

Dŵr Cymru Welsh Water

Pont-y-felin Nature Based Solution

Flood Consequence Assessment

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1. Introduction

1.1 Background

Ove Arup and Partners Limited (Arup) have been commissioned by Dŵr Cymru Welsh Water to undertake a range of engineering and environmental services for the detailed design of a Nature Based Solution (NBS) scheme in the New Inn area of Cwmbran.

The proposed development is described as follows:

“The proposed development would constitute a Combined Sewer Overflow (CSO) and wetland/reedbed biodiversity enhancement scheme, with areas of public amenity space. The development and design of the proposed development is still evolving and may be subject to change prior to the PAC and full submissions.”

The site is located adjacent to the Afon Lwyd and has been identified as being partially located within Development Advice Map (DAM) Zones C2 and B. As such, there is a requirement to produce a Flood Consequences Assessment to both assess flood risk to, and as a result of, the development. The purpose of this report is to address the requirements of Technical Advice Note 15 (TAN15), by:

- Assessing flood risk to the scheme from all sources;
- Considering the consequences of the scheme on flood risk elsewhere within the catchment for a range of potential flood events; and
- Determining any flood risk mitigation measures necessary to ensure that the scheme and scheme users will be safe from flooding, whilst ensuring flood risk is not increased elsewhere.

The scope of this assessment comprises a desk-based study using existing information obtained from a variety of sources regarding the flood risk at the scheme location. Hydraulic modelling has been undertaken to assess any wider impacts of the scheme in terms of fluvial flood risk. Relevant planning documents have also been reviewed where applicable to the scheme.

2. Site Description

2.1 Location

Pont-y-felin is located in New Inn, Pontypool (Ordnance survey Grid Reference: ST3026999067, nearest postcode: NP4 0QF). The application site extends to an area of 3.0ha and is shown in Figure 1.

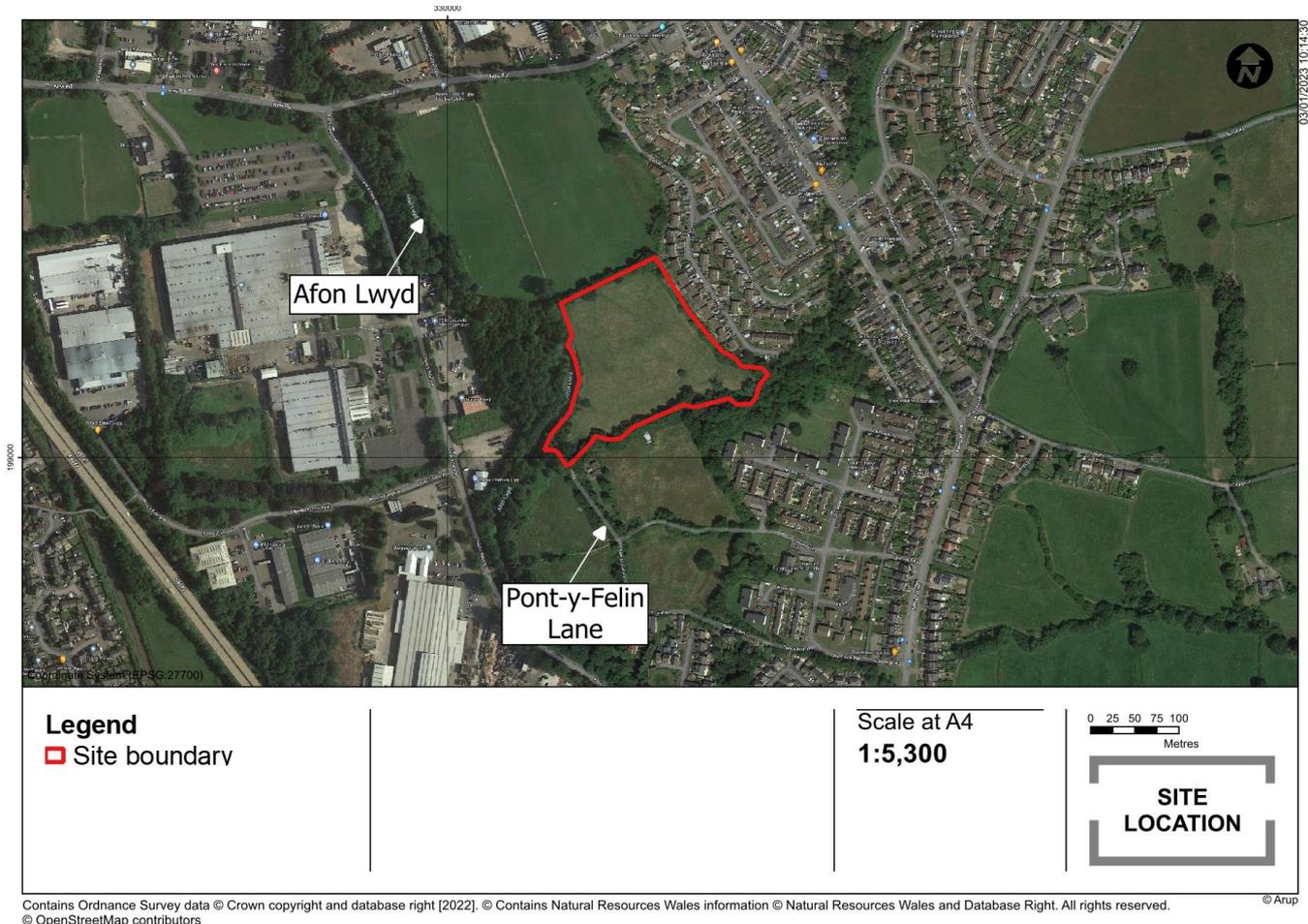


Figure 1 Location of the Pont-y-felin site, New Inn.

2.2 Existing site

The site comprises a parcel of land used for informal recreation by the local community comprising an open field which is bordered by existing trees and hedgerow. The site is bound on the western edge by the Afon Lwyd and residential properties to the east at Afon Close. Access to the site is afforded from the southwestern boundary along the existing access lane adjacent to Pear Tree Cottage. The site is located immediately south of New Panteg Rugby Football Club which comprises a series of rugby and football pitches, with associated floodlights.

Topographical survey for the site has been undertaken. The site levels are lowest to the west of the site, adjacent to the Afon Lwyd, where levels are approximately 89.6mAOD. Elevations increase steeply to the east of the site, rising to a maximum of 91.8mAOD in the south-eastern corner of the site red line boundary.

2.3 Site geology

The available Onshore GeoIndex Mapping¹ indicates that the bedrock geology underlying the site consists of the Raglan Mudstone formation. This group comprises red mudstones and silty mudstones with mixed

¹ [GeoIndex \(onshore\) - British Geological Survey \(bgs.ac.uk\)](https://www.bgs.ac.uk/geoindex/), accessed 02/11/2022.

calcretes and sandstones, and conformably overlies the Downton Castle Sandstone formation. The mudstone units have relatively low permeability but this is overlain by the Townsend Tuff bed and Bishop's Frome Limestone, which are higher permeability units.

The bedrock lithology is overlain by superficial deposits of alluvium, comprising mixed sand and gravel. Both the bedrock and superficial deposits are classified as Secondary A aquifers, which are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale. The hydrogeological mapping further classifies the site area as being within a low productivity aquifer, with limited groundwater. The potential for groundwater flooding is further discussed in Section 4.5.

2.4 Proposed development

The proposed development constitutes a Combined Sewer Overflow (CSO) and wetland/reedbed biodiversity enhancement scheme, with areas of public amenity space. The development and design of the proposed development is still evolving and may be subject to change prior to the Pre-Application Consultation (PAC) and full submissions but is likely to include:

- Screening chamber with mechanical screen;
- Aerated reed beds;
- Structural slab for reed bed blowers;
- Structural slab for motor control centre (MCC) and new MCC kiosk;
- Footpaths and boardwalks;
- Chambers and pipework to connect to sewage network and sample flows;
- Ducting for cabling and power supply;
- Roads for maintenance vehicles and parking area suitable for operative vehicles, with laydown area;
- Constructed wetlands;
- Bins and benches; and,
- Associated amenity space and educational areas.

An excerpt from a drawing of the current design is shown below. The drawing indicates the proposed location of the reedbed and wetland areas.



Figure 2 Current proposed design

3. Planning Policy and Guidance

3.1 Planning Policy Wales: Edition 11

Planning Policy Wales: Edition 11 (February 2021) (PPW11) sets out the land use planning policies of the Welsh Government. PPW11 provides advice on a wide range of issues and is supported by a number of Technical Advice Notes (TANs) which contribute toward the delivery of improved social, economic, environmental, and cultural well-being in Wales. The Welsh Government is committed to sustainable development and PPW11 states that the planning system shall provide a presumption in favour of sustainable development. PPW11 acknowledges the risk of flooding to the provision of development within Wales, as discussed below.

Paragraph 6.6.22 of PPW11 states that the climate emergency is likely to increase the risk of flooding as a result of sea-level rises, increased storminess, and more intense rainfall. Development proposals should consider the potential consequences of flooding, as well as the likelihood of an event occurring.

PPW11 states that the use of Flood Defence Maps and Flood Consequence Assessments should be used to assist the understanding of how natural and manmade defences work as integral components of places and provide a means by which the cumulative effects of development can be understood.

Paragraph 6.6.25 outlines that development proposals should reduce and must not increase flood risk arising from river flooding on and off the application site.

In areas of flood plain currently unobstructed or undeveloped, where water flows in time of flooding, built development and obstructions should be wholly exceptional and limited to essential transport and/or utilities infrastructure.

Paragraph 6.6.28 states that new or improved flood defences in riverside locations should be carefully planned, ensuring environmental effects are taken account of. Flood defence works can provide opportunities to achieve wider social, economic, and environmental benefits, which should be maximised wherever possible. Where possible, nature-based solutions should be the preference to deliver habitat creation, biodiversity enhancement and water quality improvements.

Paragraph 2.8 outlines proposals must promote sustainable development and support the well-being of people and communities across Wales. This can be done through maximising their contribution to the achievement of the seven well-being goals and by using the five Way of Working, as required by the Well-being of Future Generations Act.

3.2 TAN15

3.2.1 Technical Advice Note 15: Development and Flood Risk (2004)

Technical Advice Note 15² (TAN15) provides technical guidance in relation to development and flooding and sets out the precautionary framework to guide planning decisions in respect of development in areas at high risk of flooding. It provides guidance on how to fully assess flood consequences and how to design and implement sustainable development.

Section 2.3 of TAN15 states that at least 140,000 properties in Wales, approximately 12% of the total housing stock, are at risk from river and coastal flooding. The primary causes of flooding include high rainfall events which result in watercourse capacity being exceeded. Other factors can include human activity including development within the catchment and lack of maintenance of flood defences and hydraulic structures.

The general approach of PPW, supported by the TAN, 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. The overarching aim of the precautionary framework is, in order of preference, to:

² [TAN15 Text English.qxp \(gov.wales\)](#)

- Direct new development away from those areas which are at high risk of flooding
- Where development has to be considered in high risk areas (Zone C) only those developments which pass both the Justification Test and the Consequences test should be considered

The operation of the precautionary framework is governed by:

- A development advice map containing three zones (A, B and C with subdivision into C1 and C2) which should be used to trigger the appropriate planning tests.
- Definitions of vulnerable development and advice on permissible uses in relation to the location of development and the consequences of flooding.

The precautionary framework should be used for both forward planning and development control purposes. The TAN15 also states that managing flood risk is an important part of contributing towards achieving sustainable development, specifically in terms of provision for future changes in flood risk, taking into account the impacts of climate change.

The TAN15 guidance indicates that the development would be classified as “Less Vulnerable” development. The lower part of the site, including a small proportion of the proposed wetland, an access track and various amenity spaces, are located in Zone C2. Based on the vulnerability classification of the development it is appropriate to be situated in this zone, subject to the application of both the justification test including the acceptability of consequences test.

3.2.2 Technical Advice Note 15: Development and Flood Risk (2023)

The previous TAN15 guidance was published in 2004, and as such an updated version has been prepared. The new TAN15³ document was originally published in December 2021, however its implementation was delayed to allow local planning authorities time to develop a more detailed understanding of the consequences of flooding, including a review of the Strategic Flood Consequences Assessment for their area. The new guidance is due to become adopted policy advice on 1st June 2023.

The existing TAN15 document, published in 2004, and the Development Advice Map will continue in the meantime as the framework for assessing flood risk. However, it is recommended that developments are assessed with consideration of the new TAN15 guidance.

The TAN15 update aims to:

- Replace the development advice map with a new Wales flood map, with Flood Zone 1, 2 and 3 and the Defended Zone;
- Place a greater emphasis on the Local Development Plan (LDP) and the value of strategic flood consequences assessments (FCA);
- Integrate guidance on coastal erosion and flood risk issues in TAN15; and,
- Provide guidance for regeneration initiatives affecting communities in flood risk areas.

A significant change compared to the previous guidance is the inclusion of climate change allowances in the assessment of Flood Zone extents. This means that a larger area will be classified as being within Flood Zones 2 and 3 in future.

3.3 Local planning policy context

3.3.1 Torfaen County Borough Council Local Flood Risk Management Strategy (2013)

Under the Flood and Water Management Act 2010, Local Authorities become Lead Local Flood Authorities (LLFA) and are responsible for what are deemed “Local Flood Risks”, including risks from Ordinary watercourses, surface runoff and groundwater.

³ [Technical Advice Note 15, Developing, flooding and coastal erosion \(gov.wales\)](https://gov.wales/technical-advice-note-15-developing-flooding-and-coastal-erosion)

All LLFA in Wales are required to develop, maintain, apply and monitor the application of a strategy for local flood risk management in their area. The Torfaen County Borough Council (TCBC) is the LLFA in the study area, and have therefore developed a Local Strategy⁴ in keeping with the four overarching objectives for flood and coastal erosion risk management in Wales as set out in the Welsh Government's National Strategy, and listed below:

- Reducing the impacts on individuals, communities businesses and the environment;
- Raising awareness of and engaging people in the response to flood and coastal erosion risk;
- Providing an effective and sustained response to flood and coastal erosion events; and
- Prioritising investment in communities most at risk.

TCBC has also set out 17 detailed objectives to satisfy the four overarching objectives. The relevant objectives are extracted below:

- Objectives 1 – 5 relate to reducing risk to people, communities and infrastructure and adopting a precautionary approach to the location of new development in respect to flood risk;
- Objectives 6-9 relate to providing systems to give warning of flooding, manage and maintain surface water assets, reduce economic damage of flooding and reduce the cost of management;
- Objectives 10-16 relate to the protection of sites of specific scientific, nature, conservation and geological interest, the improvement of biodiversity, the creation of natural channels, the protection and improvement of water quality, the provision of flood risk management plans, sustainability and collaborative working; and
- Objective 17 relates to ensuring that investment decisions for the implementation of Flood Risk Management Schemes are made on a consistent, defensible basis and are subject to cost benefit analysis.

3.3.2 Torfaen County Borough Council Flood Risk Management Plan (2015)

As part of the Flood Risk Regulations set out in 2009, local authorities identified as being at risk of flooding were required to produce a Flood Risk Management Plan (FRMP) by 22nd December 2015. Torfaen is one of the 8 areas identified within Wales as being at risk of flooding, and therefore Torfaen County Borough Council was given the statutory responsibility to produce a Flood Risk Management Plan⁵, which was published in 2015.

The FRMP sets out how TCBC intends to manage flooding so that the communities most at risk and the environment benefit the most. The plan takes forward the objectives and actions set out in the Flood Risk Management Strategy.

Within the FRMP, riverine flooding is identified as occurring due to the overtopping of main watercourses. Within TCBC, the Afon Lwyd is the Main River which runs north-south within the Borough, with a number of smaller tributaries including the Dowlais Brook. Main River flood risk is identified as the responsibility of Natural Resources Wales.

The published iteration of the FRMP mainly focuses on establishing the baseline conditions to then manage flood risk over a longer term. The plan will consolidate information from throughout the borough to identify the suitability of existing hydraulic modelling, and areas where flood risk can be sustainably improved whilst maintaining the ecological significance of the environment. The plan outlines that TCBC will work collaboratively with the Severn River Basin Management Plan and Severn Flood Risk Management Plan.

The FRMP outlines the importance of consideration of flood risk both now and in the future in plans for development within Torfaen County.

⁴ [Local Flood Risk Management Strategy - July 2013 \(torfaen.gov.uk\)](https://www.torfaen.gov.uk)

⁵ [Torfaen County Borough Council Flood Risk Management Plan](#)

3.4 Justification test

TAN15 states that development can be justified if it can be demonstrated that:

1. *Its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement;*

Or

2. *Its location in zone C is necessary to contribute to key employment objectives supported by the local authority; and other key partners, to sustain and existing settlement of region;*

And,

3. *It concurs with the aims of Planning Policy Wales and meets the definition of previously developed land;*

And,

4. *The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable.*

The proposed development has been assessed against the requirements of the Justification Test with the results summarised in Table 1. All the criteria have been satisfied with regards to the proposed development.

Table 1 Justification test for development

| TAN-15 Justification Criteria | Comments | Achieved? |
|--|--|------------------|
| Its location in zone C is necessary to assist or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement | Strategic Objective 8 in the Torfaen Economy and Enterprise Strategy ⁶ promotes the use of physical infrastructure to enhance the environment. It is considered that the proposed development supports this objective. | Yes |
| It concurs with the aims of Planning Policy Wales and meets the definition of previously developed land | PPW indicates that where possible, sites should be developed in the order of previously developed and/or underutilised land within settlements, then land on the edge of settlements. The site is considered to fit within the definition of underutilised land within a settlement. The development cannot be relocated, as it relates to an existing CSO and therefore it is considered an appropriate use of this site. The development concurs with the aims of PPW, and its aims to support the well-being of people and communities across Wales, as it provides recreational facilities for the local community and additional benefits in terms of ecology and wildlife. | Yes |
| The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable | Hydraulic modelling has been undertaken to assess the impact of the development on flood risk in the surrounding area, as detailed in this assessment. The model results indicate the development does not cause flood risk disbenefit elsewhere. A further assessment of the acceptability of consequences is given in this document. | Yes |

⁶ [Torfaen Economy and Enterprise Strategy | Torfaen County Borough Council](#)

4. Flood Risk

4.1 Overview

TAN15 guidance requires that all flood sources that could affect the proposed development be considered. This includes flooding from sewers and drainage systems, groundwater, rain, rivers and the sea, potential blockages and breaches of defences, reservoirs and other artificial sources. If the site is affected there should be a demonstration of how these risks will be managed so the development can remain safe throughout its lifetime, taking into account predicted climate change.

4.2 Historic flooding

The available recorded flood extents have been obtained from Natural Resources Wales (NRW). This dataset indicates there are no historical records of flooding within the site boundary. In December 1979 there was a flood from the Afon Lwyd which occurred as a result of channel capacity exceedance on the right bank of the watercourse, opposite the site, as shown in Figure 3.

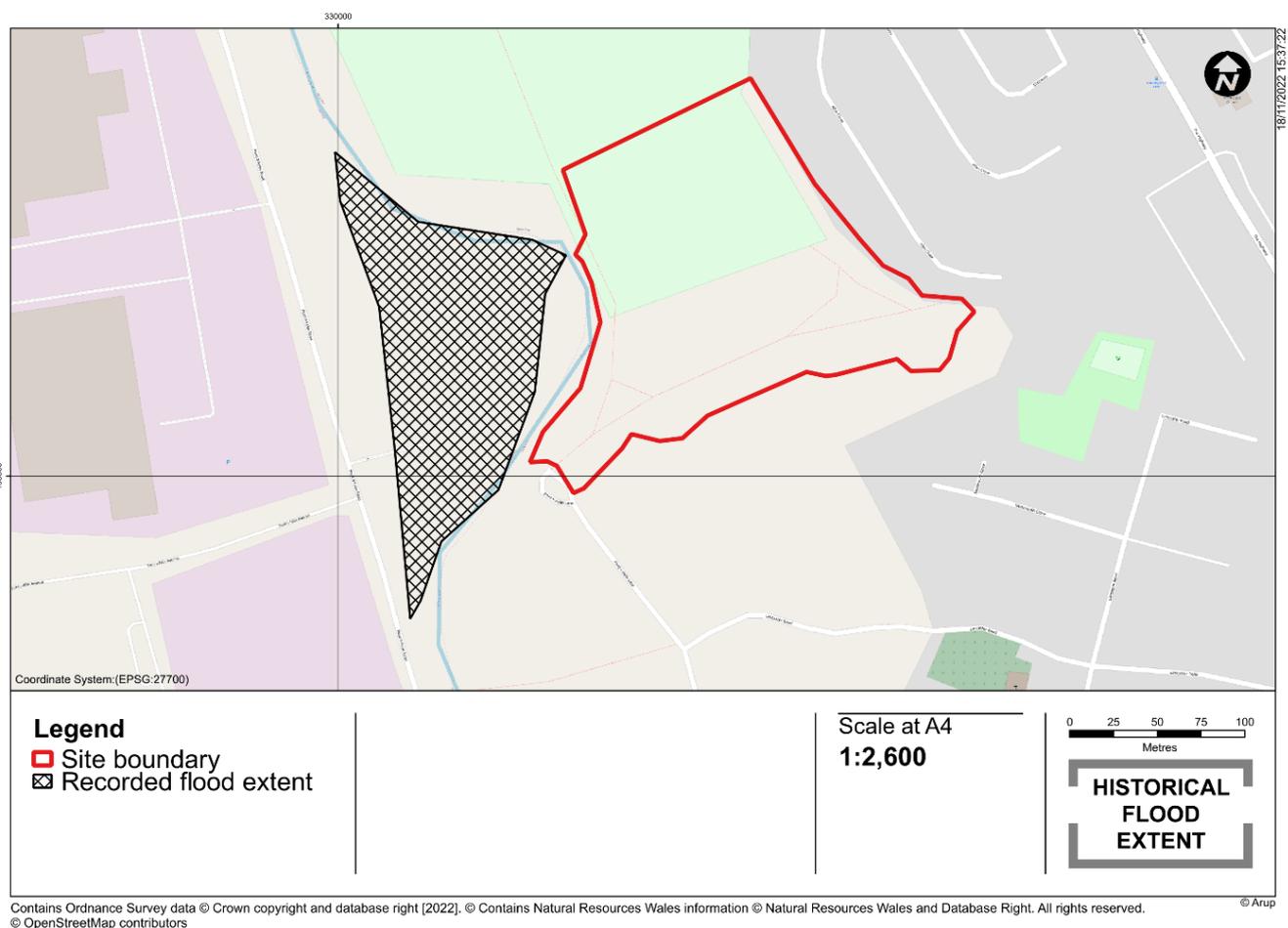


Figure 3 Recorded flood extents adjacent to the site

Torfaen County Borough Council produced a Section 19 Flood Investigation Report subsequent to floods which occurred in May 2014 within the borough area. However, this document indicates the flooding within the area occurred only in Cwmbran, approximately 3km to the south of the site. There was no flooding reported within the New Inn area or surrounds.

4.3 Fluvial and tidal flooding

4.3.1 Tidal flooding

The site is located at an elevation varying between 89.6mAOD and 91.8mAOD and is located approximately 17km inland. Based on this, the risk of tidal flooding is considered to be negligible and has not been considered further.

4.3.2 Fluvial flooding

The primary source of fluvial flood risk to the scheme is from the main watercourse, the Afon Lwyd, which is located to the west of the site.

Natural Resources Wales Development Advice Maps (DAM) are used as a screening tool to understand where further assessment of flooding may be required. The DAM set out different levels of flood risk, defined as follows:

- Zone A – Considered to be at little or no risk of fluvial or tidal/coastal flooding
- Zone B – Areas known to have been flooded in the past evidenced by sedimentary deposits
- Zone C – Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)
 - Zone C1 - Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.
 - Zone C2 - Areas of the floodplain without significant flood defence infrastructure.

The DAM for the site is shown in Figure 4 below. The maps indicate that the lower part of the site adjacent to the Afon Lwyd is within Flood Zone C2. A small proportion of the northern-most wetland basin is located in Zone C2, as shown in Figure 4. Due to the proximity of the site to Flood Zone C2, the available river model has been used to undertake a hydraulic modelling assessment including refinement of the incoming model and representation of the proposed development. The study is presented in Section 4.3.3.

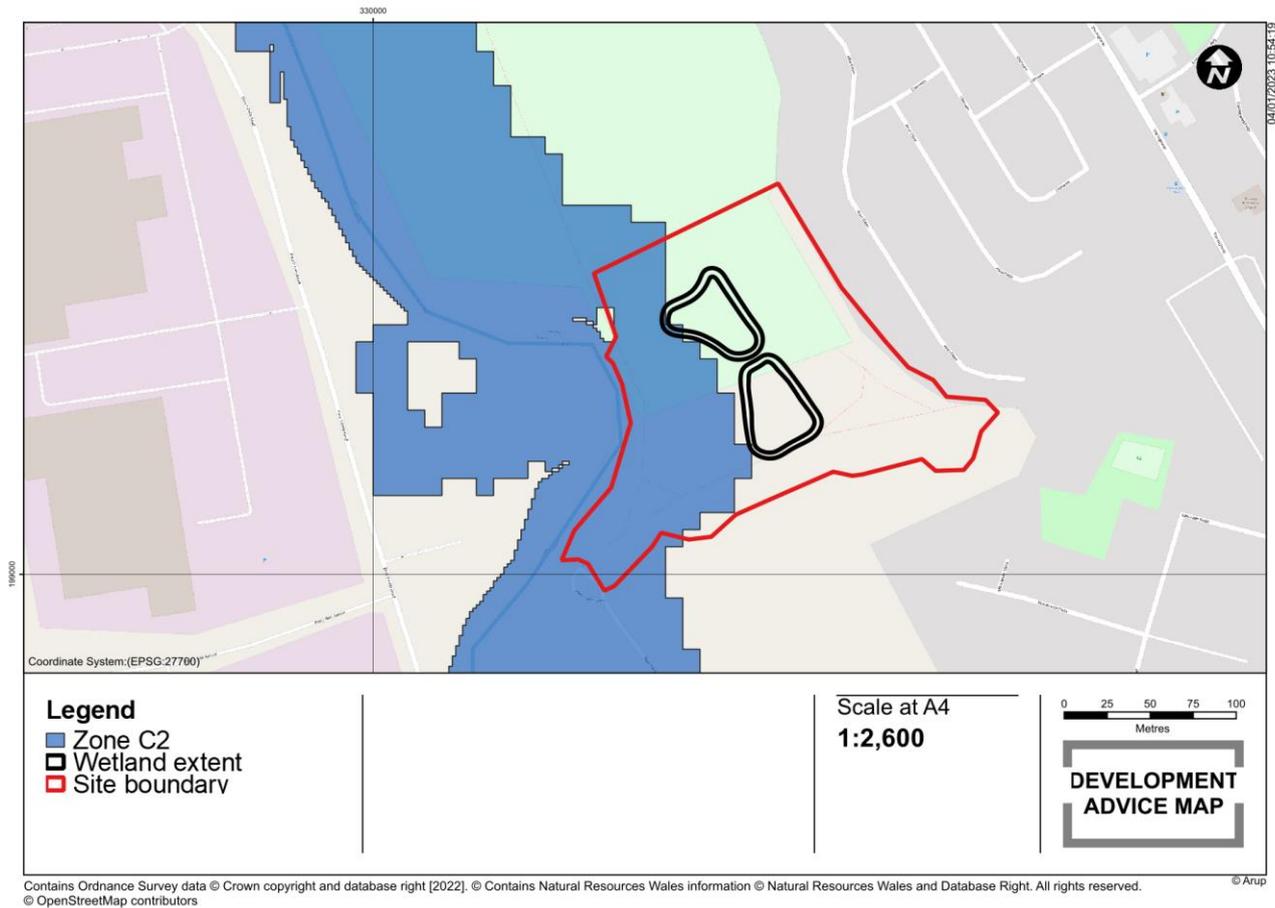
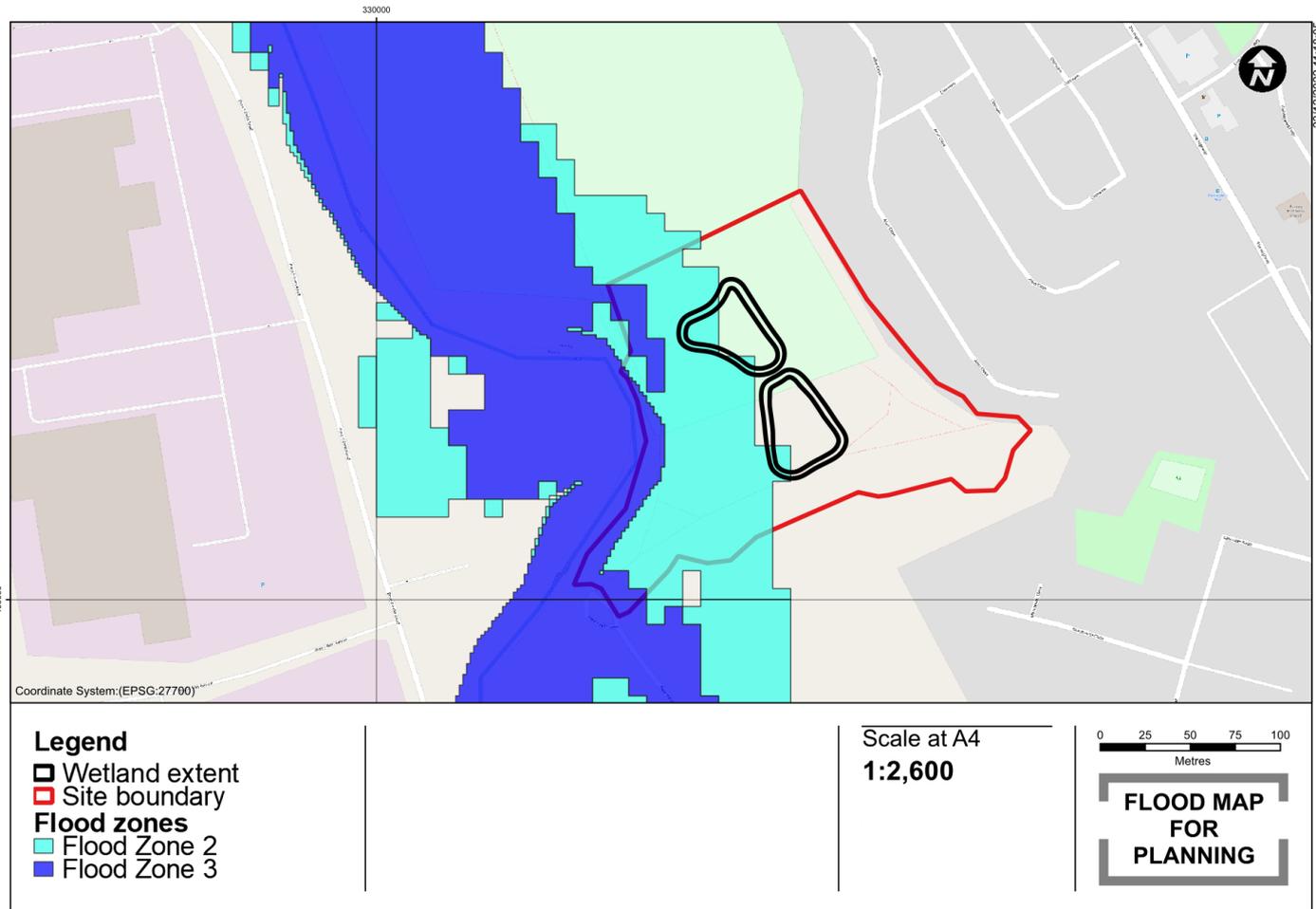


Figure 4 Development Advice Map

As part of the update to TAN15, the flood maps are also being updated. The Development Advice Maps are to be renamed as the Flood Map for Planning, and similarly the definition of the flood zones will also be updated as follows:

- Zone 1 – Less than 1 in 1000 (0.1% plus climate change) chance of flooding in a given year
- Zone 2 – Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change
- Zone 3 – A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change
- Defended Zone – Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from rivers of 1 in 100 (1%) (plus climate change and freeboard).

The Flood Map for Planning at the site is shown in Figure 5 below. The map indicates that the site is almost entirely in Flood Zone 2, with a smaller area adjacent to the Afon Lwyd within Flood Zone 3. The wetland area is located in Flood Zone 2.



Contains Ordnance Survey data © Crown copyright and database right [2022]. © Contains Natural Resources Wales information © Natural Resources Wales and Database Right. All rights reserved. © Arup © OpenStreetMap contributors

Figure 5 Flood Map for Planning

4.3.3 Hydraulic modelling

Natural Resources Wales were contacted in June 2022 to obtain their latest hydraulic model covering the site area. Arup were provided with the Afon Lwyd Integrated Catchment Model. This model has been used as a basis for a hydraulic modelling assessment of the proposed development to determine any potential impact of the development to flood risk in the area.

The study has concluded that there is no interaction between the floodplain and the scheme for either the 1% AEP event or the 1% AEP + Climate change allowance, and therefore there is no resulting change in flood risk during these events.

In the 0.1% AEP event the scheme results in limited changes to flood depths on the floodplain. A localised increase in flood depth is shown within the wetlands, where the lowered ground provides a preferential flow path for water leaving the left bank of the Afon Lwyd. There is no change in flood risk to third parties.

The climate change scenario has been used as a sensitivity test to assess disbenefit as a result of the scheme. In the 0.1% AEP event plus climate change, depths on the floodplain are marginally reduced downstream of the development as a result of the additional floodplain storage provided by the wetland area. As such, there is no disbenefit predicted during this event.

The modelling methodology and results of the study are presented in Section 4.3.4.

4.3.4 Modelling methodology

The model is an FMP-TUFLOW 1D-2D hydraulic model of the Afon Lwyd and tributaries. The associated report states that the 1D part of the model was originally produced by NRW using survey undertaken in late 2013 and early 2014. In March 2018, Arcadis updated the model with a new hydrological assessment, and

linked the existing 1D model to a 2D domain to represent the floodplain. The model domain covers the lower 24km of the Afon Lwyd from Abersychan to the confluence with the River Usk in Caerlon. A number of different 2D domains have been applied in order to utilise larger grid cell sizes in rural areas to improve model run times.

Baseline modelling

An initial review of the incoming model for suitability to inform flood risk to the site was undertaken. Generally, the model was deemed appropriate for further use however a number of potential issues were flagged:

- The incoming model has separated domains into “rural” domains, where the cell size is 10m, and “urban” domains, where the domain is 4m. The site is located in a rural domain and therefore the 10m grid resolution of the incoming model is considered too coarse to represent the proposed scheme.
- The incoming model report suggests that the model is generally stable, although it has flagged some non-convergence and stability issues in the 0.1% AEP event. The report suggests that the majority of issues occur at two locations – one is upstream of the site, where the Nant Ffrwd-Oer tributary joins the Afon Llwyd, and the second is further downstream where water pools against a railway embankment between model domains 4 and 5. There may therefore be some issues with stability when running the 0.1% AEP event with an allowance for climate change.
- The model extent does not include the entirety of the site boundary.
- The nearest structure upstream is New Road bridge which is approximately 370m from the site. This structure surcharges in the larger events, but orifice flow hasn’t been turned on which is not in accordance with best practice. Similarly, orifice flow hasn’t been turned on for the footbridge approximately 240m downstream of the site.

Based on the review, a number of minor updates were made to the model to make it more suitable for use to inform flood risk to the site:

- The grid cell size for domain, “2_Pp-Cb_R”, has been decreased to 4m in order to better represent the scheme development.
- The active code area has been extended to include the entirety of the site boundary. The incoming LiDAR data has been used to inform the model DTM where the active area has been extended, with topographic survey data used to inform site levels. Materials values have been applied for the extended area, with a value of 0.04 applied to the site.
- The 0.1% AEP inflow file has been scaled by 25%, in accordance with the Central estimate for the 2080s epoch for the Severn river basin district⁷.
- Orifice flow has been turned on for the two bridge units immediately up and downstream of the site.

The same software versions, TUFLOW 2017-09-AC-iDP-w64 and FMP 4.3.0.290, have been retained to allow direct comparison with the incoming model outputs. The baseline model has been re-run for the 1% AEP, 1% AEP + Central climate change allowance, 0.1% AEP and 0.1% AEP + Central climate change allowance to form an updated baseline model.

The application of climate change to both the 1% and 0.1% AEP event is not currently required as part of the existing TAN15 guidance, however in compliance with the future guidance the climate change events have been used to sensitivity test the development to ensure it has no impact in terms of flood risk both now and in the future.

The minor updates made to the baseline model do not result in a significant change in flood extents and depths when compared to the incoming model results. The primary differences result from the reduction in grid cell size in the “2_Pp-Cb_R” domain where the increased resolution results in additional granularity of the results. In the 1% AEP event, flood extents and depths are very similar. In the 0.1% event, an additional

⁷ [Flood Consequences Assessments: Climate change \(gov.wales\)](https://gov.wales/flood-consequences-assessments-climate-change)

flow path is introduced where water is now able to flow down Pont-y-felin Road to the south, resulting in shallow flooding to the large industrial building to the south of Pont-y-felin avenue. Flood depths and extents at the site are very similar between the incoming and updated model.

The maximum flood depths in the 1% AEP plus climate change event, and the 0.1% AEP flood event in the baseline scenario are shown in Figure 6 and Figure 7 respectively. The wetland location is shown for comparison with the baseline flood extents.

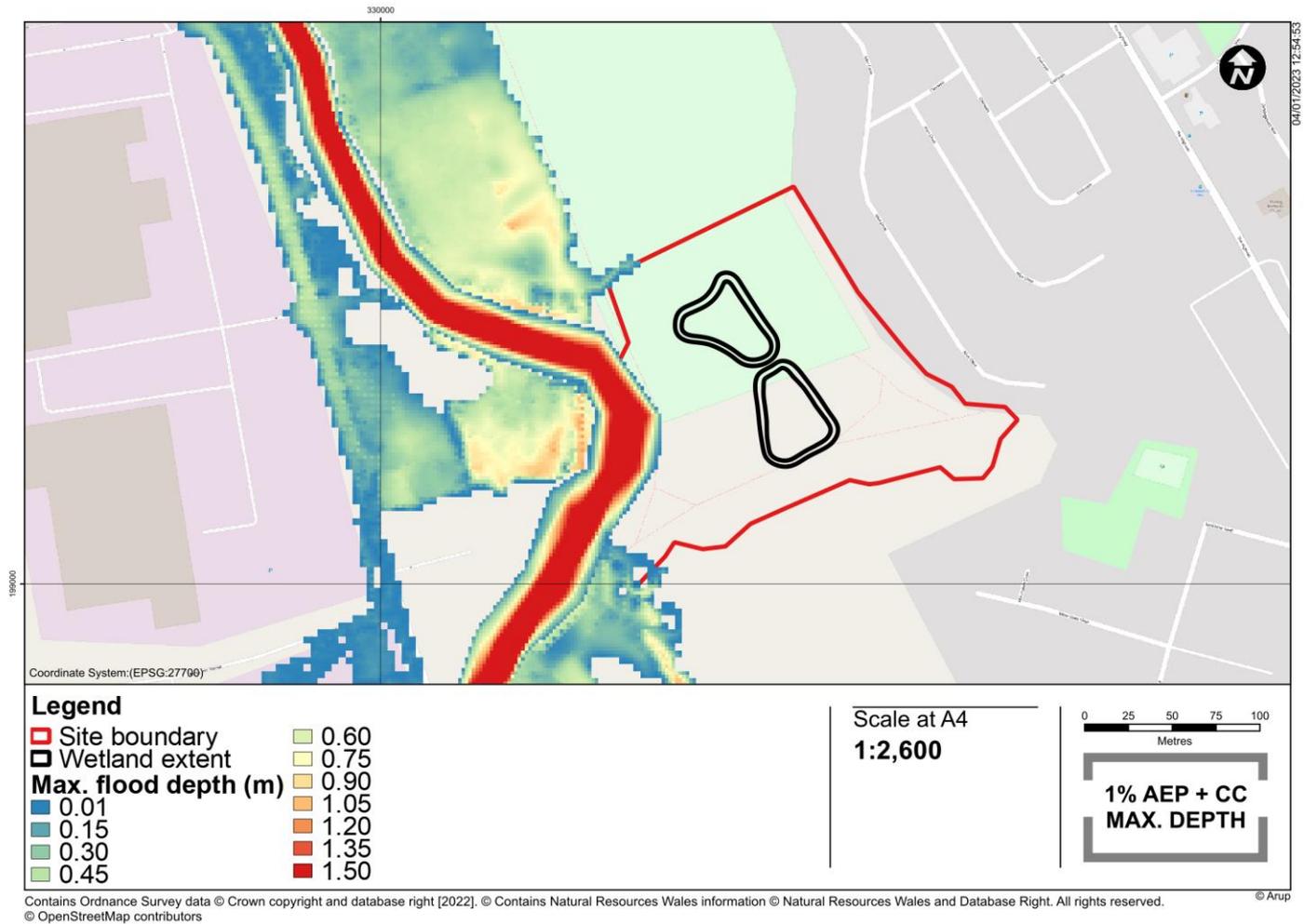


Figure 6 Maximum flood depth in the 1% AEP event plus climate change in the baseline scenario

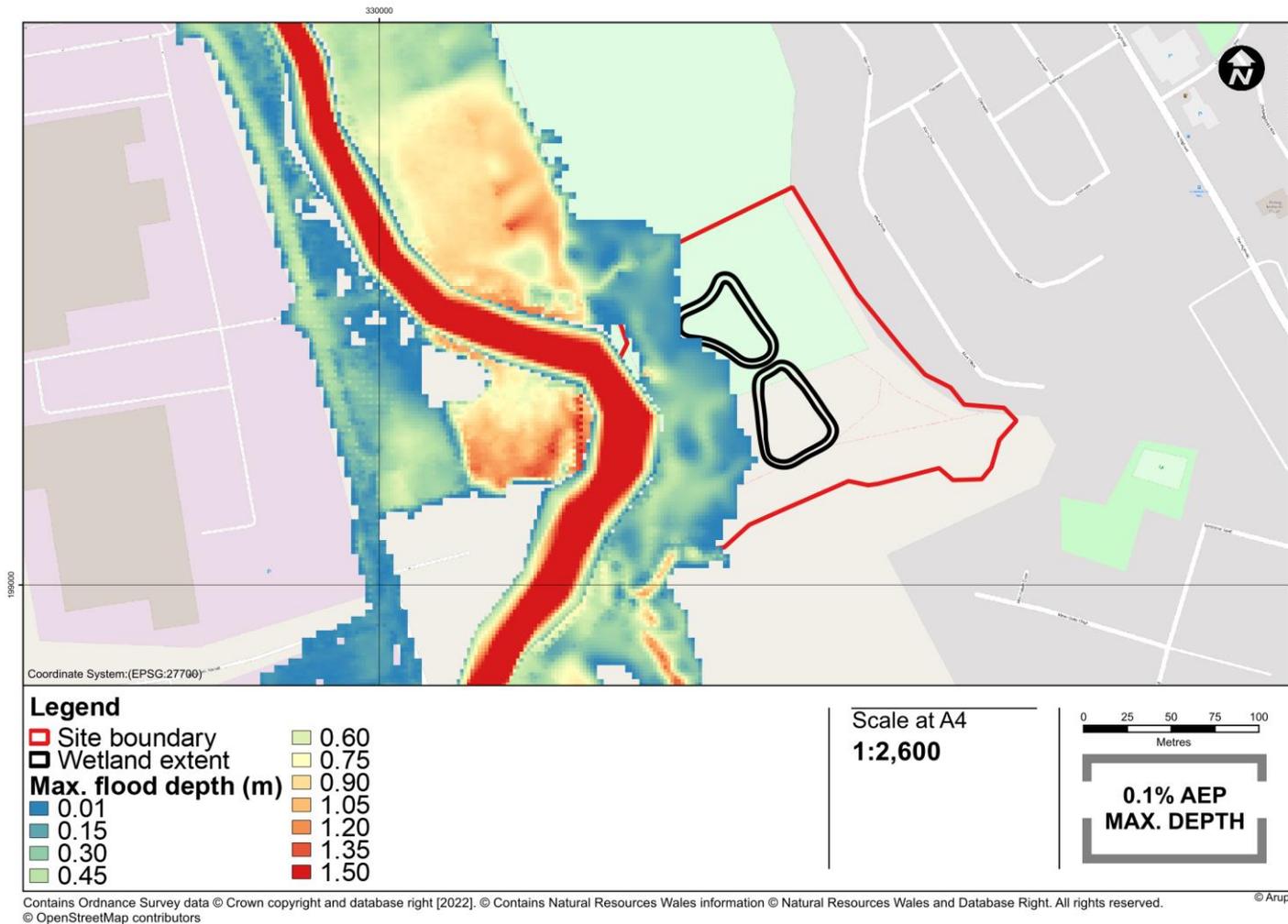


Figure 7 Maximum flood depth in the 0.1% AEP event in the baseline scenario

Post-development modelling

The model has been subsequently modified to incorporate the scheme design. The scheme elements within the floodplain comprise the wetland, boardwalk, outdoor classroom, trim trail, public plaza and tree planting. The amenity facilities will not require any change in ground elevation and therefore these features have not been incorporated specifically into the modelling. It is anticipated that as the existing ground elevation will be maintained these features will not impact flood risk in the area.

The access track will run parallel to the southern site boundary, and will require minor ground raising, on the order of 100-200mm. Flood depths in this area typically exceed 200mm and therefore it is anticipated that existing flow routes will be maintained with this structure in place. On this basis, there is no anticipated change in flood risk as a result of the access track.

As the wetland will require ground lowering and is located partially within Flood Zone C2, this element has been modelled. The wetland has been represented using a series of zshape regions. There are two basins within the wetland, and each basin has been added as a separate zshape with a set elevation. The shape option, “NO MERGE”, has been applied to ensure applied levels are not interpolated with the existing DTM elevations. An additional zshape has been added around the perimeter of the basins to smooth the transition between the lowered basins and the existing ground elevation.

Figure 8 shows the geometry of the scheme in the hydraulic model. The figure inside the shape region details the bottom elevation of each basin.

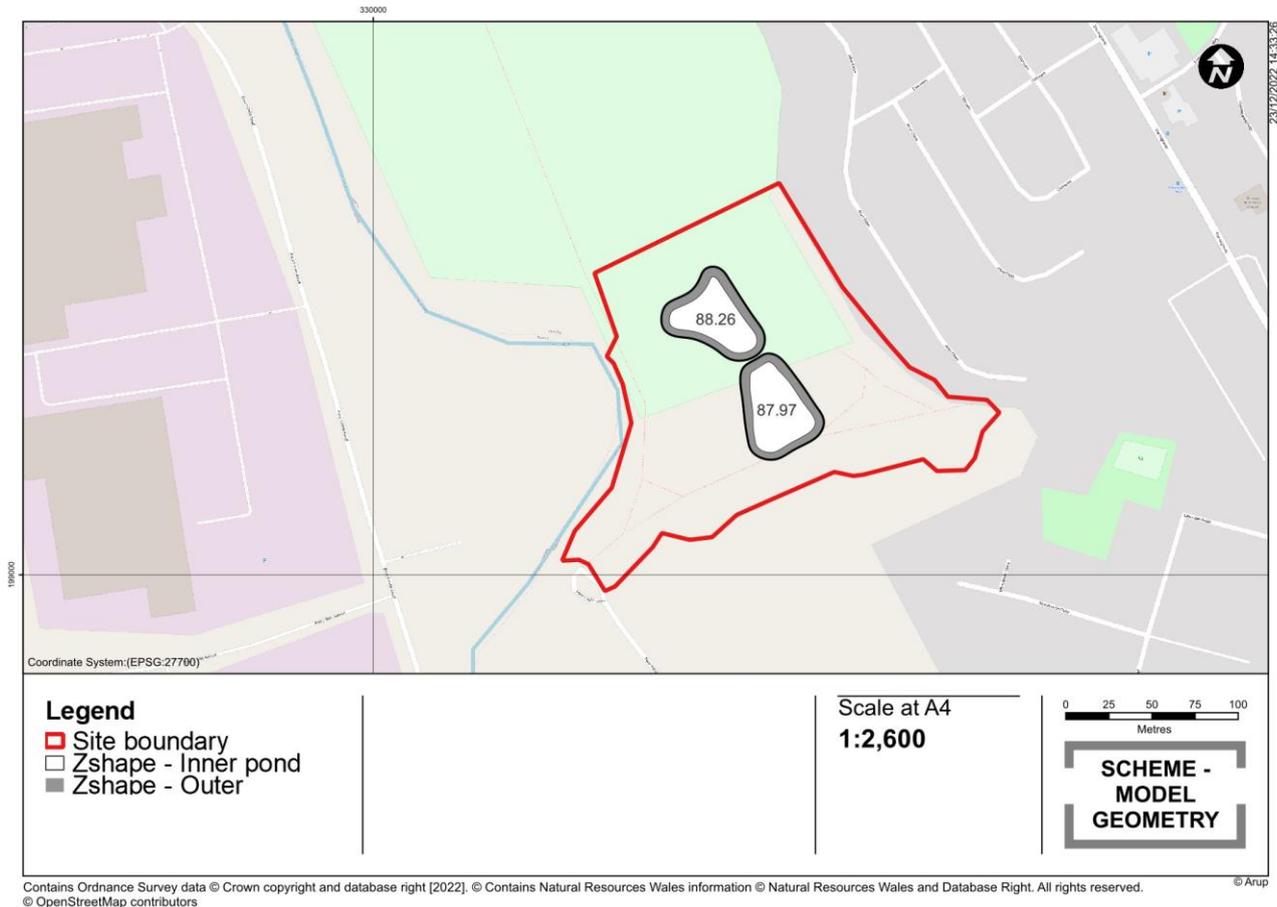


Figure 8 Schematisation of the proposed development in the model

The updated scheme model has been run for the 1% AEP, 1% AEP + Central climate change allowance, 0.1% AEP and 0.1% AEP + Central climate change allowance. The model results have been compared to the baseline outputs to assess any changes to flood risk as a result of the scheme.

There is no interaction with the scheme for either the 1% AEP event or the 1% AEP + Climate change allowance, and therefore there is no resulting change in flood risk during these events. Figure 9 shows the flood extents for the 1% AEP event plus climate change allowance in comparison to the scheme extent.

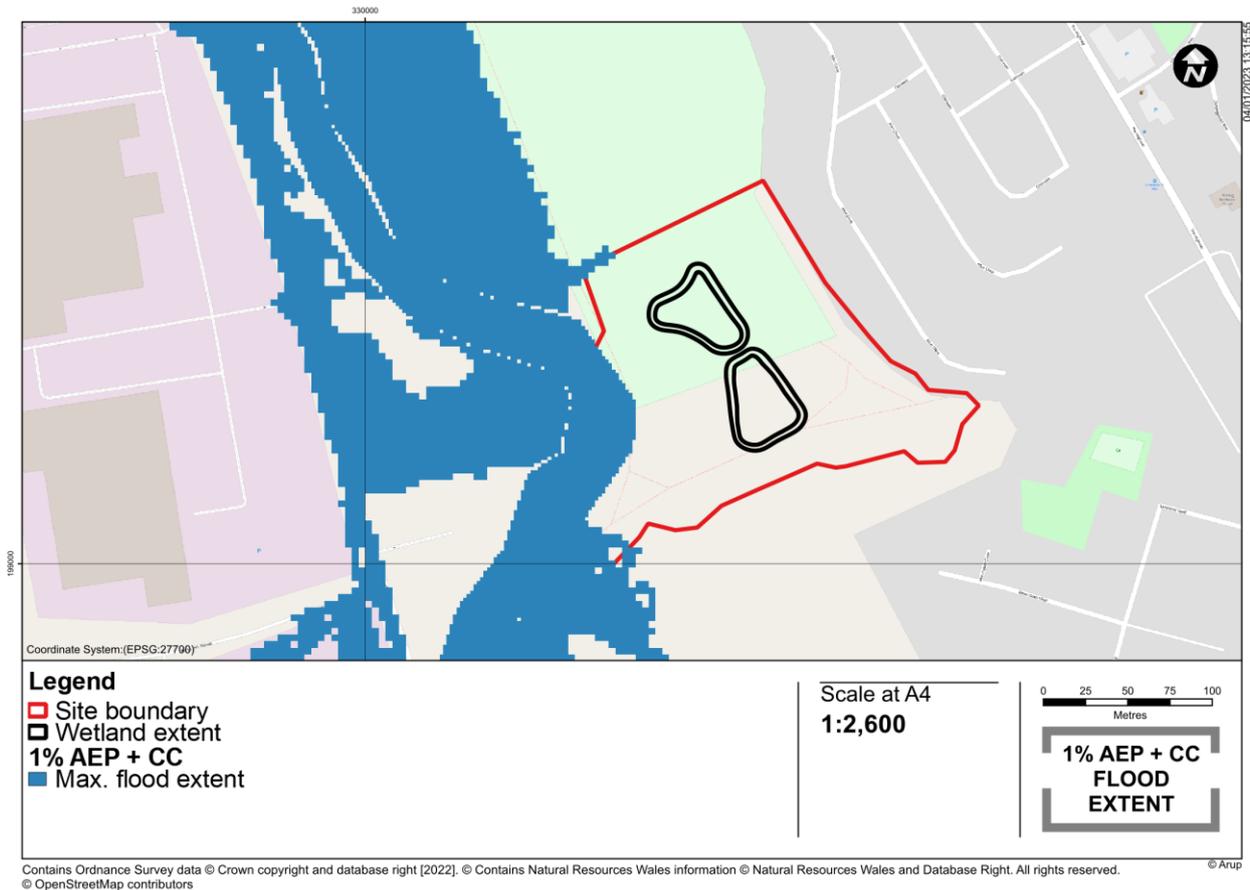


Figure 9 Flood extent map for the 1% AEP and 1% AEP plus central climate change allowance

Both the 0.1% and 0.1% AEP plus climate change allowance flood events interact with the scheme development. As such, depth difference maps have been produced to show any potential impact to flood risk elsewhere resulting from the scheme.

Figure 10 shows the depth difference map for the 0.1% AEP event. The map indicates that the scheme results in limited changes to flood depths on the floodplain. A localised increase is shown within the wetlands, where the lowered ground provides a preferential flow path for water leaving the left bank of the Afon Lwyd. There is no change in flood risk to third parties.

It is noted that the depth difference maps show some changes to depths within the Afon Lwyd channel itself. This is associated with small-scale fluctuations associated with minor instabilities present in the incoming model in the larger flood return periods, including the 0.1% AEP. These fluctuations do not propagate into the floodplain and therefore are considered to have negligible impact on the assessment of the scheme.

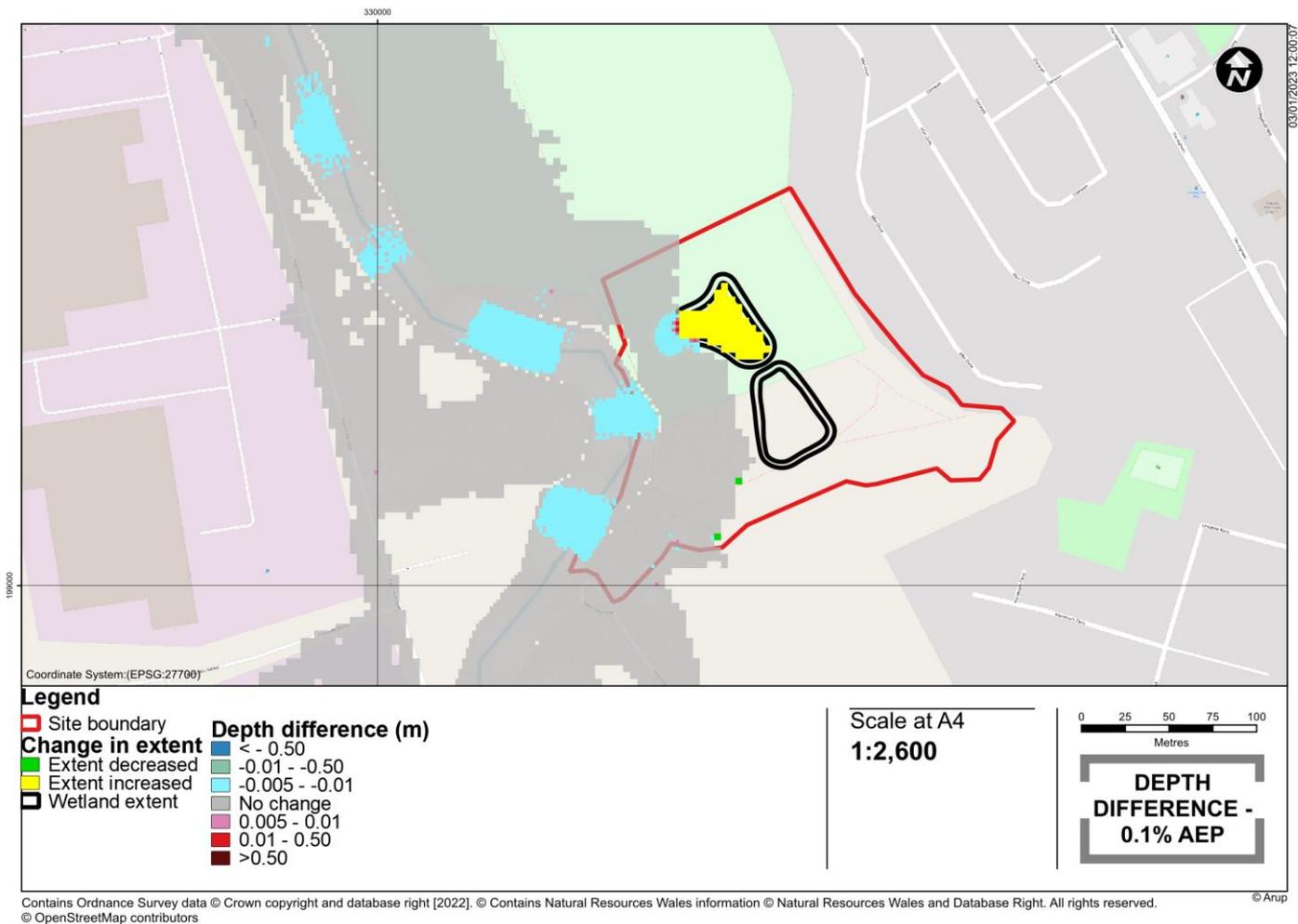


Figure 10 Depth difference map for the 0.1% AEP event before and after the scheme is installed

Model sensitivity

The climate change scenario has been used as a sensitivity test to assess disbenefit as a result of the scheme.

Figure 11 shows the depth difference map for the 0.1% AEP event plus climate change. In this event, depths on the floodplain are marginally reduced downstream as a result of the additional floodplain storage provided by the wetland area. As such, there is no disbenefit predicted during this event.

As in the previous scenario, there are localised areas where fluctuations in depths are observed. When the climate change allowance uplift is applied to the flows there is an associated increase in these fluctuations, including on the floodplain. An assessment of flood mechanisms in the area indicates that these fluctuations are unlikely to occur as a result of the scheme – some fluctuations are observed at a significant distance from the scheme location and therefore appear to be related to the wider model set up only.

The results from the sensitivity test indicate that the scheme does not cause disbenefit elsewhere, including to receptors within the area.

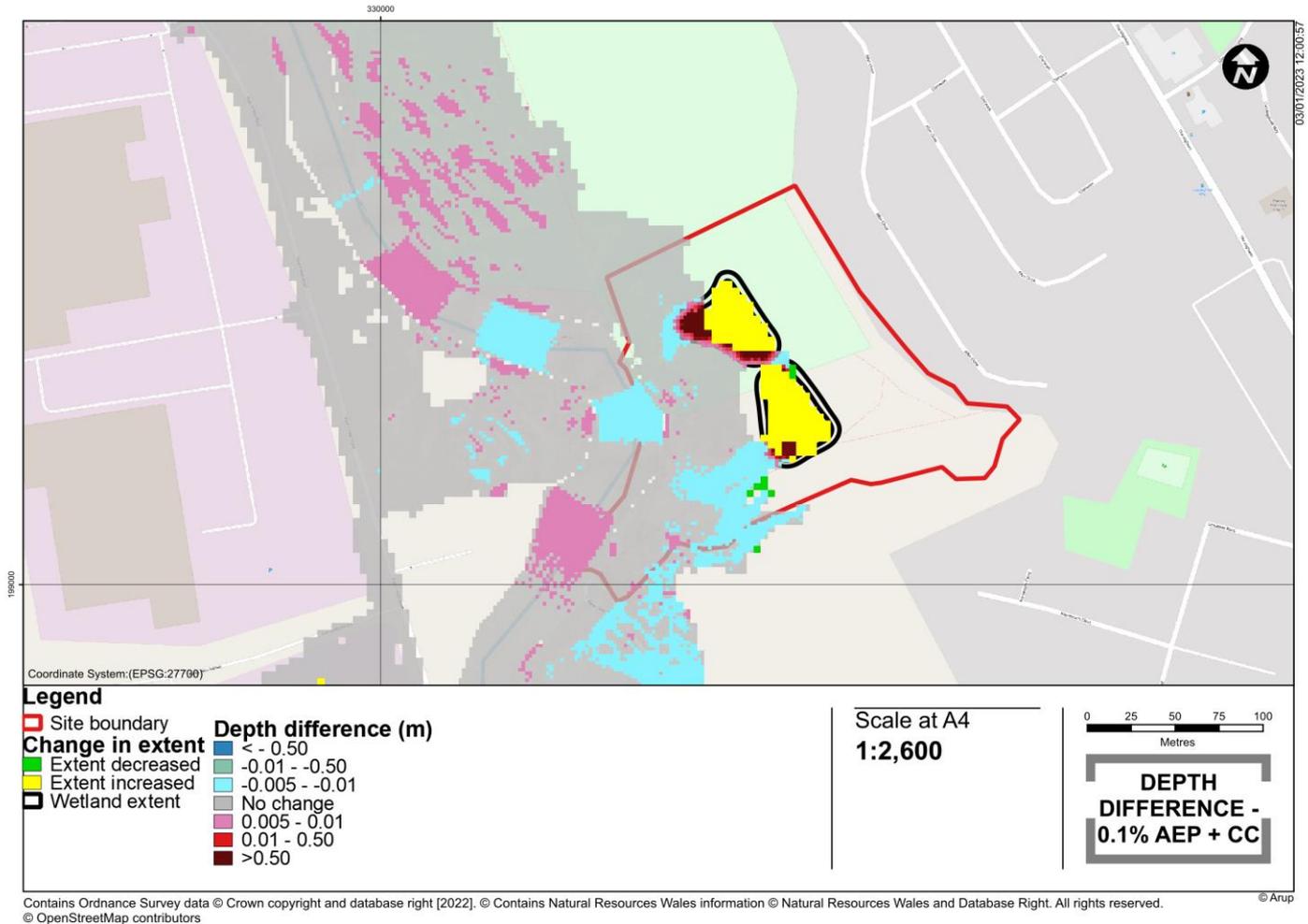


Figure 11 Depth difference map for the 0.1% AEP event plus an allowance for climate change before and after the scheme is installed

4.4 Surface water

Surface water flooding can occur when the volume of rainfall exceeds the capacity of existing drains and surface water sewers and is unable to infiltrate into the ground. Welsh Government flood maps define the surface water flood zones as follows:

- Flood Zone 1 – Less than 1 in 1000 (0.1%) plus climate change chance of flooding in a given year.
- Flood Zone 2 - Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
- Flood Zone 3 - A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.

Figure 12 shows the surface water mapping for the site, indicating that the majority of the site is within Flood Zone 1. There are isolated areas within Flood Zone 2, and a more significant surface water flow path parallel to the southern site boundary which is associated with a ditch that runs through the field in this location. The existing surface water flood risk is considered to be very low.

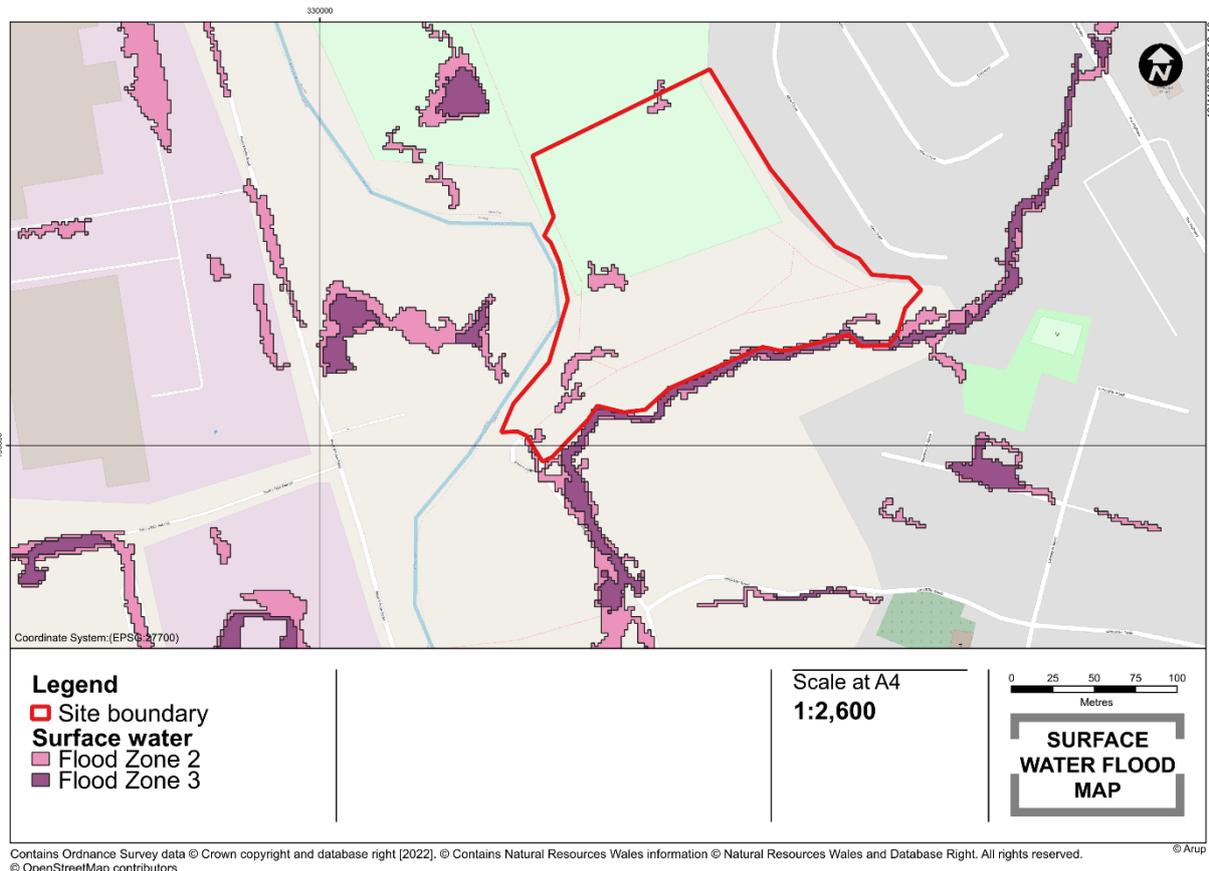


Figure 12 Surface water and small watercourse flood map

The proposed development will effectively change the existing grassy field into a water treatment facility with additional amenity and habitat areas. The proposed nature based solution will create large voids in the site that will be able to intercept surface water flow before it is directed to the Afon Lwyd.

As part of the scheme, some of the development features including roads and footpaths will require solid surfaces, however this will be mitigated by the use of permeable material to aid drainage. Areas requiring impermeable hardstanding will have adequate drainage, which will be designed according to geotechnical parameters taken from the ground investigation. Significant additional planting will further improve surface water absorption. The hardstanding areas will also be very localised and comprise a small proportion of the overall site area. Based on the proposed design, which includes features to deal with any additional surface water generated as a result of the scheme, it is considered that there will be no detriment in terms of surface water flooding to the surrounding area.

4.5 Groundwater

The Torfaen County Borough Council Flood Risk Management Plan includes an assessment of groundwater flood risk within the study area. The plan states, “Numerous studies have been carried out to determine the historical significance of groundwater flooding, the outcome of which has identified that Groundwater is not typically a hazard; however the implications of wetter milder winters may require a re-examination of the risk.”

Arup have undertaken a geotechnical High Level Desk Study (Doc Ref: B15116-102503-XX-XX-RP-GB-GC6701) for the Pont y felin scheme which outlines features and potential constraints which may impact the construction of the proposed development. The findings of the desk study were used to inform a scope of ground investigation works which were subsequently undertaken by Socotec UK Ltd (Socotec) in August 2022, as commissioned by Morgan Sindall on behalf of DCWW.

The intrusive ground investigation found that groundwater strikes were noted in some of the exploratory holes, with depths below ground level varying from 0.3-2.0m. No water was encountered in 5 of the 11

holes. A high water table could have an impact on the scheme design and therefore it is likely this will be investigated in more detail during the design process.

Based on the bedrock geology being identified as comprising mainly low permeability mudstones, the designation of the area as having low groundwater productivity, and the variable levels of groundwater found during the intrusive ground investigation, groundwater flooding is not considered to be a significant risk at the site.

4.6 Artificial sources

Flooding from artificial sources can happen because of infrastructure failure or human intervention. Potential sources of risk include canals, ponds, reservoirs and other artificial structures. Although the risk of a breach is low, the potential extent of damage could be significant.

The site is located approximately 2.7km to the west of Llandefgegd reservoir, however the available reservoir flood mapping indicates that a spill from this waterbody would flow to the south and therefore not impact the site. Part of the western end of the site, nearest to the Afon Lwyd, is shown within the reservoir flood extent originating from Cwmavon Reservoir.

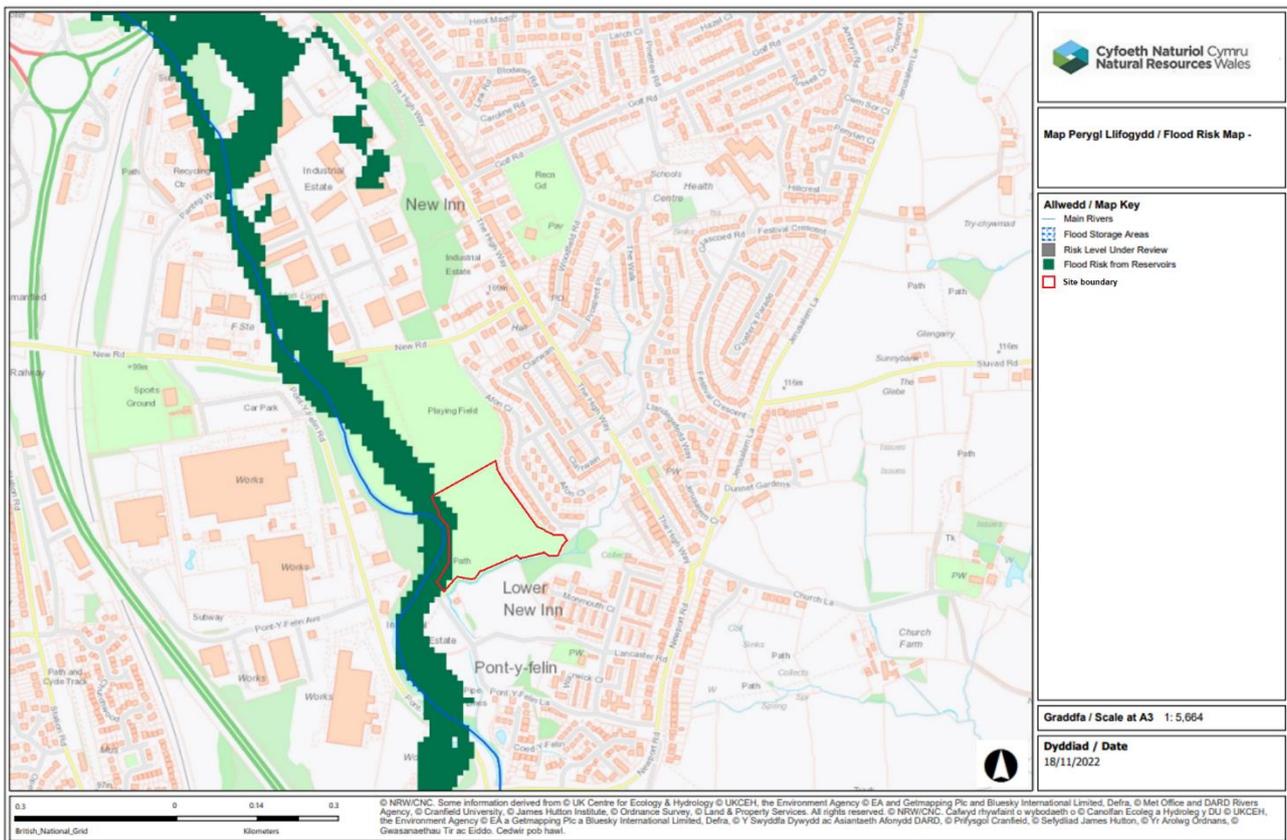


Figure 13 Reservoir flood extent

The extents show the worst-case scenario for the area that could be flooded if a large reservoir were to fail and cause a release of water. Natural Resources Wales state that, “Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in Wales, we ensure that reservoirs are inspected regularly and essential safety work is carried out.”⁸

There are no canals within the vicinity of the site. The reservoir flood extent is relatively well constrained to the banks of the Afon Lwyd and covers only a small proportion of the site, and would be unlikely to impact

⁸ Natural Resources Wales / Flooding from reservoirs

the developed area of the site, including the wetlands and reed beds. Based on this assessment, the overall risk of flooding from reservoirs is considered low.

4.7 Breach and blockage

Within the vicinity of the site, there are no formal flood defences. Similarly, there does not appear to be any informal defences, such as railway tracks or roads, that constrain the flood extent in the area. As such, the risk of flooding due to a breach of such a structure is considered negligible.

There is a footbridge approximately 240m downstream of the site, which has a width of approximately 1.9m and a soffit of 87.9mAOD. The hydraulic model results indicate that this structure does not surcharge in the 0.1% AEP event. The bed gradient through this reach of the channel is steep at 0.01, with riverbed elevations approximately 4m higher at the site in comparison to bed levels at the bridge. Based on this it is considered that if blockage were to occur and cause an increase in afflux it would be unlikely to significantly alter water levels at the site location.

As such, the risk of flooding caused by breach and blockage is not considered to be significant at the site.

5. Assessment of Acceptability Criteria

TAN15 states that for development to be considered within Zone C2, the proposed development must meet the requirements of set out within the Justification Test, including the acceptability criteria.

An assessment of the Acceptability criteria, as set out in TAN15, is summarised in Table 2. These criteria should be satisfied in order for the proposed development to comply with TAN15.

Table 2 Acceptability Criteria Assessment

| TAN15 Acceptability Criteria | Comments | Requirements achieved? |
|---|--|-------------------------------|
| Acceptable consequences for nature of use | Development is considered to be Less Vulnerable and therefore acceptable within Flood Zone C2. The amenities within the floodplain are considered to be low risk, including a wetland, and various amenity spaces. | Yes |
| Flood defences adequate | No flood defences present. | N/A |
| Agreement for construction and maintenance costs secured | No flood defences proposed. | N/A |
| Occupiers aware of flood risk | The site will not be permanently occupied. | Yes |
| Escape/evacuation routes present | Higher ground is present to the east of the site, and therefore egress from the floodplain would be achieved by moving to this area, away from the Afon Lwyd. | Yes |
| Effective flood warning provided | The site is partially located within the Rivers Ebbw, Sirhowy and Lwyd flood warning area. Flood alerts for this area are provided by NRW. DCWW should sign up to this service for awareness – no action required. | Yes |
| Flood emergency plans and procedures | A formalised flood emergency plan is not considered to be required at the site as it will not be permanently occupied. The onset of flooding to the site occurs over 2 hours, and therefore there will be sufficient time for people to leave the site if the watercourse breaks banks. Flooding to the site is only anticipated in an extreme event (equal to or exceeding the 0.1% AEP flood event). | N/A |
| No flooding elsewhere | Hydraulic modelling has been undertaken to assess the impact of the development on flood risk in the surrounding area, as detailed in this assessment. The model results indicate the development does not cause flood risk disbenefit elsewhere. | Yes |
| Development is designed to minimise structural damage during a flooding event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of the flood. | The proposed development features that are within the floodplain are relatively resilient to flooding, and therefore extensive structural damage is not anticipated. | Yes |

| | | |
|---|---|-----|
| The development is designed by the developer to allow the occupier the facility for rapid movement of goods/possessions to areas away from the floodwaters | It is not anticipated that goods or possessions would be stored within the parts of the site that are in the floodplain. | Yes |
| Flooding in extreme event does not exceed prescribed values regarding maximum water depths and velocities | Maximum depths in the 0.1% AEP event do not exceed 600mm. Maximum velocities are typically around 0.3-0.4m/s, however some higher velocities are observed in the south corner of the site. This occurs only for the peak of the flood event, however the location of amenities will be directed away from this area to reduce potential risk. The onset of flooding to the site is approximately 2 hours from when the Afon Llyd first breaks bank, therefore giving adequate time for members of the public using the amenities to leave the area. | Yes |

Based on this assessment, it is considered that the proposed development satisfies the acceptability of consequences criteria.

6. Conclusion

6.1 Overview

This FCA has assessed flood sources to and from the proposals in the context of the existing and proposed development.

The proposed development is classified as Less Vulnerable and a minor part of the wetland, amenity space, the public plaza and tree planting area is located in Zone C2 according to the existing TAN15 guidance. According to the new TAN15 guidance, the development is classified as Less Vulnerable and is located primarily in Flood Zone 1, with the wetland located in Flood Zone 2.

The potential sources of flooding which could affect the proposed development have been considered and assessed as follows:

- Groundwater flood risk is considered to be **low**;
- Tidal flood risk is considered to be **negligible**;
- Surface water flood risk is considered to be **low**;
- Artificial flood risk is considered to be **low**;
- Breach and blockage flood risk is considered to be **very low**; and
- Fluvial flood risk is considered to be **low**;

Flooding from the Afon Lwyd forms the primary source of flood risk to the site, and therefore this is explored further below.

6.1.1 Fluvial flood risk summary

Part of the proposed wetland, and various amenities including amenity space comprising, a public plaza, boardwalk, access track, outdoor classroom, trim trail and tree planting, are located in DAM Zone C2. The development is considered to be “less vulnerable”, and therefore considered appropriate to be located in this zone, subject to the application of the justification test including the acceptability of consequences test.

The development has been shown to pass the justification test as it will provide regeneration of the existing area, including an improvement of recreational facilities for the local community and additional benefits in terms of ecology and wildlife, in keeping with the objectives set out in the Torfaen Economy and Enterprise Strategy and PPW. The scheme cannot be relocated as it pertains to the existing CSO that discharges to the Afon Lwyd in this location. The wetland impinges only minorly on Zone C2, and the vast majority of it is located outside of the 0.1% AEP flood extent. Additional amenity features located within Zone C2 have been designed so that they do not require any change in ground elevation, and are therefore unlikely to impact the existing flood risk.

The access track parallel to the southern site boundary will require minor ground raising, approximately 100-200mm. As flood depths typically exceed this, it is anticipated that there will be no significant change to flow paths in this area and therefore no anticipated change to flood risk as a result of the track.

Hydraulic modelling has been undertaken to assess the potential impact to flood risk of the wetland area and this has shown there are no disbenefits to the surrounding area in terms of flood risk. The rest of the development site is located outside of the flood extent. As such, it is considered that the site passes both the justification test and the acceptability of consequences test under the existing TAN15 guidance.

The development has also been assessed in accordance with the updated TAN15 guidance. Under the new guidance, the development is considered to be “less vulnerable”. The wetland is located in Flood Zone 2, and therefore development can proceed subject to the justification test and acceptability of consequences.

As with the existing guidance, it is considered that the development would pass the justification test due to the benefits it provides in terms of regeneration for the area, and additional benefits in terms of the environment. Hydraulic modelling has been undertaken and used to show that the development does not cause any disbenefit in terms of flood risk, including in the 0.1% AEP with an allowance for climate change. The majority of the development is flood-free during the 1% AEP event with an allowance for climate change, and therefore the overall risk of flooding to the site is considered to be low. Based on this assessment of flood risk, it is considered that the development satisfies all requirements including both the justification test and the acceptability of consequences test.