avoid direct light being projected outside of the boundary. The type of floodlights employed should have Type C asymmetric reflectors (GN01:2021), with a flat glass lens, and be mounted with the glass parallel to the ground (zero-degree tilt). Wide angle, symmetric floodlights mounted at low level, with a high tilt angle should not be used as the majority of the light is at or above the horizontal creating excessive glare and obtrusive light within the environment.

16.5.7 These mitigation measure are common practice and would be expected for most construction sites based on BS EN 12464-2 and the ILP GN01:2021 Guidance on obtrusive light.

Operational Phase

16.5.8 The long-term operational phase of the proposed development will require exterior lighting for safe movement for vehicles, cyclists and pedestrians.

16.5.9 Exterior lighting of the road network has been included as this will form the majority of the exterior lighting within the Site and is necessary to ensure safe movement during hours of darkness, whilst helping to promote a greater feeling of safety and security at night.

16.5.10 It should be noted that indicative internal lighting has also been included within the lighting modelling and assessment. Where possible, internal lighting will be located at central locations within rooms away from windows in order to minimise light spill to external areas.

16.5.11 The indicative lighting design has not illuminated all road sections to keep areas intrinsically dark and it is common practice at the detail design stage to implement controls which would only activate lighting in these zones in response to pedestrian or vehicle movement.

16.5.12 In order to prevent light spill on sensitive receptors including dark skies, the indicative lighting design has some areas illuminated using dark sky bollards, 4000k temperature luminaires, and directional luminaires angled towards the ground to limit upward sky glow, in accordance with the recommendations of the ecological consultants, and in order to keep the light contained at low level.

16.5.13 In addition to this, warmer temperature lights have been used in this indicative design to decrease the effect of any light spill for any bats roosting or foraging in the surrounding area.

16.5.14 The proposed development maintains hedges, trees and other such natural features around the perimeter and within the Site boundary, which help to reduce the spread of light trespass across boundaries whilst creating visual barriers to the Site.

16.5.15 It is considered that the indicative design measures detailed above are all appropriate and achievable at the detailed design phase.

16.6 Negligible Effects of the Scheme

Construction Phase Effects

16.6.1 Given the construction mitigation measures detailed above, which will be controlled through the CEMP, it is considered that the effects upon sensitive residential, ecological and dark sky receptors will be minor, resulting in a negligible, short-term and reversible effect, which is not considered to be significant.

16.6.2 Any installation of lighting during the construction phase will be temporary and only installed during the construction phase.

Operational Phase Effects

16.6.3 Following computer modelling of the proposed indicative external and internal lighting scheme using DIALux 4.13 lighting modelling software, the proposed impacts at the residential receptors, ecological receptors and the effects on dark skies have been assessed.

16.6.4 It should be noted, as stated within the assumptions and limitations section, that internal lighting from the proposed development has been assumed based on standard LED luminaires used on external facades. At this stage, full internal layouts of the amenity areas are yet to be development. This is considered to be a worst-case assessment as the modelling has assumed that all amenity areas will be illuminated internally at the same time with no consideration for curtains, blinds or glazing.

16.6.5 Full details of the illuminance levels at each assessed receptors are detailed within Appendix 16.1.

Residential Receptors

16.6.6 The sensitivity of all receptors is high and the magnitude of impact, following design mitigation, is minor adverse as the ILP pre-curfew and post-curfew criteria for Environmental Zone E1 of 2 and <0.1 lux respectively, are not predicted to be exceeded as a result of the development. As such, the impact of the proposed development is predicted to be negligible with respect to local sensitive residential locations. The effect of the development will be ‘negligible and the magnitude of impact ‘negligible’, which is not considered to be significant.

16.6.7 The impacts of the proposed development on the surrounding sensitive residential receptors will be negligible.

Ecological Receptors

16.6.8 As illustrated in Appendix 16.1, light trespass associated with the proposed development does not exceed 1 lux at any of the modelled ecological locations across the site and surrounding area. As such the proposed development is not predicted to result in any significant adverse impacts with respect to local sensitive ecological receptors. The sensitivity of the ecological receptors is considered High, and the magnitude of impact negligible, as a result the significance of the development on ecological receptors is considered negligible.

16.6.9 The operational effects of the Proposed Development on the surrounding sensitive ecological receptors will be negligible.

Dark Skies

16.6.10 Modelled upward light predicts a sky glow figure (ULR) of 0.0% with the ILP sky glow limitation for an area classified as Environmental Zone E1. As such the indicative lighting scheme meets the ILP sky glow limitations and, therefore, will not result in adverse effects on the dark sky landscape.

16.6.11 The sensitivity of the dark sky is considered high, and the magnitude of impact negligible, as a result the significance of the development on dark skies is considered negligible.

16.6.12 The effects of the proposed development in terms of dark sky on surrounding sensitive receptors will be negligible.

16.7 Additional Mitigation, Compensation and Enhancement Measures

Construction Phase

16.7.1 No additional mitigation measures other than those detailed within the lighting design measures embedded within the CEMP are required during the construction of the proposed development.

Operational Phase

16.7.2 Section 16.5 details the type of lighting equipment utilised within the indicative modelling, the design standards and indicative design measures for the development. During the detailed design stage, a detailed lighting layout will be produced with consideration given to the location and directionality of luminaires, as well as the potential suitability of features such as optic controls, cowls, shields, baffles, and louvres.

16.7.3 The detailed lighting design will be developed in accordance with the design measures in section 16.5 as well as the design standards within section 16.3.3. This can be subject of a planning condition. Following this there will be no change in the overall lighting significance.

16.8 Negligible Residual Environmental Effects

Construction Phase

16.8.1 In terms of construction lighting levels, the results of the assessments indicate that following best-practice measures within the CEMP, the lighting impacts are expected to result in effects with a negligible impact magnitude and the sensitivity of the receptors have been assessed as high, therefore the overall effect will be negligible.

Operational Phase

16.8.2 Following the design mitigation measures above and given that no additional mitigation measures are required at this stage, it is considered that the overall residual effects of the sensitive residential, ecological and dark sky receptors will be 'negligible and the magnitude of impact 'minor', which is not considered to be significant.

16.8.3 The effects of the Proposed Development on the surrounding sensitive receptors during the construction phase is expected to be negligible.

16.8.4 It should be noted as stated within the limitations and assumptions section that the effects of non-solid structures such as trees and hedgerows have not been taken into account within the models. These non-solid structures have the ability to block and act as a barrier to light further reducing the potential for light spill and any subsequent significance of effects on residential, ecological and dark sky receptors. The assessment is accordingly worst-case and these will be considered in more detail at the detailed design stage.

16.8.5 Also as discussed within the limitations and assumptions section, all internal lighting has been assumed as worst case, assuming one light per window on the outer façade as detailed internal layouts and a detailed internal lighting scheme is yet to be finalised.

16.8.6 It is expected that during the night-time when internal lights will be on, some windows would have curtains drawn or blinds closed within the hotel rooms, thus further reducing the effects of internal lighting on the external environment. The impact of curtains or blinds has not been taken into account in the assessment and it is accordingly worst-case and these will be considered at the detailed design stage

16.9 Cumulative Impacts

Construction Phase

16.9.1 There are not expected to be any simultaneous, large-scale construction projects within 1km of the development site, following a review of the cumulative sites. As such, there are not expected to be any cumulative impacts relating to lighting during the construction phase of the development and the overall effects of the cumulative impact from surrounding developments are negligible.

16.9.2 It is considered that any construction lighting from cumulative developments similarly to the construction lighting from this proposed development, will follow best practice measures within the Construction Environmental Management Plan as well as the Construction Industry Research and Information Association (CIRIA) provide good practice guidance documents and British Standards.

16.9.3 As such the overall cumulative impacts with the proposed development are considered to result in effects with a Negligible impact magnitude and the sensitivity of the receptors have been assessed as high, therefore the effect will be negligible.

Operational Phase

16.9.4 A review of the potential future developments surrounding the site has been undertaken. The closest potential future development to the Site is the 'Allocated Hoover Site 1' which is located approximately 800m east of the proposed development. This site is also located on the eastern side of the A470 and due to the distance and lighting in the area around 'Allocated Hoover Site 1' there is not expected to be any cumulative impacts relating to lighting during the operational phase of the proposed development.

16.9.5 Other nearby cumulative sites are over 1km from the site boundary. As such it is considered that the effect of light spill on sensitive residential and ecological receptors will be negligible.

16.9.6 Additionally, all lighting designs for the cumulative schemes should be developed in accordance with the applicable policies, guidance and standards, as detailed within this document (or any replacement thereof)) further ensuring that the overall cumulative effects of the scheme will be negligible.

16.9.7 There is potential for cumulative contributions to sky glow on dark sky receptors in the local area associated with all the cumulative developments, including LDP allocations, in the area together with the proposed development. It should be noted that the proposed development has 0.0% of upward light ratio, and given the dark sky area and baseline monitoring, most cumulative schemes will also be required to achieve 0.0% upward light This can be achieved with the implementation of best practice lighting designs that minimise upward light loss and reflected light and designs are likely to be controlled via the planning process. Therefore, there is likely to be only a negligible direct, permanent, long-term effect.

16.10 Summary

16.10.1 Baseline lighting conditions were determined during a site survey of the assessment area. A visual assessment of the existing artificial lighting within the assessment area was undertaken to identify the locations of lighting columns, their estimated heights and luminaire/lamp types currently employed. The site was determined to be in the E1 Environmental Zone.

16.10.2 The technical assessment has concluded that the risk of the proposed development resulting in exceedances of either the ILP pre-curfew or post-curfew obtrusive light limitations at sensitive ecological receptors and local residential receptors will be low, and overall, the impact on surrounding residential and ecological receptors will be negligible during both the construction and operational phases.

16.10.3 The indicative lighting scheme for the operational phase has been developed in accordance with the lighting design standards and design mitigation measures are incorporated to ensure minimal effect on the surrounding sensitive residential, ecological and dark sky receptors. These standards and measures will also be considered further at detailed design stage.

16.10.4 With implementation of the construction mitigation design measures detailed within Section 16.5, which are best practice measures in accordance with the British Standard and guidance, the overall effects upon sensitive residential, ecological and dark sky receptors will be negligible.

16.10.5 Following the design mitigation measures above it is considered that the overall effects during the operational phase of the Proposed Development at the sensitive residential, ecological and dark sky receptors will be 'negligible' and the magnitude of impact 'negligible'.

Table 16.10 Assessment Summary and Residual Environmental Effects

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Temporary light spill Temporary Illumination of bat foraging and commuting routes	Medium	Negligible	Minor negative, short-term, reversible	No additional mitigation required above that already detailed in section 12.3.3 and 12.5	Negligible	Negligible negative, short-term, reversible	High
Operation							
Permanent Lighting Human Receptors	Medium	Negligible	Minor negative, short-term, reversible	No additional mitigation required above that already detailed in section 12.3.3 and 12.5	Negligible	Negligible negative, short-term	High
Permanent Lighting Ecological Receptors	High	Negligible	Moderate negative, long-term, reversible	No additional mitigation required above that already detailed in section 12.3.3 and 12.5	Negligible	Negligible negative, short-term	High
Permanent Lighting Dark Sky Receptors	High	Negligible	Moderate negative, long-term, reversible	No additional mitigation required above that already detailed in section 12.3.3 and 12.5	Negligible	Negligible negative, short-term	High

16.11 Refences

16.11.1 The Institution of Lighting Professionals (2020) Guidance Notes for the Reduction of Obtrusive Light.

16.11.2 National Planning Policy Framework (2021) Ministry of Housing, Communities & Local Government.

16.11.3 Planning Practice Guidance (2019) Light Pollution, Ministry of Housing, Communities & Local Government.

16.11.4 British Standards Institute (2013) Code of Practice for the Design of Outdoor Lighting - Lighting of Roads and Public Amenity Areas.

16.11.5 The Institution of Lighting Professionals (2013) PLG 04- Guidance on Undertaking Environmental Lighting Impact Assessments.

16.11.6 Planning Policy Wales Edition 11 (2021) – Paragraph 6.8 – Guidance on Lighting.

16.11.7 The Institution of Lighting Professionals (2018) Bats and artificial lighting in the UK, Bat Conservation Trust.

16.12 Glossary

Term	Definition
CIBSE	Chartered Institute of Building Services Engineers
CIE	Commission on Illumination
ILP	Institution of Lighting Professionals
LDF	Local Development Framework
LP	Local Plan
CS	Core Strategy
DPD	Adopted Development Plan Documents
SPD	Adopted Supplementary Planning Documents
SG	Endorsed Supplementary Guidance Documents

NGR	National Grid Reference
PPS	Planning Policy Statement
PPW	Planning Policy Wales
NPPF	National Planning Policy Framework
Lx	Lux
ULR	Upward Lighting Ratio



17.0 Human Health Impact Assessment

17.1. Introduction & Executive Summary

17.1.1. This chapter defines the study area, the methodology used for developing the impact assessment, and provides a description of the baseline environment and impacts in relation to human health and wellbeing. Where relevant it also identifies and proposes mitigation measures to address potential impacts of the Scheme on human health and wellbeing during construction, and operation.

17.1.2. This chapter presents a summary of the information on health and wellbeing provided in Chapter 5: Community and Socio-Economic; Chapter 9: Transportation and Movement; Chapter 14: Noise, Acoustics and Vibration; and Chapter 15: Air Quality of this Environmental Statement.

17.1.3. The proposed scheme is a mixed-use tourism and leisure resort development. This consists of an Indoor Snow Centre, Indoor Tropical Waterpark, Indoor and Outdoor Adventure Centre, external activity areas, Resort Hotel accommodation (up to 418 bedrooms), Woodland Lodge accommodation (up to 30 units), car parking (up to 830 spaces) and associated earthworks, access, drainage, servicing and utilities connections/infrastructure.

17.1.4. As the proposed development is a mixed-use leisure and tourism scheme, there are multiple known health benefits that the local area and its population could benefit from with its completion. The site will include an Indoor Snow Centre, Water Park and Indoor and Outdoor Adventure Centres; all allowing visitors to participate in physical exercise. These sports facilities can help to increase activity and promote healthier lifestyles. Engaging in physical exercise and movement also promotes a range of mental and psychological benefits such as increased happiness and reduced stress. The scheme also seeks to create new footpaths through the site to encourage walking and active travel and to complement a number of rights of way which have recently been established as a result of an application to modify the definitive map and a positive dialogue and collaboration between the landowners and MTCBC.

17.1.5. The project's stakeholders include Snowsport Wales and GB Snowsport, and operator, who all have clear commitments to support increased participation in snow sports. This is particularly important both in terms of encouraging participation but also the profile of the area as a location for both leisure activity and as part of a wider strategy to support elite snow sports and training as part of Snowsport Wales and GB Snowsport's wider strategies.

17.1.6. In addition, the Rhydycar West project would complement a range of existing facilities which deliver and promote active lifestyles and participation in outdoor sporting and leisure activities. These include BikePark Wales, Zip World and wider activity within the Brecon Beacons and surrounding area covering walking and climbing. As such the investment adds to the potential range of opportunities for both residents and visitors to pursue healthier lifestyles. Accessibility and affordability are key considerations in the extent to which the facilities at Rhydycar West help to maximise healthier behaviour and activity and this should be considered as part of the project's social value and engagement strategy. As an example, preferential rates and tariffs

will be available for local residents at appropriate periods during the week in order to further promote the benefits of the development in the local area.

17.1.7. This Socio-economic Assessment concludes that during the construction period, the Scheme will support approximately 1,549 total net jobs per annum, a considerable proportion of which (1,219 jobs per annum) are expected to benefit the local workforce. During operation, the Scheme will require 842 permanent staff members onsite. Targeting these opportunities towards local people will be secured by a s106 agreement committing the developer to work with Partner Organisations which will maximise local opportunities. The potential health impact of this employment during both construction and operation is assessed to be positive.

17.1.8. The scheme will include the running of a shuttle bus during the operation phase which will provide an additional transport connection between the site and rail station, bus station, town centre, leisure centre and Merthyr College. The proposed shuttle bus would synchronise with the arrivals/departures from Merthyr Tydfil rail station and will provide opportunities to use the bus/train as part of a multi modal journey to access the site, therefore increasing accessibility. It is considered that the shuttle bus provides an attractive offering to visitors and staff and will encourage site users to access the site by public transport. Access to public transport is anticipated to have a positive potential health impact during both the construction and operation phases of the Proposed Development.

17.1.9. The development will have a neutral impact on access to healthcare facilities and a positive impact on users' access to social infrastructure during the operational phase. While a negative impact on walking and cycling at the site is anticipated during construction, in the operational phase, the Proposed Scheme will link the new public realm to the local community through new footpaths, connecting the greenspaces outside of the development area to the site, as well as to the public realm areas proposed in the scheme. The connection of the Proposed Development to local and strategic cycle and walking networks is anticipated to have a positive health effect during the operation phase. The negligible impact of the development on air quality and noise result in a neutral health impact.

17.1.10. Overall, the development will have a positive impact on human health.

17.2. Methodology and Scope

Policy Background

National Policy

Future Wales: The National Plan 2040

17.2.1. Future Wales: The National Plan 2040 sets out the national development framework and spatial strategy for Wales which will act as a guiding framework for where large-scale change and nationally important developments will be focused over the next 20 years. It sets the strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of our communities.

17.2.2. Rhydycar West is closely aligned with the priorities set out in Future Wales, and the development will create 'active and social places'. A key area of Future Wales is a healthier society, and this can be supported through the active and health-focuses elements of Rhydycar West, such as creating a new world-class sports facility coupled with sports and active leisure facilities for users of all ages and abilities, as well as creating jobs for local residents.

17.2.3. The proposed development incorporates a mix of tourism and leisure uses to create a year-round leisure destination with easy connection to homes, the town centre and public transport facilities. The development would be built at an appropriate high density and would have a significant customer draw which will help to support public transport services. The site's setting and the design of the development itself makes the most of the green infrastructure, utilising it for recreation, wellbeing, amenity and biodiversity functions. It is therefore considered the development is in accordance with Policy 2.

17.2.4. Policy 9 'Resilient Ecological Networks and Green Infrastructure' sets out the Welsh Government's objectives in respect of enhancement of biodiversity, the resilience of ecosystems and the provision of green infrastructure. The proposed development complements the opportunities afforded by existing and proposed green infrastructure to provide sustainable growth, ecological connectivity, social equality and well-being. The development will seek to achieve biodiversity mitigation sufficient that the negative impacts on the SSSI could be outweighed. In operation the development will also provide recreational access to the site and the surroundings via footpaths and heritage/nature trails and interpretation as well as increasing participation for all in sport in a green infrastructure setting, all to the benefit of users' well-being. It is therefore considered the development is in accordance with Policy 9.

17.2.5. Policy 12 'Regional Connectivity' prioritises walking, cycling and active travel and supports the roll out of ultra low emission vehicles. The proposed development will be accessible by walking, cycling and public transport. Links to adjacent rights of way and the adjacent National Cycle Route 8 will be provided and a shuttle bus between the site and the rail station will also be provided. The scheme will also incorporate at least 10% electric vehicle charging spaces. It is therefore considered the development is in accordance with Policy 12.

Taking Wales Forward 2016-2021

17.2.6. Taking Wales Forward sets out the government's programme to drive improvement in the Welsh economy and public services, delivering a Wales which is prosperous and secure, healthy, and active, ambitious, and learning, united and connected.

17.2.7. Taking Wales Forward 2016-2021 outlines this government's priorities for delivering those improvements. They are ambitious measures, aimed at making a difference for everyone, at every stage in their lives.

Planning Policy Wales (11th edition, February 2021)

17.2.8. This key framework document sets out the nation's land use planning policies in managing development and use of public land, with the overall aim of achieving sustainable development.

17.2.9. One of the strands of the Strategic and Spatial Choices sections is 'Placemaking in Action', aiming to ensure effective placemaking in developments, and considering how to integrate these early in development. A relevant part of this is the section on 'Promoting Healthier Places'.

17.2.10. This section of the document places emphasis on disadvantaged and deprived communities being disproportionately affected by health problems. It encourages the planning system to enable opportunities for activity and recreation and environmental and physical improvements. Places that support healthy and active lifestyles across all age and socio-economic groups are key to the planning system.

17.2.11. Access to health and community assets such as libraries, GPs and hospitals should not be affected by new developments. Green infrastructure is encouraged within new developments due to its ability to enhance mental and physical health and well-being. It is also important to sensitively manage light and exposure to airborne pollution.

Well-being of Future Generations Wales Act 2015

17.2.12. The policy places a duty on public bodies in Wales and those listed in the Act to work to improve the economic, social, environmental, and cultural wellbeing of Wales. It puts in place seven wellbeing goals, to benefit current and future generations of Wales. From a health perspective, the following well-being goals are especially relevant:

- A prosperous Wales
- A resilient Wales
- A healthier Wales
- A more equal Wales
- A Wales of cohesive communities
- A Wales of vibrant culture and thriving Welsh language
- A globally responsible Wales

17.2.13. The Rhydycar West development achieves and advances with the goal of A Prosperous Wales by generating employment opportunities for local residents, thereby allowing people to take advantage of the wealth generated through securing decent work, in turn contributing to A Resilient Wales. Such opportunities will be spread across occupation levels, with opportunities for new entrants supporting progression and social mobility, contributing to A More Equal Wales. The project will not only generate benefits through tourism but also support participation in sports and recreation which are key focuses of A Healthier Wales. The development will include a heritage walking trail, affording access to two scheduled monuments (Cyfarthfa Balance Pond and Leat and Cwm Pit and Head of Railway) and a listed building (the Grade II listed building Base of Chimney at Cwm Pit) all of which are closely associated with Cyfarthfa ironworks and the wider industrial history of the town, aligning with a Wales of vibrant culture and thriving Welsh language. Rhydycar West will also develop more Cohesive Communities through providing a recreation asset which enables people to become more active, develop positive relationships and reduce isolation. Moreover, providing a world-leading facility within the UK reduces the need for UK residents to travel internationally to access world-class facilities - both at an elite and recreational level - supporting a more Globally Responsible Wales, having the potential to make a positive contribution to global environmental wellbeing.

The Public Health (Wales) Act 2017

17.2.14. The Public Health (Wales) Act 2017 requires Welsh Ministers to require public bodies to carry out health impact assessments (HIA) in certain circumstances to ensure health is taken into account as part of decision making and planning processes. The Act is specific to public bodies however it is acting as a driver for HIA to be undertaken for projects outside just public bodies.

17.2.15. 'A Healthier Wales' also aims to develop a nation with healthy functioning ecosystems, that support social, economic and economic resilience Regarding the "A healthier Wales" wellbeing goal, Planning Policy Wales sets out three goals to achieve this:

- Reduction in emissions and air pollution through improving access to facilities and services to support people adopting healthier lifestyles – Rhydycar West will achieve this and see also Greenhouse Gas Emissions and Climate Change Chapter
- Generating energy from non-carbon sources – Rhydycar West will achieve this and see also Greenhouse Gas Emissions and Climate Change Chapter, in particular for details on the proposed exergy exchange system at Rhydycar West
- Enabling opportunities for connecting with the environment, access to tranquil areas and promoting active lifestyles to benefit physical and mental wellbeing – Rhydycar West creates multiple and varied opportunities around this.

17.2.16. The Local Development Plan for Merthyr Tydfil has relevance for the scheme and its potential impacts. Policy SW13: Protecting and Improving Local Community Facilities sets that the Council will protect and support the enhancement of the County Borough's existing community facilities. Policy EnW4: Environmental Protection states that development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and / or the natural environment.

Assessment Assumptions and Limitations

17.2.17. This human health impact assessment is based on professional judgement and considers both the adverse and the beneficial impacts that the Scheme will have on the surrounding receptors. It provides an indication of human health and well-being effects on people and the local community.

17.2.18. Community resources (as set out in Section 14.6) are mentioned expressly in the environmental baseline only where they contribute to the local context or where they may be affected by the Scheme. Information in the baseline related to demographics and the health profile of the population in the study area uses the most up to date available sources in each context. In respect of ethnicity data only, the 2011 Census provided the most recent source at time of preparation of the baseline.

17.2.19. All temporary effects during construction are assessed as occurring simultaneously and for an estimated 141 week programme of construction. The approach taken to assuming a simultaneous 36-month programme ensures that the likely 'worst-case' is assessed, which will likely result in the overestimation of predicted health effects. Should the construction phase be extended or delivered in phases the predicted effects would be the same or less than those outlined in this chapter.

Assessment Methodology

Sources of Information

17.2.20. The following assessment seeks to establish the potential Human Health effects and assesses these against the current baseline conditions at the Site and in the surrounding area.

17.2.21. Baseline data illustrating the existing conditions surrounding the Site has been collected through a desk-based research exercise using publicly available sources, documents, and web-based applications. These sources include:

- ONS Census 2011, the most recent and relevant data available at the time of writing in relation to key demographic statistics.
- Local Area Summary Statistics 2014;
- National Survey of Wales 2021;

- ONS Population Estimates 2020; and
- Welsh Indices of Multiple Deprivation 2019.

Impact Assessment Methodology

17.2.22. There is no consolidated methodology or practice for the assessment of effects on human health. The impacts of the scheme on human health are assessed qualitatively using professional judgement, best practice and draw upon other assessments within the ES. Best practice principles are provided in NHS England's Healthy Urban Development Unit's (HUDU) Rapid Health Impact Assessment (HIA) Toolkit 2019 and forms the basis of the approach adopted to assess impacts on health and wellbeing in this chapter. In addition, consideration has been given to the Health and Wellbeing checklist of the Wales Health Impact Assessment Support Unit (WHIASU) (2020) to help with the identification of which health determinants are relevant. The methodology for the assessment is outlined below.

17.2.23. This qualitative assessment of human health effects considers the following health and well-being determinants of relevance:

a) Access to healthcare services and other social infrastructure;

b) Retain and enhance existing open and natural spaces;

c) Impact of air quality, noise, and neighbourhood amenity;

d) Accessibility and active travel; and

d) Access to work and training.

17.2.24. The assessment has considered the potential consequences for health and wellbeing from the construction and operation phases of the Scheme and draws upon the information and conclusions reported within the traffic and transport assessment (Chapter 9: Transportation and Movement), the noise and vibration assessment (Chapter 14: Noise, Acoustics and Vibration), and the air quality assessments (Chapter 15: Air Quality) of this Environmental Statement.

17.2.25. Due to the diverse nature of health determinants and outcomes which are assessed, the assessment of human health effects describes the likely qualitative health outcomes, and it is not possible to quantify the severity or extent of the effects. There is no published definition of significance for health effects. The description of the changes to health determinants, the characteristics and sensitivity of the receptor population, and the likelihood of negative or positive health effects has been undertaken in accordance with HUDU and WHIASU guidance. The description provides information to inform stakeholders and decision makers of the likely direction of change in terms of health and wellbeing outcomes. Therefore, in line with current knowledge and methods of assessment, the consideration of health outcomes reports effects as being positive, negative, or neutral, rather than indicating a level of significance. The potential health effects during construction and operation are described using the criteria as outlined in Table 16-1. Where an impact is identified, actions will be

proposed to mitigate any negative impact on health, or to realise opportunities to create health benefits. It should be noted that in many cases, mitigation is embedded within the Scheme and the implementation of this is an underlying assumption of the assessment (see Section 16.7).

Table 17-1: Human health impact categories

Impact Category	Impact Symbol	Description
Positive	+	A beneficial impact is identified
Neutral	0	No discernible health impact is identified
Negative	-	An adverse impact is identified
Uncertain	?	Where uncertainty exists as to the overall impact

Study Area

17.2.26. The study area comprises all human health receptors in surrounding areas which may have potential to be impacted by the proposed development including the local community at large. It will therefore be derived in part on ward and local authority level boundaries at which data regarding health indicators will be available, and the location of the nearest key healthcare facilities. It should be noted, however, that it is not always possible to determine the catchment area for community facilities. Residents of an area may utilise facilities located within different districts, counties, or regions without regard for statutory boundaries.

Sources of Information

17.2.27. The following assessment seeks to establish the potential human health effects and assesses these against the current baseline conditions at the site of the Proposed Development and in the surrounding area.

17.2.28. Baseline data illustrating the existing conditions surrounding the site has been collected through a desk-based research exercise using publicly available sources, documents, and web-based applications. These sources include:

- ONS Census 2011 (Ref 16-16);
- ONS Population estimates 2020 (Ref 16-17);
- Annual Population Survey (Ref 16-18);
- Welsh Index of Multiple Deprivation (Ref 16-19);

- UK Business Register and Employment Survey (2019) (**Error! Reference source not found.**); and
- StatsWales (2019) (**Error! Reference source not found.**).

17.3. Baseline Environment

The Local Area

17.3.1. Chapter 5: Community and Socio-Economic of this Environmental Statement provides a review of the local area as part of its baseline analysis. This section summarises receptors identified as part of that review which are relevant to the health assessment, including residential properties, community facilities, and non-motorised user (NMU) facilities.

Site Location & Description

17.3.2. The proposed application site comprises 30.4 ha of land and is located south-west of the A470/A4102 roundabout, to the north-west of Abercanaid. The site comprises an extensive area, forming a mix of woodland/grassland on predominantly east and south-east facing slopes in the north and west, which is more open in appearance. The southern area of the site encompasses a more enclosed woodland area. The Blaen-Canaid Valley lies to the south adjacent to Gethin Wood.

17.3.3. The principal access into the site is taken from the A470/A4102 roundabout. An emergency access is available via an underpass from Abercanaid Industrial Estate in the far south-east of the site. Pedestrian and cycle access is also available over the A470 in two locations nearby. The site has historically been subject to coal and iron ore extraction and remains affected to differing extents by mining legacies, as well as legacies associated with the construction of the A470.

17.3.4. Rhydycar West is rich in heritage, as an area that contributed to Merthyr's key role in the industrial revolution. The site's plentiful supplies of iron and coal contributed significantly to the industrial revolution and beyond, up until the mid-20th Century.

Residential Properties

17.3.5. The study area is mostly rural and sparsely populated. Properties relevant to this assessment are in small groups and estates. The closest residential properties to the Rhydycar site are a small group of properties located 485m to the east on Plymouth Street. There are also a few housing estates around 500m away from the site; houses on Graig Road 520m to the south-east of the site and an estate off Cae'r Wern 540m to the north.

Community Resources

17.3.6. There are two schools located within 600m of the site area (Caedraw Primary School and St Mary's Catholic Primary). Merthyr Tydfil Police Station is located in close proximity of the site.

17.3.7. There are also a number of businesses located within 500m of the site such as Rhydycar Business Park (accommodating Welsh Government Offices), Orbit Business Centre and Enterprising Merthyr. Other businesses in direct proximity include Draig Haulage, Kabin Hire Ltd., EE Contact Centre and a collection of car showrooms and associated businesses on Pentrebach Road.

17.3.8. Within 1km of the site, there are several leisure and tourism facilities. These include Bike Park Wales, Merthyr Clay Pigeon Shooting, The View Camping, Merthyr Rugby Club and Merthyr Tydfil Leisure Village (accommodating Merthyr Tydfil Leisure Centre, skate park, Superbowl, Travelodge, Vue Cinema, and restaurants (Nando's, Subway, Frankie and Benny's, Harvester and McDonald's)).

Healthcare Facilities

17.3.9. The nearest hospital to the site (with an accident and emergency department) is Prince Charles Hospital located 3.2km to the north of the site. There are also GP surgeries within 3km of the development, Pontcae Medical Practice and Ivor St Surgery.

Non-motorised user (NMU) Facilities

17.3.10. Pedestrian and cycle access to the site is gained via an existing bridleway bridge over the A470 carriageway. The bridge provides a connection from the site over the A470 to the bridleway bridge over the A4102 which connects to the Taff Trail and provides access to the local pedestrian network within Merthyr Tydfil. The bridges benefit from ramps which accommodate both pedestrian and cycle movements to and from the site, with the route forming part of the existing Public Right of Way (PROW) network within Merthyr Tydfil. A secondary pedestrian access is provided to the south of the site, via the emergency access where a link is provided under the A470 to Dragon Parc and the Taff Trail.

17.3.11. There are also a number of rights of way through and surrounding the site which have recently been established as a result of an application to modify the definitive map and a positive dialogue and collaboration between the landowners and MTCBC.

Health Profile

17.3.12. This section provides a human health profile of the study area, focusing on key determinants of health relevant to the assessment criteria provided within the Healthy Urban Development Unit (HUDU) / NHS England guidance (Ref. 16-5). This local health baseline will be used to assess potential health effects of the Proposed Development.

17.3.13. Based on 2011 Census data, which is the latest dataset available for self-assessment of health, 11.2% of the residents in Merthyr Tydfil believed they were living in 'bad' or 'very bad' health. This assessment accounts for an overall rating of mental and physical health. Of the 22 local authorities in Wales, this is the highest proportion of 'bad' or 'very bad' health meaning that Merthyr Tydfil performs worst in terms of self-assessed health in the country. 11.2% is

also comparatively higher to the figures recorded in Wales (7.6%), and England and Wales[1] as a whole (5.6%).

17.3.14. In addition, the proportion of the population who had a long-term health problem or disability which limited their day-to-day activities at least a little in Merthyr Tydfil was 26.9%. This is relatively higher than the proportion in Wales (22.7%) and England and Wales[2] on average (17.9%), again suggesting poorer health.

17.3.15. Life expectancy data also suggests that Merthyr Tydfil performs poorly in terms of health. In a 2020 report by the Welsh Government (Summary Statistics for Wales by region), it was stated that life expectancy at birth in Merthyr Tydfil was very low compared to other local authorities in Wales. In particular, life expectancy for females in Wales is at its lowest in Merthyr Tydfil.

17.3.16. The last Local Area Summary Statistics report for Merthyr Tydfil (last produced by Welsh Government in 2014) discusses mental health statistics in the county compared to other areas in Wales. It indicates that the mean mental component summary score for Merthyr Tydfil has been consistently lower than the Welsh average since the 2003/05 period, indicating consistently poorer mental health and well-being in the county.

17.3.17. Regarding the health of children in Merthyr Tydfil, a report by Public Heath Wales using 2011 census data stated that 28.2% of children were living in poverty. Poverty is regarded as a key determinant of health and this figure is considerably higher than the average rate for Wales (22.2%). In addition, it was reported that 33.8% of 4- to 5-year-olds were overweight or obese in Merthyr Tydfil, the highest proportion across all Welsh local authorities. Public Health Wales also recently produced a child personal wellbeing report (2020) which showed that the Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS) score in secondary school aged children in Merthyr Tydfil was 23.6, slightly below the Welsh average of 24. The SWEMWBS covers the feeling and functioning aspects of mental wellbeing.

17.3.18. Furthermore, in the current release of the National Survey for Wales (2021), it is suggested that 23% of adults in Merthyr Tydfil are regular smokers, the second highest proportion of the 22 local authorities in Wales. This is higher than the Welsh average of 17% and suggests that unhealthy lifestyle behaviours are more common in the county in comparison to most other areas in Wales. The survey also illustrates that Merthyr Tydfil performs similarly to the Welsh average in terms of obesity. Merthyr Tydfil has 23% of its adults classed as obese (having a BMI of 30 or over) whilst the average for Wales is 24%. Almost half (48%) of adults in Merthyr Tydfil were active for less than 30 minutes in the previous week of the survey. This is the highest percentage across the 22 local authorities which suggests a severe lack of physical exercise amongst a significant proportion of the local population.

[1] The wider geography of 'England and Wales' is used for context here as. It provides a comparison to the wider population (of England & Wales) and also puts into context the regeneration when compared to larger geographies.
[2] The wider geography of 'England and Wales' is used for context here as. It provides a comparison to the wider population (of England & Wales) and also puts into context the regeneration when compared to larger geographies.

17.3.19. Based on these lifestyle indicators and others such as being physically active, drinking alcohol within weekly guidelines, eating the recommended five daily fruit and vegetables, the Summary Statistics for Wales report illustrates that 15% of adult residents in Merthyr Tydfil have fewer than two healthy lifestyle behaviours. This is the highest proportion of all local authorities in Wales and higher than the Welsh average of 10%. The five healthy lifestyle behaviours are defined as: not smoking, average weekly alcohol consumption 14 units or lower, eating five or more portions of fruit and veg the previous day, having a healthy BMI and being physically active at least 150 minutes in the previous week.

Population and Demographics

17.3.20. According to the 2020 Office for National Statistics Mid-Year Population Estimates, there are approximately 60,424 people living in Merthyr Tydfil out of 3,169,586 in Wales in total.

17.3.21. The proportion of older people aged 65 years or over in Merthyr Tydfil (18.9%) is slightly lower than in Wales (21.1%). The share of people of working age is defined by the ONS as people aged between 16 and 64 and is approximately 62% in the study area. This is broadly similar to Wales (61.2%).

17.3.22. Based on 2011 Census data (Ref 14-4), which is the most recent dataset for ethnicity statistics, approximately 97.6% of residents in Merthyr Tydfil were defined ethnically as White. This was similar to the proportion recorded for Wales (95.6%). The second largest ethnic group in the study area was Asian/Asian British, which accounted for approximately 1.2% of the resident population. This figure is lower than the proportion in Wales (2.3%).

Qualifications and Economic Activity

17.3.23. Approximately 17.8% of residents in Merthyr Tydfil hold a degree-level qualification (NVQ Level 4) as their highest level of qualification. This is notably lower than in Wales (24.5%). The proportion of people with no qualifications in the study area is 34.3%, a much higher figure than in Wales (25.9%).

17.3.24. Merthyr Tydfil has slightly lower levels of economic activity[3] with a rate of 64.2% compared to 65.8% in Wales. Of working age residents, approximately 5.7% are unemployed which is higher than in Wales (4.3%).

[3] Economic activity can be regarded as those in the workforce, including those in employment (including self-employment), unemployed, and full-time students. The Office of National Statistics indicates that the census concept of economic activity is compatible with the standard for economic status defined by the International Labour Organisation (ILO), and is one of a number of definitions used internationally to produce accurate and comparable statistics on employment, unemployment and economic status.



Deprivation

17.3.25. Based on the Welsh Indices of Multiple Deprivation (2019), the LSOA[4] that the site is located in (Plymouth [Merthyr Tydfil] 1) is ranked 428 out of 1909 LSOAs in Wales, which places it among the 20-30% most deprived in the country. Of the 36 LSOAs in Merthyr Tydfil, it ranks 13th worst in terms of overall deprivation. The domain that the area performs most poorly in is employment deprivation for which it is in the 10-20% most deprived LSOAs in Wales.

17.3.26. Nearby the site are very deprived LSOAs such as Cwmbach 2 (ranked 220 out of 1909 in Wales) and Park 3 (ranked 153).

17.4. Mitigation within the Submitted Design

17.4.1. Embedded and additional mitigation measures are incorporated and secured into the Scheme as set out in the respective chapters to reduce other construction and operational effects (such as noise and vibration, air quality, transport and access and socio-economics) which in turn will mitigate the effects on the local community and existing facilities from a Human Health.

17.5. Likely Environmental Effects of the Scheme

17.5.1. Table 16-5 to Table 16-10 below set out the potential health and wellbeing impacts associated with the Scheme during construction, once the Scheme is complete and operational. The potential health impact is described in accordance with the methodology set out in Section 16.2.

[4] Lower Super Output Area – the smallest statistical area with data commonly available. They were produced by the Office for National Statistics for the reporting of small area statistics.

Table 177-1: Access to Healthcare Services and Other Social Infrastructure

Assessment Criteria	Relevant to the proposed development ?	Details and Evidence	Potential Health Impact	Further Action or Mitigation
Does the proposal assess the impact on healthcare services?	Yes	**During construction** As identified in the baseline, there are 2 GPs located within 3km of the Scheme (in Merthyr Tydfil and Troedyrhiw). The nearest hospital is Prince Charles Hospital 3.2km to the north of the Scheme. The construction workers required to build the Scheme will not place additional demand or pressure for services on these as these services can only be accessed by residents living within the catchment area of the practices. If any of the workers reside locally already, they will be registered at a practice currently and will not therefore place additional demand for services on these GPs. However, residents of single properties and properties in the village surrounding the Scheme attempting to access these healthcare facilities are likely to use the same strategic roads as construction traffic associated with the Scheme and workers attempting to access the Order limits.	0 during construction 0 during operation	**During construction** None required **During operation** None required

Assessment Criteria	Relevant to the proposed development ?	Details and Evidence	Potential Health Impact	Further Action or Mitigation
		The presence of this additional traffic will not affect local residents' ability to access healthcare facilities. The existing road network is projected to remain free of congestion during the construction period and there is not expected to be any considerable changes in journey time for existing users of any of the strategic roads in the study area. This is in part due to measures in the Construction Traffic Management Plan (CTMP) contributing to only negligible driver delays identified in the transport assessment (**Chapter 9: Transportation and Movement)**. Therefore, the potential health impact on access to healthcare services during the construction period is assessed to be neutral. **During operation** During the operational phase, there are expected to be 842 full time staff expected to be working at the site per day. The Scheme will therefore generate low levels of traffic and it will not impact local residents' ability to access healthcare facilities. Rhydycar West will also be implementing measures to encourage staff to use sustainable modes of transport and public transport. The potential health impact on access to healthcare services during operation is therefore assessed to be neutral.		

Assessment Criteria	Relevant to the proposed development ?	Details and Evidence	Potential Health Impact	Further Action or Mitigation
Does the proposal assess the capacity, location, and accessibility of other social infrastructure , e.g., schools, social care, and community facilities?	Yes	**During construction** There are two primary schools within 500m of the site. Local residents are likely to travel to Merthyr Tydfil for services including a shopping centre. Users of these services may use the A470 road to access these, which would also be used for construction traffic associated with the Scheme and workers attempting to access the site. However, the presence of this additional traffic will not affect local residents' ability to access this social infrastructure. The existing road network is expected to remain within during the construction period and there is not expected to be any considerable changes in journey time for existing users of any of the strategic roads in the study area. This is in part due to measures in the Construction Traffic Management Plan (CTMP) contributing to only negligible driver delays identified in the transport assessment (**Chapter 9: Transportation and Movement**). Therefore, the potential health impact on access to social infrastructure during the construction period is assessed to be neutral. **During operation**	0 during construction + during operation	**During construction** None required **During operation** None required

Assessment Criteria	Relevant to the proposed development ?	Details and Evidence	Potential Health Impact	Further Action or Mitigation
		During the operational phase, there are expected to be up to 842 staff working at the Proposed Development. The Scheme will therefore generate low levels of traffic and it will not impact local residents' ability to access social infrastructure. The potential health impact on access to healthcare services during operation is therefore assessed to be neutral. The resort will provide a wide range of new facilities in the form of Indoor Snow Centre, Water Park, and other activity and leisure areas, adding to the local offer. This will have a positive impact on users' access to social infrastructure.		

Table 177-2: Retain and enhance existing open and natural spaces

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation
Does the proposal retain and enhance existing open and natural spaces?	Yes	**During construction** The Rhydycar West site is currently closed to visitors other than in respect of previously claimed and now recently established rights of way through the land. During the construction period, temporary or permanent diversion or stopping up of Public Rights of Way will be required. Access would be managed during the construction phase. **During operation** The Rhydycar West site is currently closed to visitors other than in respect of previously claimed and now recently established rights of way through the land. The development will result in enhanced open space with the addition of landscaped areas and additional routes.	- during construction + during operation	**During construction** None required **During operation** None required
In areas of deficiency, does the proposal provide new open or natural space, or improve access to existing spaces?	Yes	**During construction** N/A **During operation** The Rhydycar West site is currently closed to visitors other than in respect of previously claimed and now recently established rights of way through the land. In the operational phase, the Proposed Scheme will provide enhanced natural space with the addition of landscaped areas and outdoor activity spaces, enhancing public access to and through parts of the site.	N/A during construction + during operation	**During construction** None required **During operation** None required

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation
Does the proposal provide links between open and natural spaces and the public realm?	Yes	**During construction** N/A **During operation** The Rhydycar West site is currently closed to visitors and access is restricted, other than in respect of previously claimed and now recently established rights of way through the land. In the operational phase, the Proposed Scheme will link the new public realm to the local community through new footpaths. This connects the greenspaces outside of the development area to the site, as well as to the public realm areas proposed in the scheme design. The proposed footpaths connect to Merthyr Tydfil to the northeast of the site and provide the potential to connect to Aberdare, to the west.	N/A during construction + during operation	**During construction** None required **During operation** None required
Are the open and natural spaces welcoming and safe and accessible for all?	Yes	**During construction** N/A **During operation** High quality amenity spaces have been provided within the scheme, giving users valuable landscaped open space. The Proposed Development will deliver the optimum amount and quality of public walkways through parts of the site, carefully crafted to ensure flexibility across a range of community uses and sensitive to the important ecological designations and historical features on the site.	N/A during construction + during operation	**During construction** None required **During operation** None required

Table 177-3: Air Quality, Noise and Neighbourhood Amenity

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal minimise construction impacts such as dust, noise, vibration, and odours?	Yes	**During construction** An assessment of the risk of dust and particulate matter impacts during the construction stage is provided in the **Chapter 15: Air Quality** of this Environmental Statement. The assessment concludes that during construction, when proposed measures to mitigate the same are employed, earthworks and other construction activities will all result in negligible effects An assessment of the impact of construction of the Scheme on noise and vibration is provided in **Chapter 14: Noise** of this Environmental Statement. The assessment states that there will be negligible impacts on surrounding receptors arising from the construction of the Scheme. Overall, therefore, the above assessments conclude that when proposed measures to mitigate dust and noise are followed, there is likely to be negligible impacts on surrounding receptors and the potential health impact is assessed to be neutral. No discernible health impact is identified. **During operation** Not applicable as assessment criteria refers to construction impacts.	0 during construction n/a during operation	**During construction** None required **During operation** n/a

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal minimise air pollution caused by traffic and energy facilities?	Yes	**During construction** An assessment of the risk of dust and particulate matter impacts, and road traffic emissions, during the construction stage is provided in **Chapter 15: Air Quality** of this Environmental Statement. Site-specific mitigation measures have been proposed based on Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition, Earthworks, Construction and Trackout. Therefore, if measures to mitigate dust which are set out in the chapter are followed, there will be negligible impact on surrounding receptors and the potential health impact is assessed to be neutral. **During operation** The two operational scenarios of the Proposed Development presented in Chapter 15 are not anticipated to cause any air quality impacts. There are not predicted to be any exceedances of pollutant concentrations in either scenario and therefore mitigation is not required. The chapter also concludes that the development is not considered contrary to any of the national and local planning policies regarding air quality therefore the potential health impact is assessed to be neutral.	0 during construction 0 during operation	**During construction** None required **During operation** n/a

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal minimise noise pollution caused by traffic and commercial uses?	Yes	**During construction** An assessment of the impact of traffic on noise levels during the construction period is provided in **Chapter 14: Noise** of the Environmental Statement. The assessment states that following mitigation measures within the Construction Environmental Management Plan, noise impacts will have a very low to low impact magnitude which means the effect will be negligible to minor adverse. This is not significant in EIA terms. The presence of construction traffic will lead to a negligible or minor adverse effect (not significant) noise impact on residents of properties in the area. Noise mitigation are set out Chapter 14 which includes measures such as: ensuring that, where reasonably practicable, noise is controlled at source (e.g., the selection of inherently quiet plant and low vibration equipment); review of the construction programme and methodology to consider quieter methods; consideration of the location of equipment on-site and control of working hours. The minor adverse noise impacts on residents of properties in the area means that the potential impact during construction on the residents' health is assessed as neutral due to them being temporary and non-significant. **During operation**	0 during construction 0 during operation	**During construction** No additional mitigation is deemed necessary. **During operation** No additional mitigation is deemed necessary.

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
		An assessment of the impact of operation of the scheme on noise levels is provided in **Chapter 14: Noise** of this Environmental Statement. The assessment states that the presence of operational traffic is of very low impact magnitude and will lead to a negligible adverse (not significant) noise impact on residents of properties around the site. The impact of operational noise is also of very low impact magnitude and the overall effect will be negligible and therefore there is no significant impact. The negligible impacts on residents of properties in the area means that the potential health impact during operation is neutral due to them being non-significant.		

Table 177-4: Accessibility and Active Travel

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal prioritise and encourage walking (such as through shared spaces)?	Yes	**During construction** The Rhydycar West site is currently closed to visitors and access is restricted, other than in respect of previously claimed and now recently established rights of way through the land. During the construction period, temporary or permanent diversion or stopping up of Public Rights of Way will be required. Access would be managed during the construction phase. Nonetheless, it is anticipated the proposed development would have a **negative** impact on encouraging walking at the site. **During operation** The proposed development will include new pathways through the site. This will allow pedestrian access to and through the parts of the site. It is anticipated that during the operational phase the development will have a positive impact on prioritising walking to and through the Proposed Development.	- during construction + during operation	**During construction** None required **During operation** None required
Does the proposal prioritise and encourage cycling?	Yes	**Construction** During the construction of the scheme, there would be some restrictions on cycle connections, with formal routes through the site temporarily or permanently diverted or stopped up during the construction phase. **Operation**	- during construction + during operation	**During construction** None required **During operation** None required

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
		The scheme will be connected to local cycle networks, namely the Taff Trail cycle route, which runs to the east of the A470. There are anticipated to be cycle park facilities on the site, including cycle parking and connect to active travel routes.		
Is the proposal well connected to public transport, local services, and facilities?	Yes	An existing bus stop is located 1.2 km from the application site within the grounds of the Merthyr Tydfil Leisure Village which benefits from a regular level of services which operate Monday to Saturday, providing connections to the town centre and wider parts of Merthyr Tydfil. The bus routes can benefit construction workers taking public transport to site during the construction site, as well as employees and users of the facilities during the operation period. Merthyr Tydfil Bus Station offers many services that provide regular access to the wider parts of Merthyr Tydfil and surrounding settlements as well as several more strategic destinations. There are therefore opportunities to use the bus as part of a multi modal journey to access the site, therefore increasing bus accessibility to and from Trefechan, Pant, Dowlais Top, Twynyrodyn, Clwydfagwyr, Bargoed, Aberdare, Hirwaun, Brecon, Newtown and Llwydcoed, Brecon, Builth Wells, Llandrindod Wells, Newton, Brynmair and Abergavenny.	+ during construction + during operation	**During construction** None required **During operation** None required

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
		Merthyr Tydfil train station is located within the town centre and provides regular links to surrounding settlements, including direct links to Cardiff Central from where connections are available to national destinations The scheme will also include the running of a shuttle bus during the operation phase which will provide an additional transport connection between the site and rail station, bus station, town centre, leisure centre and Merthyr College. The proposed shuttle bus would synchronise with the arrivals/departures from Merthyr Tydfil rail station to minimise layover time for visitors to the site. It is considered that the shuttle bus provides a very attractive offering to visitors and staff and will encourage site users to access the site by public transport. The access to public transport is anticipated to have a **positive** potential health impact during both the construction and operation phases of the Proposed Development.		

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal connect public realm and internal routes to local and strategic cycle and walking networks?		**Construction phase** N/A **Operation phase** The Proposed Development's is highly accessible with numerous employers/jobs, shops, services, and community facilities accessible by means of bus and rail, as well as facilities within walking and cycling distance. To the north lies the residential settlement of Heolgerrig, approximately 1.5km distant. The settlement is served by a number of community facilities. The town centre of Merthyr Tydfil sits just over 1 km walking distance to the east. Likewise, c.100m north east is Merthyr Leisure Village, which comprises various restaurants and leisure facilities including national multiple operators such as; McDonalds, Frankie & Benny's, Nando's, Subway, Vue Cinema, and a Travelodge. A shuttlebus service will be provided to improve accessibility to these and other facilities. Cyfarthfa Retail Park and Trago Mills lie approximately 2km to the north either side of the A470.	N/A during construction + during operation.	**During construction** None required **During operation** None required

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
		In regard to accessibility, the Taff Trail cycle route runs to the east of the A470 and forms part of the wider strategic cycle network. Links to the Taff Trail will be improved by surfacing and lighting. The site will also benefit from walking routes through the site which connect to the wider walking network. The site's walking routes connect to the wider routes to Merthyr Tydfil to the north east and there is potential to connect to Aberdare, to the west. The connection of the Proposed Development to local and strategic cycle and walking networks is anticipated to have a **positive** health effect during the operation phase.		

Table 177-5: Access to Work and Training

Assessment Criteria	Relevant to the proposed development?	Details and Evidence	Potential Health Impact	Further Action or Mitigation Recommended
Does the proposal provide access to local employment and training opportunities, including temporary construction and permanent end-use jobs?	Yes	**During construction** During the construction period, the Scheme will support, on average, approximately 1,549 total net jobs per annum. A considerable proportion of these jobs (1,219 jobs per annum) are expected to benefit the local workforce (residents located within the Travel to Work Area of Merthyr Tydfil). As included in the s106 agreement, developer or contractor will work alongside Partner Organisations to ensure that training and employment is targeted towards local people. The potential health impact during construction is therefore assessed to be positive. **During operation** During operation, the Scheme will require 842 permanent staff members onsite. It is anticipated that these opportunities would provide employment for local people. It is anticipated that these jobs would be filled by residents of the Travel to Work Area (TTWA), with some residents outside the TTWA that are able to commute to the site. Access to local employment and training opportunities will be supported by the developer's commitments to work with Partner Organisations which will maximise local opportunities. The potential health impact is assessed to be positive.	+ during construction + during operation	**During construction** None required **During operation** None required

Does the proposal include opportunities for work for local people via local procurement arrangements ?	Yes	**During construction** The scheme includes provision of opportunities for work for local people. There are anticipated to be 1,549 total net jobs per annum, with 1,219 of these expected to be filled by local workforce. The scheme will ensure the maximum positive effect on the local economy of Merthyr by entering into legally binding obligations to secure recruitment and training opportunities, as highlighted in the Planning Statement. Therefore, the potential health impact during construction is assessed to be positive. **During operation** At least 842 permanent jobs will be generated, and these could provide employment for local people. It is anticipated that these jobs would be filled by residents of the Travel to Work Area (TTWA) of Merthyr Tydfil or residents outside the TTWA that are able to commute to the site. The scheme will ensure the maximum positive effect on the local economy of Merthyr by entering into legally binding obligations to secure recruitment and training opportunities, as highlighted in the Planning Statement. The potential health impact is therefore assessed to be positive.	+ during construction + during operation	**During construction** Meet the Buyer events will be held to provide local services with an opportunity to log their interest in supporting the scheme and outline their service and skillsets **During operation** None required

17.6 Additional Mitigation, Compensation and Enhancement Measures

17.6.1 No additional mitigation was deemed necessary.

17.7 Cumulative Effects

17.7.1 This section assesses the potential effects of the Scheme in combination with the potential effects of other development schemes (referred to as 'cumulative schemes') within the surrounding area, as listed within Chapter 2: EIA Methodology.

17.7.2 From a review of likely forthcoming developments, there have been no schemes identified as potentially resulting in cumulative human health impacts, when taken into consideration with the Proposed Development.

References

1. Department of Communities and Local Government (DCLG), (2019); Draft Planning Practice Guidance
2. NHS, (2019); NHS Long Term Plan
3. Department of Health, (2012); Health and Social Care Act (c.7)
4. Department of Health, (2011); Health and Social Care Bill
5. NHS London Healthy Urban Development Unit (HUDU); (2019) Planning for Health Rapid Health Impact Assessment (HIA) Tool (Fourth Edition, October 2019)
6. Office of National Statistics (ONS), (2016); Census 2011. ONS.
7. ONS, (2021); Population estimates - local authority based 2020. ONS.
8. ONS, (2020); Annual Population Survey (January 2019-December 2019). ONS.
9. DCLG, (2019); Indices of Multiple Deprivation. DCLG.
10. ONS, (2019); Business Register and Employment Survey. ONS.
11. Office of National Statistics (ONS), (2016); Census 2011. ONS.
12. Welsh Government, (2020); Summary Statistics for Wales, by region.
13. Welsh Government, (2021); National Survey for Wales; Adult Lifestyles
14. Public Health Wales, (2013); Health of Children and Young People: Merthyr Tydfil.
15. Public Health Wales, (2020); Mental Wellbeing in Wales.
16. Wales Health Impact Assessment Support Unit (WHIASU); (2020) Health Impact Assessment (HIA) Overview.

18.0 Utilities

18.1 Executive summary

18.1.1 Investigations have been undertaken with the local Electrical, Communications and Water statutory authorities, the results of which have identified that offsite routes will be required and that these will likely have negligible effect on the natural environment.

18.1.2 Welsh Water have yet to define the point of connection or the extent of offsite works required; connection points are available. The specific connection point will be identified and modelled at the next design stage.

18.1.3 As the electrical Point of Connection (PoC) to the Merthyr East primary substation will be at 11kV (HV), there will not be a requirement for a primary substation to be located onsite. Rather, incoming 11kV cables would terminate within an intake room, either located internally to a building or standalone/external building. A series of smaller standard size 1MVA distribution substations would then supply the various buildings across the development.

18.1.4 The 100% electric energy strategy has informed the overall load for the development and Hoare Lea have utilised this to identify the potential POC on WPD's network to deliver power to the site. WPD have been consulted and identified the Merthyr East primary substation as the POC. At the next design stage Hoare Lea will lodge a detailed application with respect to the POC.

18.1.5 All routes to site have been considered to have minimal environmental impact as they will likely be laid in the highway verge through the majority of their routes. Detailed route proving exercises will be undertaken at the detailed design stage in order to fully rationalise all routes to site, seeking to undertake combined trenching wherever possible in order to rationalise any excavation and further reducing any effects to the natural environment.

18.1.6 The presence of both the overhead powerlines and the intermediate pressure gas main are considered to be negligible and unaffected by the proposed development and any new site entrances are unlikely to have any effect on existing utilities.

18.1.7 A set of utility sketches have been produced in support of this document and can be found within under Figure 18.1 Initial Utilities Assessment - Coordinated Drawing and Figure 18.2 Initial Utilities Assessment - New Power supply routing options.

18.2 Introduction

18.2.1 A utilities assessment has been undertaken to determine the impact of providing new utility infrastructure to the site. The investigations undertaken focus on establishing the feasibility of capacity and connectivity for power, comms, and water; as well as identifying any environmental impacts that should be considered when bringing new services to the proposed development.

18.2.2 The geographical scope for the study area extends outside of the site's immediate redline boundary due to the locations of the various utility points of connection. For power, this extends to Pen-y-Darren, some 4-6km from the site boundary, depending on routing.

18.2.3 The site and surrounding site geography each present areas of consideration for utilities including the area of SSSI and SINC within the redline boundary, the nearby River Taff and Merthyr Railway, and various 'A' roads between Pen-y-Darren and the site.

18.2.4 Mitigation within the submitted design is highlighted in Section **Error! Reference source not found.** above.

18.3 Methodology and Scope

Policy Background

18.3.1 Upon review of the Merthyr Tydfil planning policy guidance notes, specifically the Local Development Plan and Supplementary Planning Guidance (note 5, nature and development), it is evident that the Historic and Natural Heritage of Merthyr Tydfil must be considered. This is considered in detail in other specific reports.

18.3.2 Section 8.5 of the 2006-2021 LDP states that 'biodiversity and landscape impacts do not always observe planning application site boundaries, and therefore, both immediate impacts and impacts remote from the development site will be considered'.

18.3.3 In respect to utilities, this will include the design routing of new cable and mains infrastructure both on and offsite, as well as the considered placement and location of associated infrastructure, such as substations, to ensure that the natural environment is protected where possible, and any that appropriate mitigation methods are identified and provided.

Key Legislation

18.3.4 In response to the UK's commitment to achieving net zero carbon emissions by 2050 and in line with policy updates such as Part L 2021, the scheme is to adopt a 100% electric energy strategy to provide all heating, hot water, and small power loads. A connection to the gas grid will not therefore be made.

18.3.5 All utility works to be compliant with NRSWA; NJUG; ENA (Engineering Recommendation G81 Part 4 and Technical Specification 43-8); The Water Industry Act 1991 and Water Supply (water fittings) Regulations 1999; The Electricity at Work Regulations 1989, and HSE requirements. This list is not exhaustive and would include any other key legislation and guidance relating to the installation, survey, operation, and commissioning of utility infrastructure. All works to also be undertaken by qualified National Electrical Registration Scheme (NERS) and Water Industry Registration Scheme (WIRS) accredited personnel.

Assessment Methodology

18.3.6 Hoare Lea has undertaken formal consultation with National Grid Electricity Distribution (NGED) (formerly Western Power Distribution (WPD)) to understand the feasibility of providing a large new connection from their local HV and/or EHV network, with a view to establish a viable POC for the site.

18.3.7 The feedback from NGED was used to assess the most appropriate POC for the scheme and to identify the subsequent routing options for bringing new cabling to the site.

18.3.8 As a result of the assessment, NGED confirmed that the local substation, Pentrebach, located in close proximity to the site, is a small 33kV/11kV primary that cannot be extended or replaced due to the site being landlocked and surrounded by third party land (owned by Zanussi). This substation could not therefore offer a POC to the site.

18.3.9 The Swansea Road substation, also in close proximity to the site, has been confirmed as being an even smaller site that is locked between a retail park, allotments, and Council-owned buildings, and cannot be extended to accommodate additional equipment enabling a large power connection to be made.

18.3.10 As a result, the Merthyr East primary substation, located c.4-6km away (depending on routeing) in Pen-y-Darren, was assessed, and found to have the capacity available to enable a new power supply sufficient in size to serve the site. NGED have established this substation as the sites POC.

18.3.11 As the POC to the Merthyr East primary substation will be at 11kV (HV), there will not be a requirement for a primary substation to be located onsite. Rather, incoming 11kV cables would terminate within a ring main unit (RMU) at the site's boundary.

18.3.12 From here, an 11kV cable would run within the new pedestrianised areas of the site and into a series of 11kV/LV distribution substations to provide low voltage (LV) 230V/400V supplies to the site buildings and infrastructure.

18.3.13 The onsite cable routing would avoid running within the SSSI and SINC. The placement of the cable intake room (housing the RMU) and the site's associated 11kV/LV distribution substations would also follow the same principle, seeking to minimise impact to the natural environment. This could be achieved by the substations being building-integrated where possible, and cabling and mains located in areas of new public realm (i.e. areas already being disturbed during the construction process).

18.3.14 Where DNO/IDNO electrical equipment is installed within a customer building, it would be required to comply with the Building Regulations and BS-9999 (Fire Safety in the Design, Management and Use of Buildings – Code of Practice.)

18.3.15 Offsite, there are various routes for the new cabling to run from the Merthyr East substation to the site. Currently NGED have provided one option which runs through Merthyr itself (but note that there are many alternatives). Hoare Lea has provided an alternative, more direct route, which avoids running in local neighbourhoods where possible.

18.3.16 See drawings 2929400-HL-LB-DR-U-900-0001 'Initial Utilities Assessment – Coordinated Drawing' and 2929400-HL-LB-DR-U-900-0002 'Initial Utilities Assessment – New Power Supply Routing Option 01s'.

18.3.17 As mentioned in the Policy Background section, the Historic and Natural Heritage of Merthyr Tydfil should be maintained, and therefore not negatively impacted by new development, in this case via the installation of new utility infrastructure.

18.3.18 The routing options to site therefore consider the location of existing trees and landscaping; the presence of ecology and wildlife; the location of listed buildings and culturally significant infrastructure; and the impact to the general surrounding environment.

18.3.19 As per NRSWA and NJUG guidelines, this means that new utilities would run within the public footpath and verge of the existing road network. Where there is insufficient space within the footpath, the public highway would be used to route new cabling.

18.3.20 From the Merthyr East substation, new cabling would be able to run in this arrangement given the extensive surrounding existing highway infrastructure.

18.3.21 When crossing the River Taff and Merthyr Railway, new utilities would remain within the existing public footway, highway, or bridges as appropriate and not run underneath via directional drill or similar.

18.4 Receptor Sensitivity

Effect Magnitude

18.4.1 Running new utility infrastructure within the existing public realm is typical for new development projects, and as such, the routing and installation of utility infrastructure would have a negligible impact to the development or surrounding natural environment.

18.4.2 Both on and offsite utility pipes and cabling would be buried beneath existing/new footway, verges, or highway, and where possible, associated infrastructure such as substations would be located internally to the new buildings. The routing and placement of new utility infrastructure would also be designed in coordination with the new and existing landscape.

18.4.3 In terms of environmental impact, the new power, telecoms cabling, and water pipes would not emit any emissions in use, produce harmful or hazardous material, require waste management or specialist treatment or be a risk to the natural environment and public safety. The only expected output from such installations would be excess heat from substations, which is managed via natural ventilation.

Limitations of the Assessment

18.4.4 Dwr Cymru Welsh Water have reported that the site is located in an area where there are potential water supply constraints and that no local network improvements to the distribution network are planned within the current Capital Investment Plan. This means that to connect to the local distribution network, reinforcement (upgrades to key sections of existing pipework, or alternatively new pipework) is likely to be required.

18.4.5 To establish the extent of potential offsite works required, and to identify a POC for the development, Welsh Water have stated the need to undertake a hydraulic modelling assessment, which will identify the location of the point of connection for the supply of water.

18.4.6 Upon receipt of the Dwr Cymru asset records however, 3no Trunk Water mains have been identified in close proximity to the site. As Trunk Water mains are used to convey water from the source to a reservoir (or similar), they are typically large pipes carrying significant volumes of water.

18.4.7 A 600mm Trunk Main is shown to cross the roundabout of the proposed site entrance, with a 24" (600mm) and a 27" (675mm) Trunk main running adjacent to each other parallel to the A470.

18.4.8 Welsh Water have been asked to confirm whether any of these mains would be suitable to establish a large diameter connection from. At the reporting however, Welsh Waters response is that hydraulic modelling is required and that this can be undertaken at a later design stage.

18.4.9 Based on previous project experience, connecting to Trunk Mains is a viable option. Should this be agreeable to Dwr Cymru, then a POC would be established from the most suitable main and a new pipe ran to site. The routing of the new infrastructure would follow the existing footpaths and highway, crossing the roundabout and entering the site via the proposed vehicular entrance.

18.4.10 Should a connection to the Distribution network be required, then upgrades (if required) would be undertaken at key sections upstream of the network, rather than via running new extensive dedicated mains to the site (as with the power for example). It is not therefore currently envisaged that lengthily offsite works would be required to service the site in either scenario.

18.4.11 When laying any new infrastructure, Welsh Water would not seek to run within greenfield or private land, nor beneath the waterway and/or railway. Infrastructure upgrades (if required) and the POC is therefore anticipated to be within the existing public footway/highway only.

18.4.12 The location of utilities shown within drawing 2929400-HL-LB-DR-U-900-0001 are currently taken from asset records only. A PAS128 utility survey, including trial holes where necessary, would be undertaken as required and ahead of any excavation works.

18.4.13 A detailed route-proving exercise for the new offsite cabling has not currently been undertaken. This would be undertaken ahead of installation of the cabling and mains at a later project design stage. Currently, a desktop review and local knowledge of the area (via the dedicated Merthyr Tydfil NGED engineering team and local developer/Client team) has been used to establish the provisional routing options for power to the site. See drawing 2929400-HL-LB-DR-U-900-0002.

18.4.14 As part of the route proving exercise, utility asset records would be procured across the entire offsite route and a walk-over survey undertaken to identify any possible engineering complexities across the route. A PAS128 utility survey, including trial holes where necessary, would be undertaken ahead of any excavation works.

18.5 Baseline Environment

Existing baseline

18.5.1 There are existing overhead National Grid Electricity Infrastructure power lines that are shown to cross the southern boundary of the site. These can be seen from ground level and will be retained onsite.

18.5.2 There is a buried Intermediate Pressure gas main also present onsite, shown crossing the south-east corner. This main is not anticipated to be impacted by development due to its depth and location.

18.5.3 Offsite, there is an extensive network of existing utility infrastructure present within the public footpaths and highways.

18.5.4 The new site entrances will not conflict with existing utilities, and as such diversionary work is not required.

18.5.5 Subject to the agreed routing of the new offsite cabling and water pipe, existing utilities may be affected by the installation of additional infrastructure.

18.6 Mitigation within the Submitted Design

18.6.1 By establishing a POC to the 11kV HV network, a primary substation (33kV/11kV, external, 40m x 40m footprint) would not be required onsite.

18.6.2 As per New Roads and Street Works Act (NRSWA) and National Joint Utilities Group (NJUG) guidelines, new utilities would run within the public footpath and verge of the existing road network. Where there is insufficient space within the footpath, the public highway would be used.

18.6.3 The indicative power routing design avoids running in greenfield, private land, beneath the River Taff and Merthyr Railway. When crossing the River Taff and railway line, new utilities would remain within the existing public footway, highway, or bridges as appropriate and would not run within Greenfield or underneath the River via directional drill or similar.

18.7 Likely Significant Environmental Effects of the Scheme

18.7.1 In regard to utilities, negligible environmental effects of the scheme are anticipated. All offsite works can be undertaken within the public footpath/highway using standard practises. Onsite installations are to be sympathetic to the surroundings, with considered placement, minimising their impact.

18.7.2 In terms of the operational energy itself, changes to Part L and the introduction of SAP 10.1 mean that by committing to an all-electric approach, there will be a significant reduction in the sites carbon footprint from operational energy when compared to a traditional or CHP gas-fired system for heating and hot water. *See Greenhouse Gas Emissions and Climate Change chapter for further detail.*

18.8 Additional Mitigation, Compensation and Enhancement Measures

18.8.1 Coordination of the on and offsite routing of the new power cables, telecoms cables and water pipe to ensure that a shared utility corridor is used, is recommended to minimise excavation and materials for reinstatement.

18.9 Summary

18.9.1 Consultation with the statutory utility authorities in the area has demonstrated feasibility in terms of connectivity to the local utility networks and effects on the surrounding natural environment are expected to be low. Although the full extent of the offsite works required for all services is not currently fully established, due to the location of the infrastructure being within the existing built environment (and public realm), is not anticipated that new installations following this principle would negatively impact the ecology or historic heritage of Merthyr Tydfil.

18.9.2 The existing onsite overhead National Grid Electricity Infrastructure power lines, and Intermediate Pressure gas main, will remain in situ and therefore avoid the requirement for diversionary works to be undertaken.

18.9.3 New utility installations will avoid running within the areas of SSSI and SINC.

18.9.4 The onsite electrical infrastructure required to support the Rhydycar West development can be provided via 2no new 11kV cables terminating in 1no main intake room (located internally to a building or standalone/external). A series of smaller standard size 1MVA distribution substations would then supply the various buildings across the development. These assets can also be located within a building footprint, reducing any impact to the surrounding environment.

19.0 Conclusions

19.1 General

19.1.1 This ES has reported on the EIA undertaken for the proposed development and has been carried out in accordance with current legislation and guidance. It has highlighted adverse and beneficial impacts and residual effects associated with the Scheme under a number of environmental topic headings and also described how any adverse effects would be mitigated.

19.1.2 A summary of the significant environmental effects of the proposed development associated with each environmental topic is provided within each environmental topic chapter (Chapters 5 to 18). Those texts are brought together here in this chapter.

19.1.3 Any limitations in the assessment process have been identified within the individual environmental topic chapters.

19.2 Background

19.2.1 Chapter 1 of this ES sets out the background of the planning application. A consideration of alternatives is set out in Chapter 4, including alternative forms of the development which were considered prior to submission of the planning application.

19.3 Proposed Development

19.3.1 The proposed development is described in detail in Chapter 3 of this ES.

19.4 Socio-Economic - Summary of Effects

19.4.1 The socio-economic assessment establishes the current baseline conditions for the local population and labour market, utilising available secondary data and applying the relevant standards provided by HM Treasury and Homes and Communities Agency, as well as expert professional judgement, in order to determine the likely impact of employment generated by the proposed development.

19.4.2 For context and comparison, baseline conditions are established for the Direct Impact Area (the Lower Super Output Area within which the site is located), the Wider Impact Area (Merthyr Tydfil Travel to Work Area (TTWA), which represents the principal labour market catchment area of the site) and at a national level (Wales). The existing socio-economic baseline conditions are established in relation population age, qualifications, employment sectors, employment industry, employment/unemployment status, deprivation, and local residential and commercial receptors.

19.4.3 In terms of proposed mitigation, no specific measures are designed into the proposal and given that no significant adverse effects are projected, no additional mitigation measures are required. Nonetheless, the developer intends to commit to a series of measures to secure local recruitment and training opportunities, including submitting a schedule of likely employment/training opportunities and a list of appropriate organisations to be consulted for each opportunity (e.g. Tydfil Training, Merthyr College, local Job Centre); and working with approved Partner organisations during the recruitment process. The measures will be legally binding via a Section 106 agreement, to ensure the economic benefits of the proposal are focused to Merthyr's local economy. The residual socio-economic effects are effectively the same as the identified likely significant effects, as no additional mitigation measures are required.

19.4.4 The construction phase of the development is expected to support 1,549 net additional jobs per year over the c.3-year construction phase, comprised of 1,219 jobs within Merthyr Tydfil TTWA and 330 jobs outside the area, resulting in a highly significant beneficial effect on employment. The operational phase of development is expected to provide 842 direct additional jobs (755 net jobs), comprised of 663 jobs (594 net jobs) in Merthyr Tydfil TTWA and 179 Jobs (161 net jobs) outside the area, resulting in a highly significant beneficial effect. Additional indirect jobs will also be created.

19.4.5 Overall, the proposed development supports high levels of new employment during both the construction and operational phases, with benefits targeted primarily to the local economy and labour market of Merthyr, whilst also contributing to economic growth on a wider regional and national level. The socio-economic impact of the proposal is therefore highly significantly beneficial.

19.4.6 The construction of Rhydycar West would contribute c.£317.6m in additional Gross Value Added (GVA) to the economy over the duration of the construction period. GVA is the value of the amount of goods and services that have been produced, less the cost of all inputs and raw materials. It represents the additional value that is added through economic activity on site and through the supply chain.

19.4.7 The Rhydycar West project will contribute c.£38.1m in GVA to the economy per annum. This compares favourably to the turnover related spend (GVA) generated by the Principality Stadium in Cardiff which stood at £19.5m in 2017-184.

19.5 Greenhouse Gas Emissions and Climate Change - Summary of Effects

19.5.1 The Greenhouse Gas (GHG) Emissions and Climate Change assessment identifies the likely significant impacts specifically in relation to embodied carbon, tree loss, traffic-related emissions and carbon dioxide emissions.

19.5.2 The assessment establishes a baseline of existing sources of carbon emissions at the site and a future baseline; identifies and measures the likely sources of carbon emissions resulting from the construction and operational phases of the development; reviews how alternatives can demonstrably reduce carbon emissions; and by applying the relevant IEMA methodology, determines the anticipated impacts of the proposal.

19.5.3 Embedded mitigation measures, i.e. those built in to the design of the proposal, are proposed to minimise GHG emissions. During the construction phase, these measures include shortening the supply chain by ensuring a preference for local suppliers; prioritising wherever possible the use of low embodied carbon materials; adopting circular economy principles within the design; detailed consideration of the placement of the proposed development to minimise impact on ecology; positioning the building and structures to minimise the number of trees to be felled; re-use and/or recycling of materials extracted during enabling works; and management of waste materials.

19.5.4 Meanwhile during the operational phase, embedded mitigation measures include a heat exchange system to enable excess heat from cooling the Indoor Snow Centre to be used to heat the Indoor Water Park; implement an all-electric, combustion-free operational energy strategy; verified green tariff so that zero emissions are achieved from day-1 of operation; optimised solar PV installation throughout the site; energy modelling in accordance with Part L requirements; energy efficient building fabric; suitable glazing to reduce heating demand; encouraging sustainable travel to and from the site via the implementation of a Framework Travel Plan to prioritise non-car travel and public transport usage; and s106 measures to increase local participation in terms of staffing and usage of the facility. For all energy that is required for the operations of the development, the Energy Strategy is projected to achieve a ~92% reduction in energy demand and therefore a ~92% reduction in regulated emissions compared to the Part L 2022 Wales notional building.

19.5.5 IEMA's overarching principles on Climate Change Mitigation and EIA acknowledge that carbon emissions from all projects will inevitably contribute to climate change. Therefore, additional mitigation measures are proposed to further reduce any potential adverse impacts arising from the development, such as low form factor design, high albedo materials, smart metres/sub metres (detailed fully within Chapter 6).

19.5.6 Taking additional mitigation measures into account, the likely residual effects of the development are:

- Embodied carbon during construction – minor adverse effect, not significant.
- Construction traffic - minor adverse, not significant.
- Energy in operation - negligible, not significant.
- Embodied carbon (during operation – repair and maintenance) – minor adverse, not significant.
- Operational phase traffic – the impact of operational traffic is moderate adverse, significant. However, if the various mitigation and other measures detailed were taken into account, this effect would be reduced. Although the effect of certain mitigation measures to address operational traffic are unknown and are difficult to quantify, the proposed mitigation measures can be actioned during the detailed design stages. Implementing secondary mitigation measures to improve access to the site with sustainable transport modes will reduce the residual effect. The ongoing electrification of the transport sector and continuous decarbonisation of the

national electricity grid are expected to further reduce the annual emissions of the Proposed Development during its operational stages.

- Climate resilience and adaptation – the embedded mitigation measures that form part of the proposal are considered to reduce potential risks related to climate change, hence none were identified that are likely to result in significant impacts, resulting in no significant residual effect.

19.6 Ground Conditions - Summary of Effects

19.6.1 The ground conditions assessment is based on a desk-based study only and intrusive investigation has not been carried out on the site to support the process. Whilst this assessment combined all data which was available to review, the actual extent of workings beneath the site will need to be proved through intrusive ground investigation in due course. Given this, the assessment process is undertaken based on a conservative approach.

19.6.2 The baseline data indicates the complex nature of the ground conditions associated with the extensive legacy of coal workings on the site and in the subsurface. The development location has been chosen to minimise risks associated with ground conditions, i.e. a form of primary embedded mitigation. Notwithstanding this, additional mitigation will be required to assess and manage risks. The implementation of the proposed mitigation measures will provide beneficial impacts for the site due to the improvement in ground stability and management of contaminated land, water and ground gas issues. The assessment and mitigation process will follow an iterative and phased approach to include:

- Initial assessment undertaken utilising geophysical surveys to identify potential locations of mine entries across the site;
- Identification of key areas to target with intrusive investigation, including drilling to assess for shallow workings and probe holes to locate mine entries. All works will be undertaken in consultation with the Coal Authority and under the licensing requirements of the Authority;
- Undertake a geo-environmental assessment of ground conditions to identify areas of the site where concentrations of contamination pose an unacceptable risk to potential receptors;
- Undertake an assessment of mining based activities in the context of the proposed development in order to identify potential remedial works required to stabilise former mine workings, mine entries and spoil tips etc;
- Piling risk assessment taking into consideration known ground conditions and based on current best practice guidance for piling in contaminated sites, with particular reference to prevention of the creation of migration pathways for potentially contaminated surface and ground water and mine / ground gas;

- Ground gas assessment will be undertaken compliant with CIRIA C665 guidance and protective measures adopted in the design of buildings and enclosed spaces as required.

19.6.3 During the construction phase:

- Localised stabilisation treatment of mine workings, mine entries and spoil tips is anticipated. Remedial works will be determined based on the findings of the ground investigation phase.
- Appropriate working practices to be adopted, such as method statements and use of PPE to protect workers.
- A Construction Environmental Management Plan (CEMP), Materials Management Plan (MMP) and Site Waste Management Plan (SWMP) will be implemented.
- Ground gas protection measures will be implemented, validated and inspected where required.

19.6.4 During the operational phase:

- Operational Management Systems will ensure correct management of fuels, oils, chemicals and waste.
- Where SUDS are in place, discharge of surface water runoff to surface water bodies should be undertaken via suitable oil water interceptors where required.
- A maintenance handbook will be developed.

19.6.5 In terms of additional mitigation proposed, a reactive approach will be adopted during the development phase to identify any adverse impacts on ground conditions. Further investigation and assessment may be required during construction phase, as ground investigation is an iterative process. A watching brief and presence of Geotechnical Specialist on site will ensure the construction works are appropriately observed and monitored.

19.6.6 The additional mitigation measures proposed reduce the identified adverse effects on ground stability and ground contamination to minor or negligible significance, i.e. there are no significant residual effects anticipated. Meanwhile, the beneficial effects identified for stabilisation of coal workings and reduction in surface water infiltration leading to reduced mobility of contaminants, are of major and minor significance, respectively. Therefore, the proposal results in a significant beneficial residual effect on stabilisation of coal workings.

19.6.7 Overall, the proposed development will require further site investigation to inform any required remedial works. However, the proposed mitigation measures that have been outlined fully in Chapter 7, are considered appropriate to reduce the impact of the proposed development on ground conditions to an acceptable level (i.e. with no significant adverse residual effects) and with beneficial impacts upon reducing infiltration rates (minor beneficial) and ground stability (major beneficial – significant residual effect).

19.7 Ecology - Summary of Effects

19.7.1 The Ecology assessment is informed by an extensive series of desk-based and field surveys undertaken at the site between 2015 and 2022, which have enabled a thorough understanding of the baseline conditions of the site in respect of statutory and non-statutory designations, habitats and flora, grassland fungi, specially protected fauna (including great crested newts, bats and badgers), breeding and wintering birds, and invertebrates.

19.7.2 The site includes approximately 6ha of Cwm Glo a Glyndyrys SSSI, representing just c.3% of the SSSI as a whole and comprising an area which does not include any significant examples of the designation's features of special interest, unimproved marshy, neutral and acid grasslands representing the prime SSSI features, or any grasslands of higher value for fungi. The site also includes areas within Rhydycar West SINC and Cwm Glo SINC.

19.7.3 Both the location of the development within the wider landholding and the detailed positioning and extent of the Application Site have been configured through numerous design iterations in order that overlap with the designated Cwm Glo a Glyndyrys SSSI is restricted to the absolute minimum necessary. This has seen the quantum of SSSI land affected by the proposed development incrementally reduced over time in order to reduce impacts on the statutory site. Some SSSI landtake remains unavoidable, however, in order to deliver the Indoor Snow Centre, which is the central focus of the scheme. In total, a direct landtake of 6ha of the SSSI is anticipated, which represents a little over 3% of the total land area of Cwm Glo a Glyndyrys SSSI.

19.7.4 The parts of the SSSI affected by the proposed development do not contain any significant representations of the primary features of special habitat or mycological interest underpinning the designation. Thus, it is considered that the direct loss of SSSI land to the development will have little or no impact on the national and international mycological importance of the SSSI, and will not result in the direct loss from the SSSI designated area of any substantive quantum of the cited marshy grassland, acid grassland or heathland habitats, including those supporting the site's current population of marsh fritillary.

19.7.5 Consequently, it is primarily the secondary interest features of the SSSI that will be directly affected, in particular woodland, scrub and 'ffridd' habitats of a type falling outside the scope of the primary interest features.

19.7.6 The nature of the proposal necessitates extensive remodelling of ground levels in the northern part of the site, whereas development in the southern part of the site will be less intrusive and seeks to retain existing woodland as far as possible.

19.7.7 Proposed mitigation includes the comprehensive management of the vast majority (c.97%) of the SSSI designated land that lies outside the application site but within the Applicant's ownership, in order to protect to grassland habitat and associated features of ecological interest in the long term. A CEMP will be implemented to ensure strict construction zones with protective fencing, pollution prevention techniques, sensitive lighting design and drainage, to ensure minimal effects on surrounding biodiversity.

19.7.8 The management of the undeveloped SSSI land will also offset impacts arising from the partial loss SINC land. A Species Protection Plan (or similar) will set out the mitigation measures to be adopted to address any impacts upon protected species, such as obtaining the relevant licenses, suitably timed habitat manipulation to ensure minimal disruption to habitats and species, and pre-commencement checks of structures and trees capable of supporting bats.

19.7.9 Additional offsite measures are yet to be confirmed and are subject to further consideration when additional information becomes available, however indicatively this will include securing and enhancing additional land and related habitats off-site or via financial contributions to established or new conservation projects ecologically and geographically in the South Wales region.

19.7.10 In terms of residual impacts, the 'worst case' impact upon the SSSI is considered to be minor adverse owing to the net loss of designated land (minor magnitude at a national level, moderate magnitude at a regional level) during construction. Proposed on and off site mitigation proposals are considered to compensate for the direct and indirect impacts in the medium to long-term, resulting in a net neutral to minor positive impact for the operational phase given the consequences remain unknown at this stage.

19.7.11 A moderate adverse 'worst case' impact is anticipated for the Rhydycar West SINC and Cwm Glo SINC during construction but again, the mitigation and compensation measures proposed are likely to offset these effects in the medium to long term, resulting in a net neutral to minor positive impact for the operational phase given the consequences remain unknown at this stage.

19.7.12 For most protected species, there is expected to be a neutral or minimal (near neutral) residual effect during construction. For great crested newts, there is potential net beneficial impact during the construction phase. Minor magnitude adverse impact significant at Borough level is anticipated for TPO woodland, depending on quantum of existing tree resource that can be retained in the woodland lodge area. Bat assemblage would suffer a minor magnitude adverse impact at Borough level, potentially reduced to near neutral by licensed mitigation, during the construction phase. During the operational phase, appropriate management of the wider SSSI land is expected to result in neutral to minor positive impacts for the majority of protected and notable species, noting some uncertainty relating to more sensitive bird species (e.g. nightjar) which has the potential to become displaced.

19.8 Traffic and Transport - Summary of Effects

19.8.1 The Traffic and Transport Chapter is supported by a Transport Assessment and Framework Travel Plan, which provides the baseline information including recent traffic survey data and accident data for the site and study area. On this basis, the TA has quantified the trip generation expected to result from the proposed development.

19.8.2 A Net Impact Assessment was also undertaken and confirmed than no roads were identified to experience a net impact of 10% or more. Therefore, the assessment is based on the two receptors with the highest identified net impact (8%): the A470 (between Site Access

Roundabout and Bike Park Wales Roundabout); and A470 (between Swansea Road Roundabout and Site Access Roundabout).

19.8.3 The Chapter assesses the likely effects resulting from the operational phase of the proposed development, upon the two road receptors in respect of traffic flows, severance, driver delay, pedestrian delay, pedestrian amenity, fear and intimidation, and accidents and safety. Effects are assessed based on two scenarios: 2026 assessment year; and 2026 assessment year plus development traffic, which includes consideration of cumulative (committed) development.

19.8.4 Although no significant impacts are expected for the construction phase, the proposal does include mitigation through implementing a Construction Traffic Management Plan (CTMP), which will form part of the Construction Environmental Management Plan (CEMP) and minimise the effects of construction traffic upon the local highway network and its users.

19.8.5 During the operational phase, additional mitigation measures beyond those incorporated into the scheme's design include a Framework Travel Plan, which aims to promote sustainable travel by, for example, providing a shuttle bus service to key destinations in Merthyr including the railway station, bus station and town centre and reduce single occupancy car trips; local network improvements to the bridleway route crossing A470; provision of EV charging facilities; and staff travel measures.

19.8.6 As a result, the likely significant residual effect for the construction phase is of short-term, temporary, negligible significance. For the operational phase, both road receptors are projected to experience a long-term, permanent residual effect of negligible significance.

19.8.7 Overall, the proposed development is expected to result in a negligible (i.e. not significant) impact upon traffic and transport.

19.9 Archaeology and Cultural Heritage - Summary of Effects

19.9.1 The baseline information for the assessment is provided within the supporting Archaeology and Cultural Heritage Baseline Assessment. The baseline also references the Assessment of the Significance of the Impact of Development on Historic Landscape Areas on the Register of Landscapes of Historic Interest in Wales (ASIDOHL2) assessment of effects on the Merthyr Tydfil Landscape of Outstanding Historic Interest (MTLOHI), in line with the relevant Cadw guidance.

19.9.2 There are parts of two scheduled monuments and a Grade II listed building within the site boundary, meanwhile within a 2km radius of the site there are 23 scheduled monuments, 3 conservation areas, part of a 4th conservation area, part of a Historic Park and Garden and 145 listed buildings. For historic assets beyond the site boundary, a Zone of Theoretical Visibility (ZTV) has been utilised to identify assets with potential intervisibility with the site. Those sites within the ZTV are the identified receptors for the EIA.

19.9.3 Embedded mitigation measures that form part of the proposal include the deliberate avoidance of sensitive historic assets in the development footprint. A Conservation

Management Plan will also be designed and implemented, to minimise adverse effects on the three scheduled monuments partly on or adjacent to the site.

19.9.4 Additional mitigation proposals include the recording of non-designated heritage assets during construction phase, archaeological investigation of the site comprising a topographic survey and targeted trenching and/or excavation, to be set out within a Written Scheme of Investigation to be secured by planning condition. Community engagement with the archaeological process is also proposed, and a bilingual heritage display with information about the site's heritage is to be provided on site for public viewing. No additional mitigation is proposed for the operational phase, beyond the primary mitigation measures.

19.9.5 The proposed development will result in the loss of 10no. non-designated heritage assets within the site. However, the additional mitigation proposed in the form of recording and opportunities for community engagement reduces the residual significance of effects from the proposal and will improve the wider understanding and interpretation of the local historic environment. As a result, only non-significant residual adverse effects to the 10no. non-designated historic assets are assessed. A beneficial effect is assessed to 1no. non-designated historic asset. The construction phase has also identified significant beneficial residual effects to 4no. designated historic assets, comprising 3no. scheduled monuments and 1no. Grade II listed building (ranging from Minor to Major significance).

19.9.6 The residual effects for the operational phase are significant (Moderate) beneficial effects to 3no. scheduled monuments, significant (Moderate) adverse effects to 2no. scheduled monuments, and non-significant (Negligible to Minor) adverse effects to 1no. scheduled monument, a Grade II* Historic Park and Garden and a conservation area.

19.9.7 Overall, the highest value assets within the site and vicinity are expected to significantly benefit from the proposed development by virtue of the protection and management of the assets as will be set out within a Conservation Management Plan. In addition, the proposed recording of archaeological remains contributes to offsetting the adverse effects arising from the loss of non-designated assets in-situ.

19.10 Hydrology and Hydrogeology - Summary of Effects

19.10.1 The baseline information for the assessment is provided within the supporting Hydrological Desktop Assessment (Preliminary Risk Assessment), which includes findings from a series of site walkovers. No intrusive investigation has been carried out on site, meaning that the actual ground conditions on site are yet to be confirmed. The desk-based information together with professional expertise has therefore been applied to conduct a qualitative impact assessment. A Hydrogeological Conceptual Site Model has also been developed to provide a basis for characterising the water environment, which has been shaped and modified by extensive mining works at the site.

19.10.2 The chapter identifies the following receptors: Coal measures aquifer; Surface water features including ponds, springs and water courses on site; Off-site private water supplies; Off-site surface water features, e.g. River Taff; Cwm Glo a Glyndyrys SSSI & Rhydycar West SINC; and Scheduled Monuments. The hydrological and hydrogeological features with the greatest

sensitivity to the proposed development are those in areas of the site which are immediately adjacent to surface watercourses. Groundwater levels, both within the underlying mine workings, sandstone units of the coal measures, and spoil tips/ heaps, have the potential to be impacted by the development.

19.10.3 Other sensitive features include the underlying ironstone drainage system, which controls the hydrogeology beneath the site and the surrounding area and two off-site private water supplies which are abstracting groundwater from the Coal Measures aquifer; and nearby Scheduled Monuments (e.g. Cyfartha Pond and Leat and Cwm Pit Head of Railway).

19.10.4 Additional mitigation is proposed, including:

- Implementation of a CEMP to ensure careful management of on site operations.
- Implementation of a Groundwater Protection Plan for construction phase to identify and manage any risks.
- A site audit to be undertaken by a Hydrogeological professional, who will monitor the construction phase works.
- Ground investigation works (monitoring boreholes) proposed to be undertaken as part of detailed design stage and will inform a Groundwater Monitoring Strategy and Plan.
- Implementation of a Remediation Strategy to identify any contamination and associated required mitigation.
- Where possible, excavations will take place in dry weather conditions.
- SuDS features.

19.10.5 During the operational phase, the following mitigation is proposed:

- Water, drainage and flooding mitigation measures, as detailed within the supporting Drainage Strategy report.
- Appropriate installation of water supply pipes, in accordance with the relevant guidance.
- Flood risk and drainage mitigation as set out within the supporting Flood Consequence Assessment Report, including the re-alignment of the Nant Melin Canaid to prevent ongoing erosion of the Cwm Pit and Head of Railway masonry stone wall.

19.10.6 As a result of the proposed mitigation, the residual effects for construction phase range from minor to negligible significance. For the operational phase, residual effects are also primarily found to be negligible, with minor adverse residual effects anticipated for accidental spillages

and potential contamination relating to the Scheduled Monuments and SSSI receptors. No significant residual effects are therefore anticipated to result from the proposal.

19.10.7 Overall, the proposed mitigation measures for both construction and operational phases to ensure that any potentially significant impacts on water, drainage and flooding are reduced to an acceptable, non-significant level.

19.11 Landscape – Summary of Effects

19.11.1 The landscape and visual impacts have been assessed through a combination of desk study research and walk-over surveys of the site and surroundings, in accordance with the relevant guidelines for LVIA.

19.11.2 The site contains former mining features, disused railway infrastructure, tips and has a distinctive character and context.

19.11.3 Various measures are incorporated into the design of the proposal to mitigate against any adverse impact upon the landscape and visual features of the site and context, such as:

- retaining trees and TPO woodland wherever possible;
- designing the northern façade of the Indoor Snow Centre with muted colours and a textured elevation to reduce visual prominence from the north;
- preserving and managing heritage features that contribute to the landscape character;
- planting along the southern facing slope to integrate the proposal into the surrounding landscape; and
- proposed public access routes to offset the diversion and removal of existing public rights of way within the site.

19.11.4 Whilst detailed design is yet to be confirmed at this stage of the development, parameters for building size, height and massing have been set. The LVIA assesses the maximum building parameters to reflect a worst-case scenario for the proposal to ensure a robust assessment. Owing to the nature of landscape and visual impacts and mitigation, LVIA methodology differs slightly from other technical chapters within this ES, whereby effects are assessed at construction stage, at completion of the development and 15 years after completion.

Landscape Effects

19.11.5 Landscape receptors are broken down into features, qualities and characteristics within the site; and landscape context of the site.

19.11.6 The landscape impact upon the features, qualities and characteristics within the site, is summarised below:

- Landform of east facing slope: major adverse (significant) effect during construction and at completion, reducing to moderate neutral (not significant) after 15 years.
- Areas of woodland and trees: major adverse (significant) effect during construction and at completion, reducing to moderate neutral (not significant) after 15 years.
- Mosaic character: major adverse (significant) effect during construction, major-moderate adverse (significant) at completion, and moderate neutral (not significant) after 15 years.
- Attractive distant views from open elevated areas: moderate adverse (not significant) effect during construction, reducing to minor adverse (not significant) effect at completion and after 15 years.
- Setting to the urban edge of Merthyr Tydfil: major-moderate adverse (significant) effect during construction, rising to major adverse (significant) at completion and reducing back to major-moderate adverse (significant) effect after 15 years.
- Recreational access and setting to PRoW and public access land: major adverse (significant) during construction, at completion, and after 15 years.

19.11.7 Meanwhile effects upon the landscape context of the site are assessed as follows:

- Merthyr Tydfil: minor adverse (not significant) effect during construction and at completion, reducing to negligible (not significant) effect after 15 years.
- Cyfarthfa Park: moderate adverse (significant) effect during construction, reducing to minor adverse (not significant) effect at completion and after 15 years.
- Upland and extractive landscape between Merthyr Tydfil and the BBNP and upland common to the east of the site: minor adverse (not significant) effect during construction, at completion, and after 15 years.
- BBNP: minor adverse (not significant) effect during construction and at completion, reducing to negligible effect (not significant) after 15 years.

19.11.8 Overall, the proposed development of the site will inevitably change the character of some features of the site, particularly during the construction phase and at completion. As well as introducing new features, some areas of the site and within the wider area of ownership, will largely retain the key characteristics. The proposal also presents opportunities to engage local people to the landscape and history of the site. 15 years after completion, it is likely that some features of the site would be ingrained within the wider landscape and would contribute to its mosaic character, including the planted south facing slope and new woodland areas. Other characteristics are likely to remain largely unchanged, including available distant views out of the site and retained woodland areas.

Visual effects

19.11.9 The visual receptors identified are people in settlement and residential properties; users of PRoW and public access areas; road users; and other areas with a specific landscape interest.

19.11.10 Effects upon visual residential amenity are assessed as follows:

- Residents with open views to the east of the site are predicted to experience a major adverse (significant) effect during construction and at completion, reducing to major-moderate adverse (significant) after 15 years.
- Residents to the northeast of the site are predicted to experience major adverse (significant) effects at construction, reducing to moderate (significant) 15 years after completion.

19.11.11 Users of public open space:

- Users of public space in Merthyr Tydfil are predicted to experience a moderate adverse effect (significant) during construction and at completion, reducing to moderate-minor (not significant) 15 years after completion.
- Users of public rights way and National Cycle Route 8 are mainly assessed as moderate adverse (significant) during construction, at completion, and after 15 years.

19.11.12 Road users:

- Road users within 2km of the site are predicted to experience a moderate-minor (significant) adverse impact during construction, at completion, and 15 years after completion. Road users would typically have oblique or partial views towards the proposed development that would be short in duration with the proposals viewed in context to the surrounding townscape.

19.11.13 The visual assessment has identified adverse impact for PRoW users within the site and areas beyond the site boundary with open views towards the site, particularly from the east within the urban area. Built development within the urban area reduces the extent of areas where uninterrupted views are available. Effects for other visual receptors are generally moderate adverse however the proposed mitigation ensures a reduction in significance of effects for several receptors following construction and after 15 years.

19.11.14 The Landscape and Visual Impact Assessment has therefore identified that the site could accommodate the proposed development without resulting in an unacceptable adverse residual impacts on landscape character and visual amenity experienced within the surrounding landscape/townscape.

19.12 Water, Drainage and Flooding - Summary of Effects

19.12.1 For the Water and Drainage assessment, the methodology involved investigating the existing baseline conditions of the site and surroundings, including liaison with key stakeholders; determining potential surface water runoff linkage to existing water and drainage regime and infrastructure, including a site walkover survey; calculating existing and proposed foul and storm flows resulting from the existing site and proposed development; considering drainage infrastructure and mitigation required to support the proposal, which is informed by the supporting Flood Consequences Assessment (FCA).

19.12.2 For the Flooding impacts, the assessment methodology involved investigating the existing baseline flooding information for existing nearby watercourses, including liaison with key stakeholders; assessment of potential flood sources using NRW secondary data supplemented by a site walkover; assessing existing site levels using topographical survey; assessing proposed development levels; comparing flood levels with the site's topography and levels information to assess flood risk, as informed by the FCA. The site lies within Flood Zone 1, i.e. minimal risk of flooding.

19.12.3 The proposal remains subject to detailed design stage, so the proposed mitigation is based on indicative proposals and desk-based information, together with applying professional expertise and best practice guidance. Hydraulic modelling and infiltration testing will be undertaken at a later stage to inform the detailed drainage design.

19.12.4 The baseline study determined that the development's foul discharges can be accommodated in the existing sewer network, whilst surface water discharges will be to watercourses within the site, subject to the relevant consents and approvals.

19.12.5 The proposed development incorporates primary mitigation measures through layout design, which facilitates detention basins for surface water flows and accommodating a Greenfield Runoff equivalent rate, in accordance with the relevant legislation. This approach results in a benefit to surface water runoff rates.

19.12.6 Additional mitigation measures proposed for construction phase include:

- Discharging foul water to a designated Wastewater Treatment Works
- Adhering to guidance and legislation
- Implementation of a CEMP, to include measures such as wheel washing and daily inspection of watercourses
- Iterative and phased approach to construction mitigation

19.12.7 Additional mitigation measures proposed for the operational phase include:

- Implementing water usage reduction measures including water efficient appliances

- Hydraulic modelling assessment to determine water supply requirements of the proposal
- Subject to planning and sewer requisition approval, construction of a sewer within the site to connect to and serve the development
- Rainwater harvesting tanks to reduce stormwater flows and reduce water demand
- Introducing swales
- Use of porous asphalt
- Use of bunded fuel storage areas, trapped gullies and silt traps manholes to mitigate potential impact on water quality
- Regular maintenance and monitoring of pollution control measures

19.12.8 No fluvial flood risk is identified, so no associated mitigation measures are required or proposed in this regard.

19.12.9 Considering the mitigation proposed, the impact of the proposed development on most of the identified receptors will be Negligible. Whereas the proposed attenuation to greenfield rate and SUDS, result in beneficial residual effects assessed for water flows during construction phase; the risk of contamination for storm drainage and flooding during operational phase; and flood risk to proposed Areas 1, 2 and 5 of the proposed development.

19.12.10 Overall, apart from pluvial flood risk, there is no risk of flooding to or from the proposed development from any identified flood sources. Any potential pluvial flood risk to or from the proposed development will be mitigated against with the measures detailed within Chapter 13 and the FCA; watercourses will be rerouted subject to appropriate consents and approvals, and a SuDS compliant drainage scheme will be implemented. Furthermore, the proposed development will provide beneficial residual effects on surface water runoff rates for all events greater than Qbar. There is a residual negligible flood risk to the site.

19.13 Noise – Summary of Effects

19.13.1 The noise impact assessment is supported by a baseline monitoring survey undertaken at various locations in and around the site, which measures the existing noise levels in accordance with the relevant guidance. The existing noise sources are primarily traffic noise associated with the A470 and surrounding roads and railway, industrial and commercial facilities to the east.

19.13.2 The nearest noise receptors to the site were chosen as the focus for the noise assessment. The receptors vary in sensitivity based on their use, for example residential uses are considered highly sensitive and commercial uses are considered to have a medium sensitivity to noise effects.

19.13.3 To mitigate noise impacts, various measures are integrated with the development proposal, namely the implementation of a CEMP (as outlined in Chapter 3) and incorporating a glazing and ventilation strategy to achieve acceptable noise levels in sensitive spaces of the proposed development.

19.13.4 As no significant adverse noise impacts are identified, no additional forms of mitigation are required or proposed.

19.13.5 For construction phase, the residual effect is Negligible to Minor Adverse, i.e. not significant.

19.13.6 For operational noise, the impact has a Negligible residual effect, i.e. not significant; and noise impact from road traffic during the operational phase is assessed as Negligible, i.e. not significant.

19.13.7 The proposal is therefore acceptable in terms of noise impact, as the assessment concludes no likely significant residual effects on any nearby sensitive noise receptors.

19.14 Air Quality – Summary of Effects

19.14.1 The Air Quality assessment involves consideration of four processes during construction phase (demolition, earthworks, construction and trackout), as well as development traffic during the operational phase in terms of predicted changes in levels of NO_2, PM_{10} and $PM_{2.5}$ emissions, in accordance with the relevant guidelines. Assessments are undertaken for different scenarios, namely a baseline scenario; future baseline scenario (accounting for committed developments and changes in emissions over time); and future scenario with the development (including the proposal together with committed developments and changes in emissions over time), in order to establish the likely effects of the proposal upon air quality.

19.14.2 There are no inherent air quality mitigation measures in the design of the proposed development, however best practice measures will be adopted during construction, as set out within a CEMP, that will control and manage potential air quality effects. The CEMP, in accordance with IAQM guidance, will include measures such as, developing a Dust Management Plan; regular site inspections; imposing maximum speed limits on site; implementing a Travel Plan; appropriate storage of materials; and wheel washing.

19.14.3 No additional mitigation measures beyond the inherent good practice measures that will be adopted, are required or proposed.

19.14.4 A full nitrogen deposition assessment was undertaken for ecological receptors Cwm Glo A Glyndyrys SSSI and Rhydycar West SINC. There were no predicted significant impacts on nitrogen deposition at these sensitive locations as a result of the proposed development and the impacts are considered to be negligible.

19.14.5 During the construction and operational phases of the proposed development, residual likely significant impacts are anticipated to be negligible, which is considered not significant in EIA terms. Based on the provided traffic data, a negligible effect on all receptors for both assessment years (2026 and 2031), are predicted to result from the development, i.e. not significant.

19.14.6 In summary, prior to the implementation of appropriate mitigation measures, the potential impact description of dust emissions associated with the construction phase of the proposed development is 'medium risk' at the worst affected receptors. However, it is anticipated that with these appropriate mitigation measures in place, the risk of adverse effects due to dust emissions from the construction phase will be negligible and not significant.

19.15 Lighting – Summary of Effects

19.15.1 Regarding lighting impact, an indicative lighting scheme has been prepared to support the proposed development. A lighting survey on site has determined the existing lighting levels and classification in the vicinity of the site, which demonstrate that existing sources of light are from the A470 road and vehicle lights, as well as lights from nearby residential properties and street lighting to the east. The assessment has involved modelling of the indicative lighting scheme to predict the obtrusive light values, in comparison with the relevant guidelines, to understand the potential likely impact.

19.15.2 The lighting scheme has been prepared in accordance with the statutory standards and seeks to meet various criteria to ensure the management of any environmental effects resulting from introducing artificial lighting to the site. These involve design measures such as use of flat glass, light baffles and time sensor controls, to reduce light spill.

19.15.3 The most sensitive receptors to the site are the nearest residential dwellings. The lighting scheme has also been prepared with input from the Ecology consultant, to ensure bat flight corridors are protected. In this regard, there are no known bat flight paths through the proposed development area, and bats will continue to use the existing flight paths around the boundary of the site, so light spill outside the site boundary has been limited.

19.15.4 Embedded mitigation measures include:

- the compliance with best practice guidelines for temporary lighting provision during construction phase, to be set out within a CEMP
- any lamp or optics equipment required for construction phase is to be carefully selected as set out within a CEMP
- internal lights designed away from windows to minimise external light spill, use of motion-sensor lighting control system on some areas of the site
- use of dark sky bollards, 4000k temperature luminaires, directional luminaires to limit upward glow
- use of warmer temperature lights to protect any roosting or foraging bats nearby
- maintenance of existing natural features such as hedges and trees to reduce spread of light

19.15.5 Likely effects during construction phase are expected to be negligible and temporary, i.e. not significant. Therefore, no additional mitigation measures are required nor proposed.

19.15.6 During the operational phase, the assessment has adopted a worst-case scenario based on the modelling of the indicative proposed lighting scheme, assuming that all amenity areas will be illuminated internally at the same time with no consideration for curtains, blinds or glazing, to ensure the assessment is robust.

19.15.7 For operational phase, the proposal's impact on sensitive residential receptors, ecological receptors, and dark sky receptors, are all assessed as negligible (i.e. not significant). Given the operational phase impacts have been assessed on a worst case scenario, it is anticipated that subject to detailed design (which will consider the impact of using curtains/blinds on windows) the likely effects of internal lighting will be further reduced.

19.16 Human Health – Summary of Effects

19.16.1 The human health assessment has been informed by desk-based research, which establishes the existing baseline conditions, together with the application of best practice principles and professional judgement.

19.16.2 In order to assess human health effects, the following determinants are considered:

a) Access to healthcare services and other social infrastructure;

b) Retention and enhancement of existing open and natural spaces;

c) Impact of air quality, noise, and neighbourhood amenity;

d) Accessibility and active travel; and

d) Access to work and training.

19.16.3 Based on the latest available data for self-assessed health (2011 Census), Merthyr Tydfil has recorded the highest proportion of 'bad' or 'very bad' health out of all Wales' local authorities (11.2%), which is also a higher rate than Wales and England as a whole. Merthyr Tydfil also performs poorly in terms of long-term health problems or disabilities, mental health and wellbeing, and has recorded lower life expectancy rates, when compared to other areas.

19.16.4 Embedded mitigation measures that form part of the proposal, which intend to reduce construction and operational effects in respect of noise, air quality, and transport, for example, will in turn mitigate effects on the human health of the local community. No additional mitigation measures are proposed.

19.16.5 The potential health benefits for the various health and wellbeing determinants are summarised below:

- Access to healthcare services – neutral health impact during construction or operation
- Capacity, location and accessibility of social infrastructure (e.g. schools, social care, community facilities) – neutral health impact during construction and positive health

impact during operation phase, with provision of additional social infrastructure (Indoor Snow Centre, Indoor Water Park, and other leisure facilities)

- Retention and enhancement of existing open and natural spaces – negative health impact during construction, due to the temporary or permanent removal of PRoW and public access. Positive impact during operation, when enhanced open space, landscaped areas and public access routes will be provided.
- In areas of deficiency, provision of new open or natural space, or improvement to existing spaces - Positive health impact during operation, due to the enhanced natural space, landscaped areas and outdoor activity provision, as well as public access routes through parts of the site.
- Links between open and natural spaces and the public realm – positive impact during operation through provision of new footpaths to link public realm to the local community.
- Welcoming, safe and accessible open and natural spaces – positive impact during operation with high quality amenity spaces proposed.
- Minimise construction impacts – neutral health impact during construction, given the proposed mitigation measures for dust and noise.
- Minimise air pollution from traffic and energy facilities – neutral health impact during construction and operation owing to the air quality mitigation measures proposed.
- Minimise noise pollution from traffic and commercial uses – neutral health impact during construction and operation owing to the negligible, non-significant noise impacts assessed in Chapter 14.
- Prioritise and encourage walking – negative health impact assessed for construction phase, with the temporary or permanent diversion or loss of PRoW routes. Positive health impact for operation phase, with provision of pedestrian access through the site.
- Prioritise and encourage cycling – negative health impact during construction, with restrictions on cycle connections. Positive health impact during operation with connections to local cycle networks and cycle parking facilities proposed.
- Connection to public transport, local services and facilities – Positive health impact during construction and operation given proximity to existing bus stop providing access to Merthyr Tydfil and its services. The scheme also proposes a shuttle bus during operation to improve connectivity and encourage use of public transport.
- Connection to public realm and internal routes to local and strategic cycle and walking networks – proposal will provide numerous jobs and facilities which will be accessible by sustainable modes of transport, walking and cycle routes.

- Access to local employment and training opportunities – positive health benefits during construction and operation due to the significant provision of new construction and permanent jobs as part of the proposed development. The proposal involves measures to ensure training and employment is targeted towards the local job market.

- Opportunities for work for local people – positive health benefit for construction and operation phases, due to the significant number of jobs that the proposal provides. The scheme will enter into a legally binding agreement (S106) to ensure employment and training opportunities benefit the local economy and job market.

19.16.6 Overall, the proposal will primarily result in positive potential health benefits for the population of Merthyr Tydfil. Although some potential negative health effects are predicted during construction phase, largely relating to the temporary diversion/closure of PRoW access, the proposal will on the whole provide much-needed health benefits to the area.

19.17 Utilities – Summary of Effects

19.17.1 Investigations have been undertaken with the local Electrical, Communications and Water statutory authorities.

19.17.2 Welsh Water have yet to define the point of connection or the extent of offsite works required; however, connection points are available. The specific connection point will be identified and modelled at the next design stage.

19.17.3 As the electrical Point of Connection (POC) to the Merthyr East primary substation will be at 11kV (HV), there will not be a requirement for a primary substation to be located onsite. Rather, incoming 11kV cables would terminate within an intake room, either located internally to a building or standalone/external building. A series of smaller standard size 1MVA distribution substations would then supply the various buildings across the development.

19.17.4 The 100% electric energy strategy has informed the overall load for the development and Hoare Lea have utilised this to identify the potential POC on WPD's network to deliver power to the site. WPD have been consulted and identified the Merthyr East primary substation as the POC.

19.17.5 All routes to site have been considered to have minimal environmental impact as they will likely be laid in the highway verge through the majority of their routes. Detailed route proving exercises will be undertaken at the detailed design stage in order to fully rationalise all routes to site, seeking to undertake combined trenching wherever possible in order to rationalise any excavation and further reducing any effects to the natural environment.

19.17.6 The presence of both the overhead powerlines and the intermediate pressure gas main are considered to be negligible and unaffected by the proposed development and any new site entrances are unlikely to have any effect on existing utilities.

19.18 Cumulative Assessment – Summary of Effects

19.18.1 Cumulative effects result from multiple actions on receptors or resources occurring in combination over time.

Socio Economic

19.18.2 There are no likely forthcoming developments identified that would result in any cumulative socio-economic impacts.

Climate Change

19.18.3 IEMA guidelines establish that GHG emissions from all projects cumulatively contribute to climate change, meaning that climate change is a cumulative effect in itself, and is therefore inherently addressed within the GHG and climate change assessment.

Ground Conditions

19.18.4 No cumulative impacts are identified for ground conditions.

Ecology

19.18.5 Two consented sites of potential cumulative impact are identified in the locality: Bike Park Wales and Trago Mills. The consent for Bike Park Wales involves the loss of some trees and woodland and secures appropriate mitigation for protected species and landscape via planning condition. In combination, there would be somewhat increased loss of woodland cover and partial loss of another SINC (Graig Gethin), however secured mitigation for protected species means no significant cumulative or additive effects are anticipated.

19.18.6 For the Trago Mills site, there is considered to be no surviving functional link between Trago Mills and Cwm Glo great crested newt populations and thus no in-combination effects. Additive effects on the local population are considered possible, however the proposed development is likely to deliver mitigation measures to result in likely beneficial effect for the species, hence no cumulative impact is anticipated.

Transport

19.18.7 The 2026 Assessment Year assessment referenced above is inclusive of cumulative (committed) development.

Heritage

19.18.8 Potential cumulative effects with Landscape and Visual effects and in-combination effects with the consented development at Bike Park Wales, as well as nearby LDP allocations have been considered. The assessment concludes that no in-combination cumulative effects are anticipated with any committed or proposed development in the Application Site's vicinity. However, the potential for future in combination effect with two sites that are allocated within the LDP and fall within the same Historic Landscape Character Area are identified. Any future

plan to develop these sites would need to take this into consideration in their cumulative assessments.

Hydrology

19.18.9 With regards to the water environment, no cumulative impacts have been identified in the surrounding area.

Landscape

19.18.10 With regards to landscape, no cumulative impacts have been identified in the surrounding area.

Drainage

19.18.11 The current outline drainage proposal results in no cumulative impacts with other developments. No cumulative impacts are expected to arise from the construction nor operation phases of the proposed development.

Noise

19.18.12 No cumulative impacts are predicted for construction phase, meanwhile operational noise levels in cumulation with other committed developments, would not result in any significant noise effects.

AQ

19.18.13 No cumulative impacts are anticipated for the construction phase, owing to the best practice measures that will be implemented and secured by a CEMP. During the operational phase of development, the likely effects are Negligible and therefore no significant cumulative impacts are predicted.

Lighting

19.18.14 No cumulative lighting impact are anticipated during construction phase of the development.

19.18.15 For operational phase, potential cumulative developments have been assessed. 'Allocated Hoover Site 1' lies 800m east of the site and given the distance and lighting in the area around the allocated site, no cumulative lighting impacts are considered likely. In terms of sky glow on dark sky receptors, cumulative impacts are considered to be suitably managed through the planning process and ensuring best practice is implemented, to ensure only negligible cumulative effects.

Health

19.18.16 No cumulative human health impacts are identified, having reviewed likely forthcoming development together with the proposed development.

Utilities

19.18.17 No cumulative impacts have been identified in in respect to utilities.

