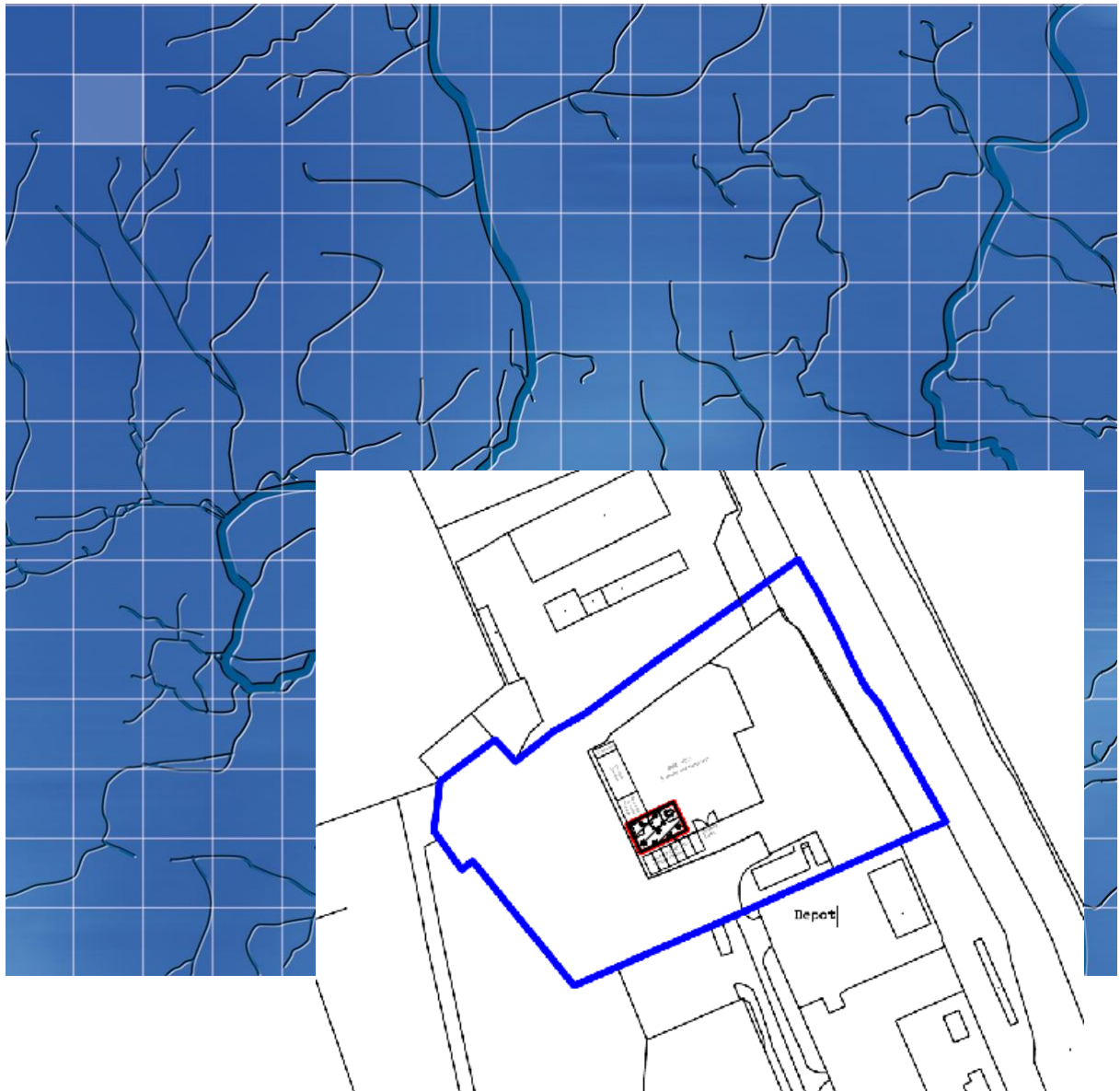


Monarch Architectural Services

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Laymak Yard Flood Consequence Assessment



WHS

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For and on behalf of Wallingford HydroSolutions Ltd.

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The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.

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1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd (WHS) has been commissioned by Monarch Architectural Services Ltd to undertake a Flood Consequence Assessment (FCA) in accordance with Technical Advice Note 15 (TAN15)¹. This is required to support a planning application for the erection of a single office building on a site in the Abercanaid Industrial Estate, Merthyr Tydfil (NGR: SO 05257 05040).

The site lies adjacent to the western bank of the Afon Taff, with the dominant mechanism of flooding being fluvial. A review of the Natural Resources Wales (NRW) development advice map (DAM) indicates that the site is within zone C2, defined as areas which are modelled to flood in the 0.1% AEP event and are without significant flood defence infrastructure.

WHS have developed a local hydraulic model of the Taff in this area for a previous planning application (P/16/0309) in order to provide an improved understanding of flood risk. This model was approved by NRW in 2017. The 2017 model shows reduced flood extents when compared to the national scale mapping.

The FCA seeks to demonstrate that the proposed development can remain compliant with TAN15 for the lifetime of development and that the risk of flooding can be managed to an acceptable level. This report gathers together the findings of the assessment, the primary objectives of which are to provide information on the flood risks associated with the development.

1.2 Scope

Due to the location of the site within DAM Zone C2, a site-specific FCA is required. This report will seek to address the requirements of an FCA as set out in TAN15 and provide a document appropriate for submission with the planning application for the site. In summary, this report will;

- Collate and analyse environmental and flood risk information obtained from a desk-based review of available data to identify and quantify the baseline flood risks to the development.
- Undertake a hydraulic modelling analysis using WHS' 2017 model of the Taff to determine the 3rd party impacts of the development on flood risk.
- Provide recommendations for the development to manage flood risks, particularly in relation to access and egress from the site.

1.3 Sources of Data

The main sources of information used to inform this FRA include:

- LiDAR data to map the site's topography.
- Proposed site layout plans provided by the client.
- Natural Resources Wales (NRW) Flood Mapping– To establish flood risk from fluvial sources²
- NRW Surface Water Flood Mapping–To quantify the pluvial flood risk to the site.
- Existing WHS 1D/2D hydraulic model of the Afon Taff ³– To further assess and refine understanding flood risk from fluvial sources.
- Landis Soilscales Map⁴– To quantify groundwater flood risk to the site.

¹ Welsh Government (2004) Planning Policy Wales Technical Advice Note 15: Development and Flood Risk <https://gov.wales/docs/desh/publications/040701tan15en.pdf>

² NRW (2020) *Long term flood risk maps* <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en> accessed on 18/12/2018

³ WHS (2017) *WHS 1506 1D/2D linked Flood Modeller/TuFLOW model*

⁴ Cranfield Soil and Agrifood Institute (2020) *Soilscales Map*, <http://www.landis.org.uk/soilscales> accessed on 12/11/2020

2 Site Description

2.1 Location

The proposed development is located on land south of Merthyr (NGR: SO 05257 05040). The site's eastern boundary follows the western bank of Afon Taff, which flows in a southerly direction.

The site is located on an industrial estate with surrounding land use urban, with commercial properties and warehouses. Figure 1 shows the location of the site and the proposed office building.

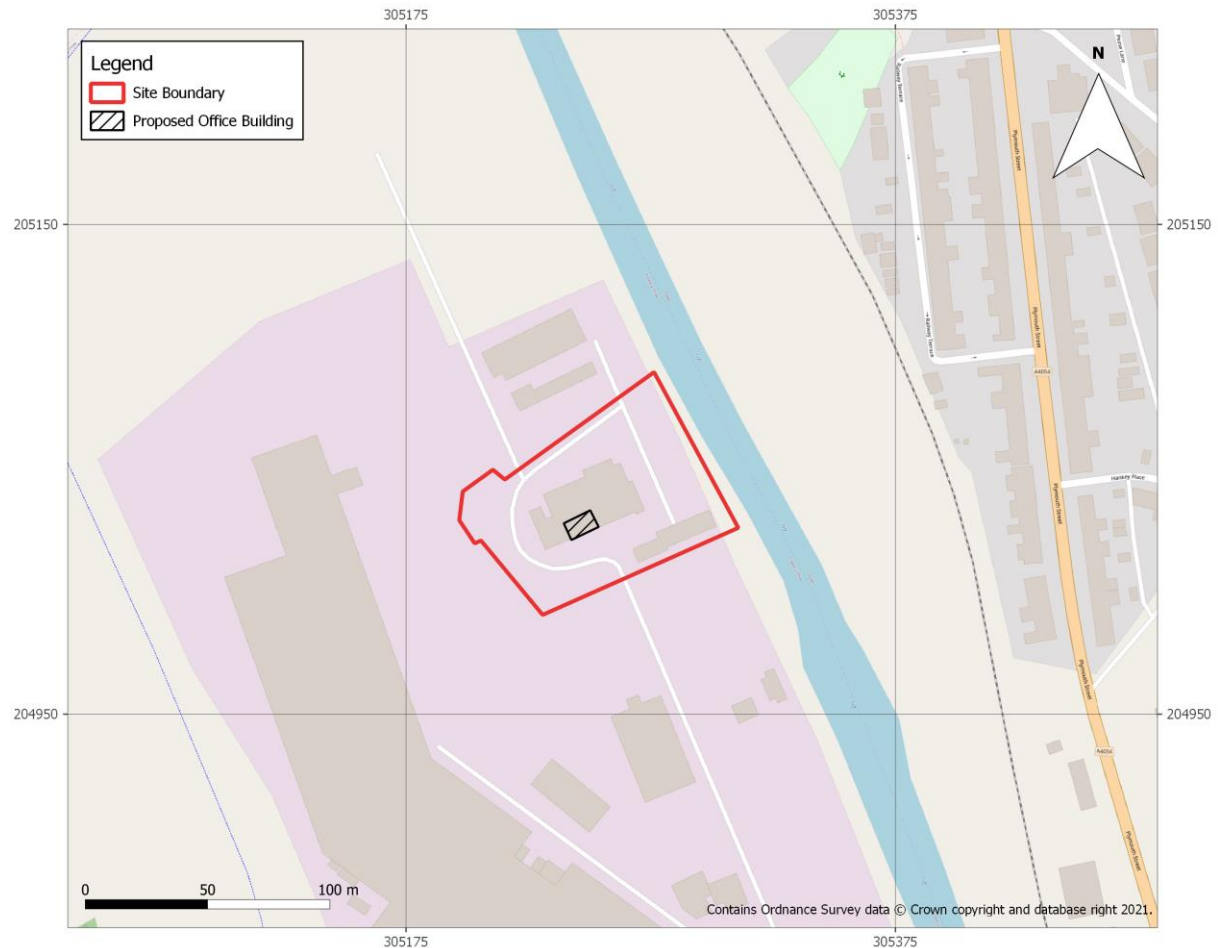


Figure 1 – Location of site and proposed office building

2.2 Topography

The topography of the site has been reviewed using LiDAR elevation data. The site is located on the valley floor of a south draining valley. The site is reasonably level with levels ranging between 156.87m AOD and 158.75 AOD. To the west is an area of floodplain lower than the site. Figure 2 shows the topography of the site.

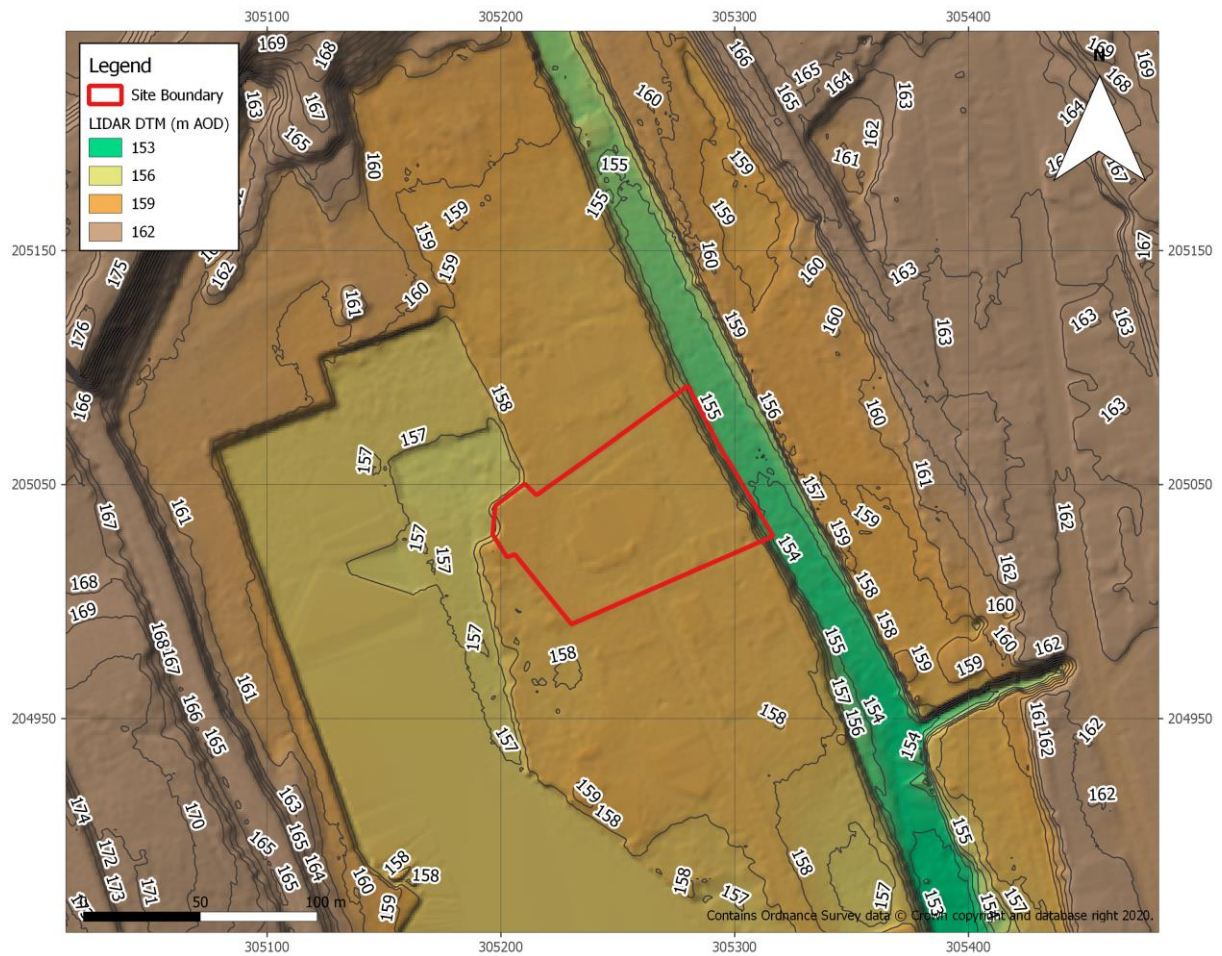


Figure 2 - Topography

2.3 General Arrangement

As shown in Figure 3 the proposed development consists of a detached office building. The office building will have a footprint of 92m². The site is accessible via a road from the south, entering the site on the southern boundary. The unit is located immediately to the south of existing storage units.

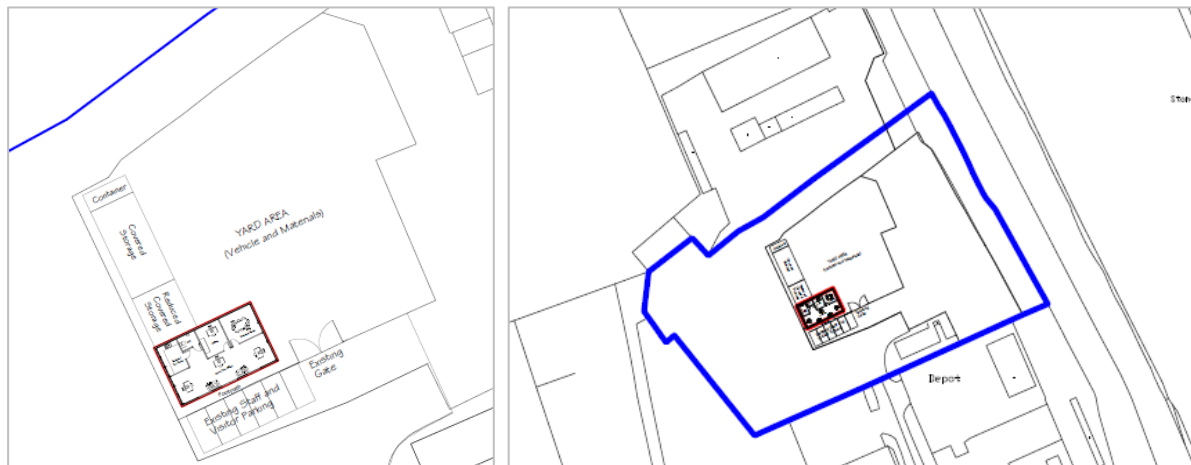


Figure 3 – General Arrangement

3 Flood Risk

3.1 NRW DAM Flood Map

To assess the risk of fluvial flooding at the site, the NRW DAM flood map has been reviewed.

The Development Advice Map (DAM) shows areas at risk of flooding for the purposes of land-use planning. The DAM should be used alongside Planning Policy Wales and Technical Advice Note (TAN) 15 to guide new development away from areas at risk of flooding wherever possible.

Figure 4 shows the DAM map in the location of the site and indicates that the site including the proposed office building lies wholly within zone C2, defined as areas which are modelled to flood in the 0.1% AEP event and are not served by flood defence infrastructure. In zone C2, only less vulnerable development is appropriate, this category applies to the proposed office unit.

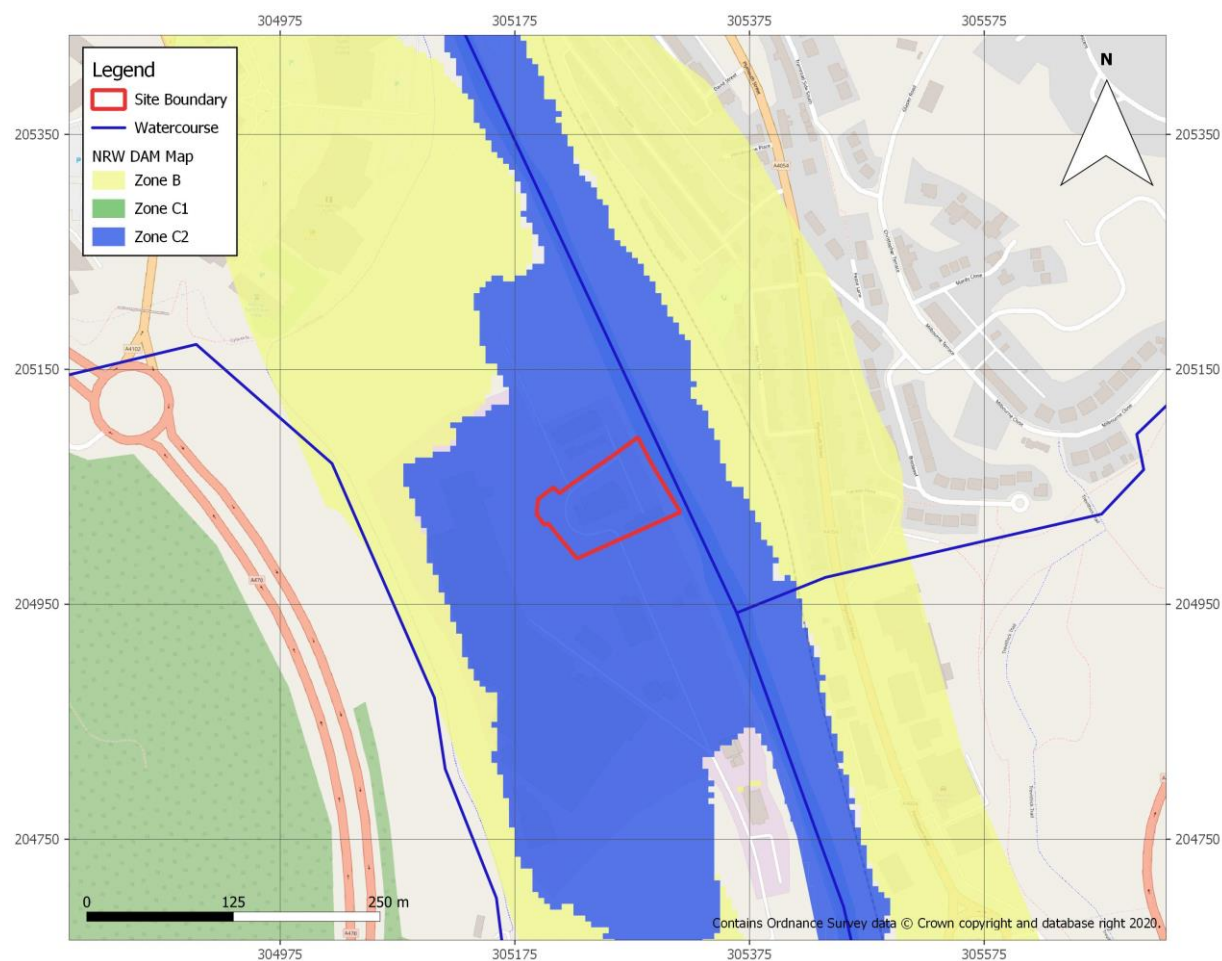


Figure 4- Development Advice Map

3.2 Fluvial Flooding

To further assess the risk of fluvial flooding at the site, the NRW fluvial flood map has been reviewed. The NRW flood map considers the flood risk associated with fluvial and tidal flood events during an undefended scenario, i.e. the presence of the fluvial or tidal defences are not considered. The map is based on model data, as well as recorded historical flood outlines.

Figure 5 shows NRW's fluvial flood map, it indicates that the site including the proposed office building is situated entirely within Flood Zone 3, defined as areas at risk of flooding during the 1 in 100-year event. Based on this data the fluvial flood risk at this site is high.

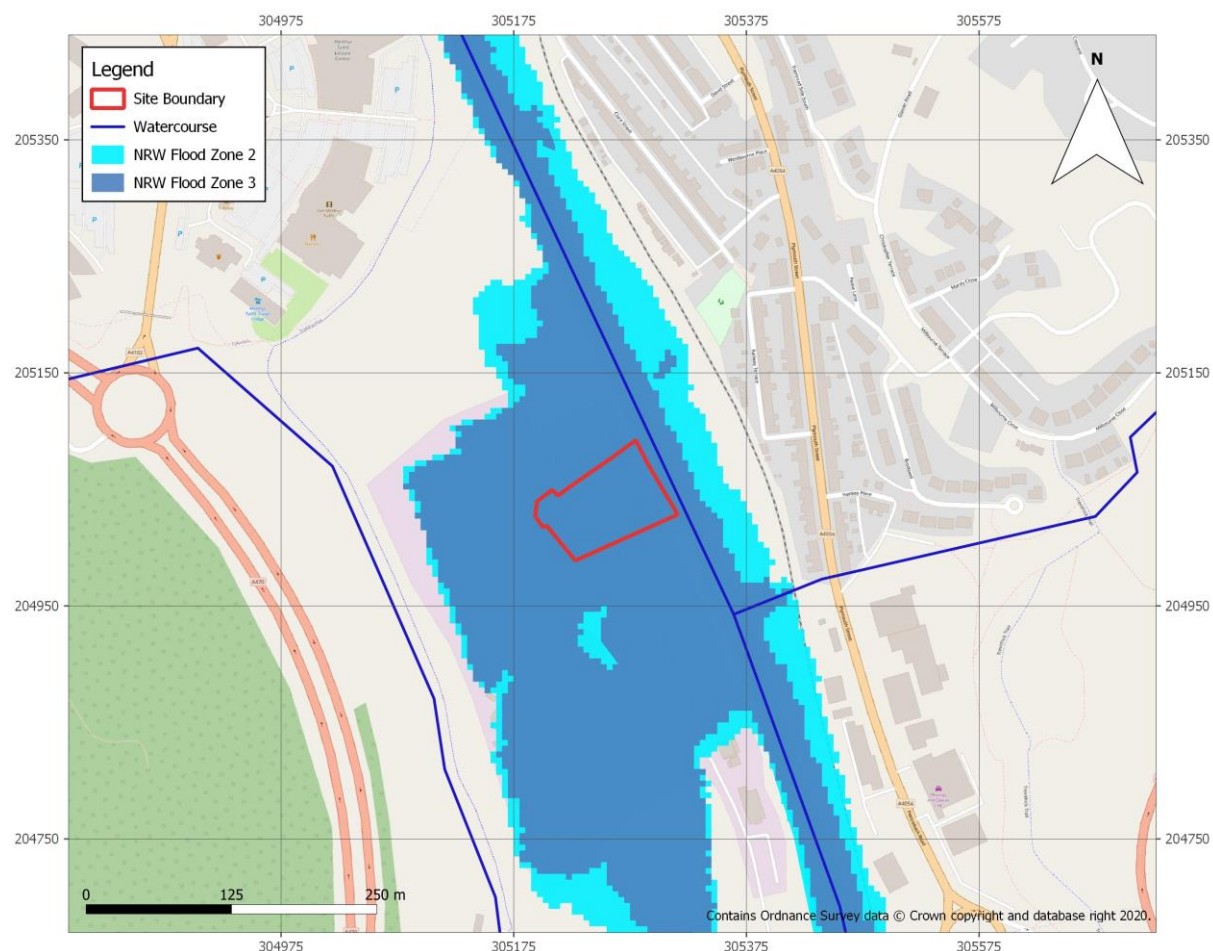


Figure 5 – Fluvial Flood Extents

3.3 Updated Flood Risk

In 2017, WHS built the Willows-Taff hydraulic model to provide a more refined assessment of flood risk to the area. The model has subsequently been re-run for this FCA, using the latest versions of TuFLOW (2020) and Flood Modeller (v4.6) at the time of writing. The results show very marginally greater flood extents and depths than for the previous model version (a 6mm depth increase near the site boundary for the 100-year with 25% Climate Change event). This model, previously

approved by NRW⁵, shows reduced flood extents when compared to the national scale mapping. However, the site still floods in the extreme 1000-year event, with limited flooding also predicted in the 100-year with a 25% allowance for climate change (central estimate for the 2080's).

Liaison with NRW has confirmed that in approving the 2017 Taff-Willows hydraulic model for the River Taff it is suitable for site specific use⁵. Therefore, the results from the model have been used to inform this FCA. The model extent stretches from NGR: 304744, 205920 at the upstream end to NGR: 306050, 203677 at the downstream end. The model includes the effects of bridges and structures along this 2.6km stretch of the Taff. The results of the modelling for the site are presented below and provide the most refined indication of flood risk to the site that is currently available.

3.3.1 1 in 100-year Event

The site remains flood free during this event, with flows remaining in bank.

3.3.2 1 in 100-year with 25% Climate Change Flood Event

As shown in Figure 6, there is inundation of the site for this event, the maximum water level for this event is 158.35mAOD, as sampled from the access road. Flooding is largely channelled down the roads through the site. Maximum flood depths reach 0.19m in the east of the site. Velocities reach a maximum of 0.18m/s. Significantly the proposed office lies outside of the flood extents.

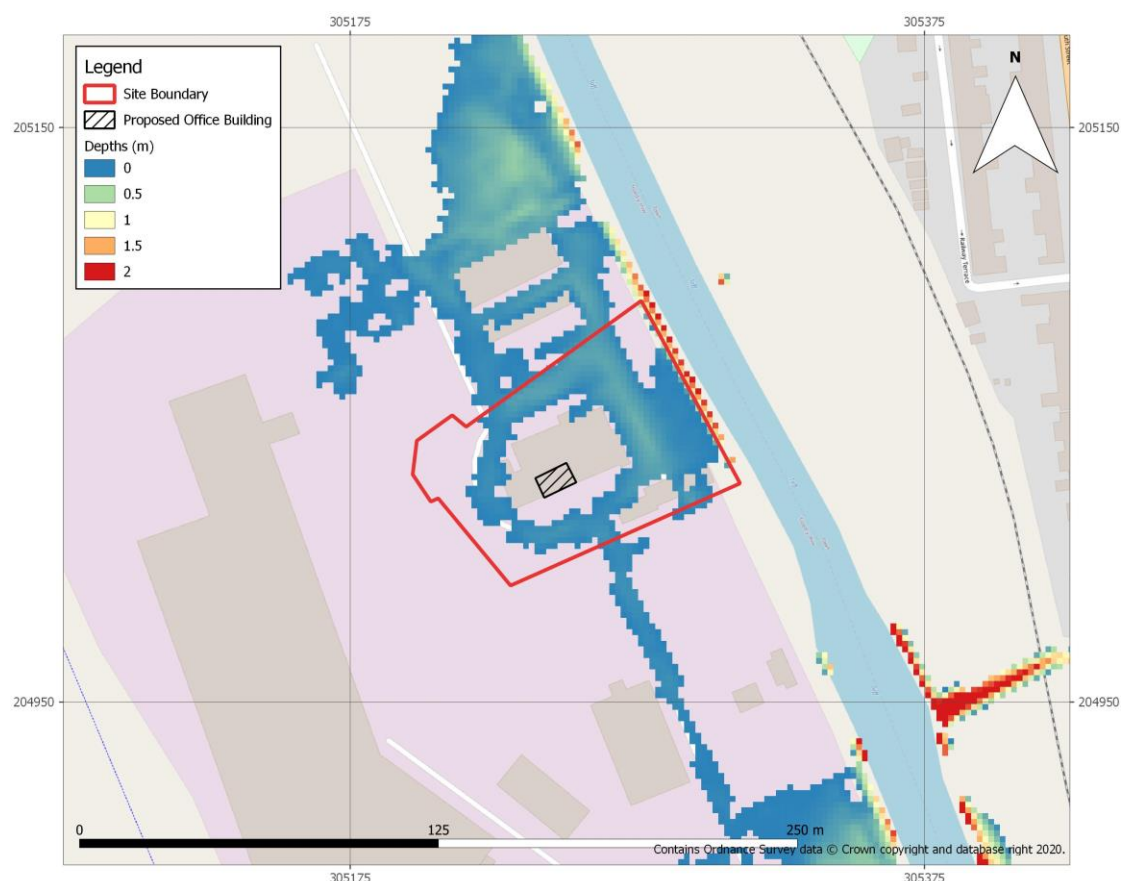


Figure 6 Model results for the 1-in-100-year + 25% Climate Change allowance event

⁵ Email Sent by Christopher Nutt, Flood Risk Analyst, Natural Resources Wales. 18/11/19.

3.3.3 1 in 1000-year Flood Event

The results from the 1-in-1000-year event are presented below in Figure 7. The maximum flood level for this event is 158.59mAOD and the majority of the site is inundated. Flood depths at the low point within the red line boundary that exists along the road through the east of the site reach a maximum depth of 0.46m. More commonly, flood depths are in the region of 0-0.4m. Within the proposed office unit footprint, flood depths peak at 0.19m and velocities peak at 0.12m/s.

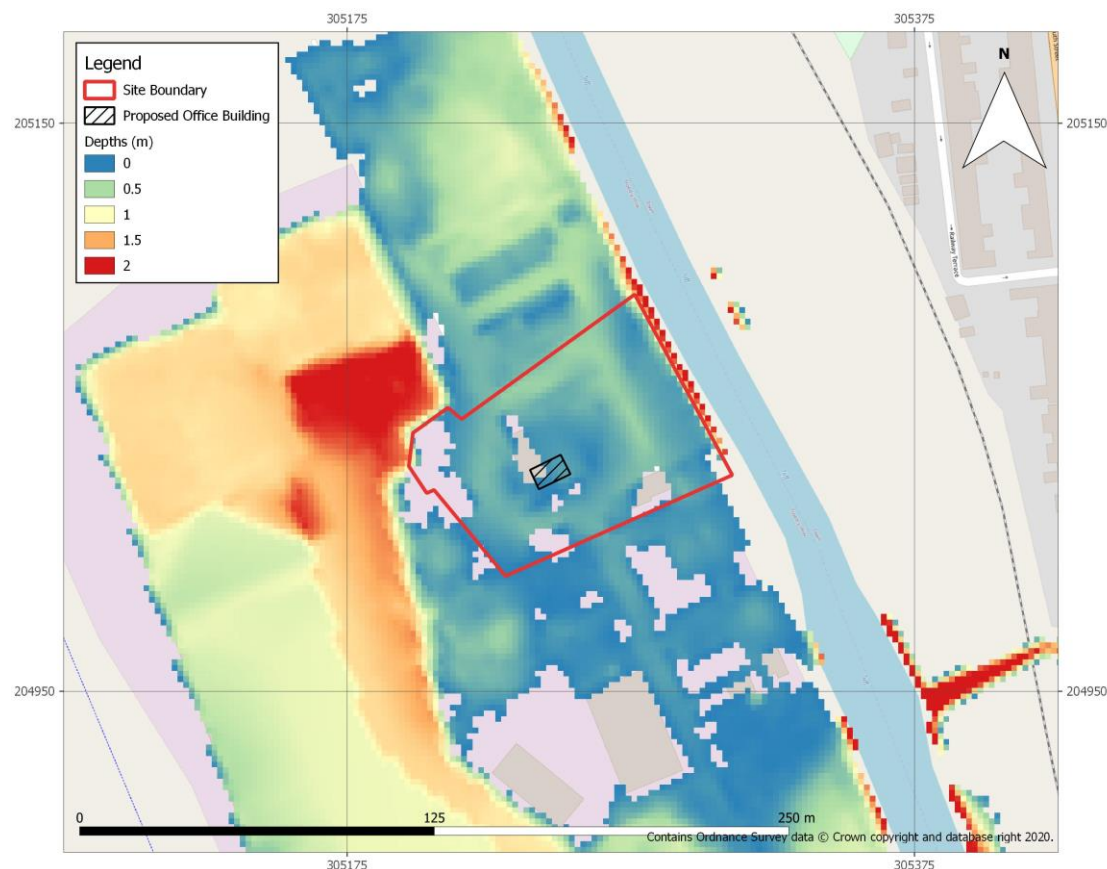


Figure 7 Model results for the 1-in-1000-year event

3.4 Surface Water Flooding

To assess the risk of surface water flooding at the site, the NRW surface water flood maps have been reviewed.

The surface water flood map, as shown in Figure 8, suggests that surface water is channelised along the low point in the east of the site, where the risk of surface water flooding is considered high. Elsewhere on site, the surface water flood risk is very low with no flooding predicted up to and including the 1000-year event.

In summary, the surface water flood risk at the site is considered generally low, with the proposed office building located outside areas at risk.

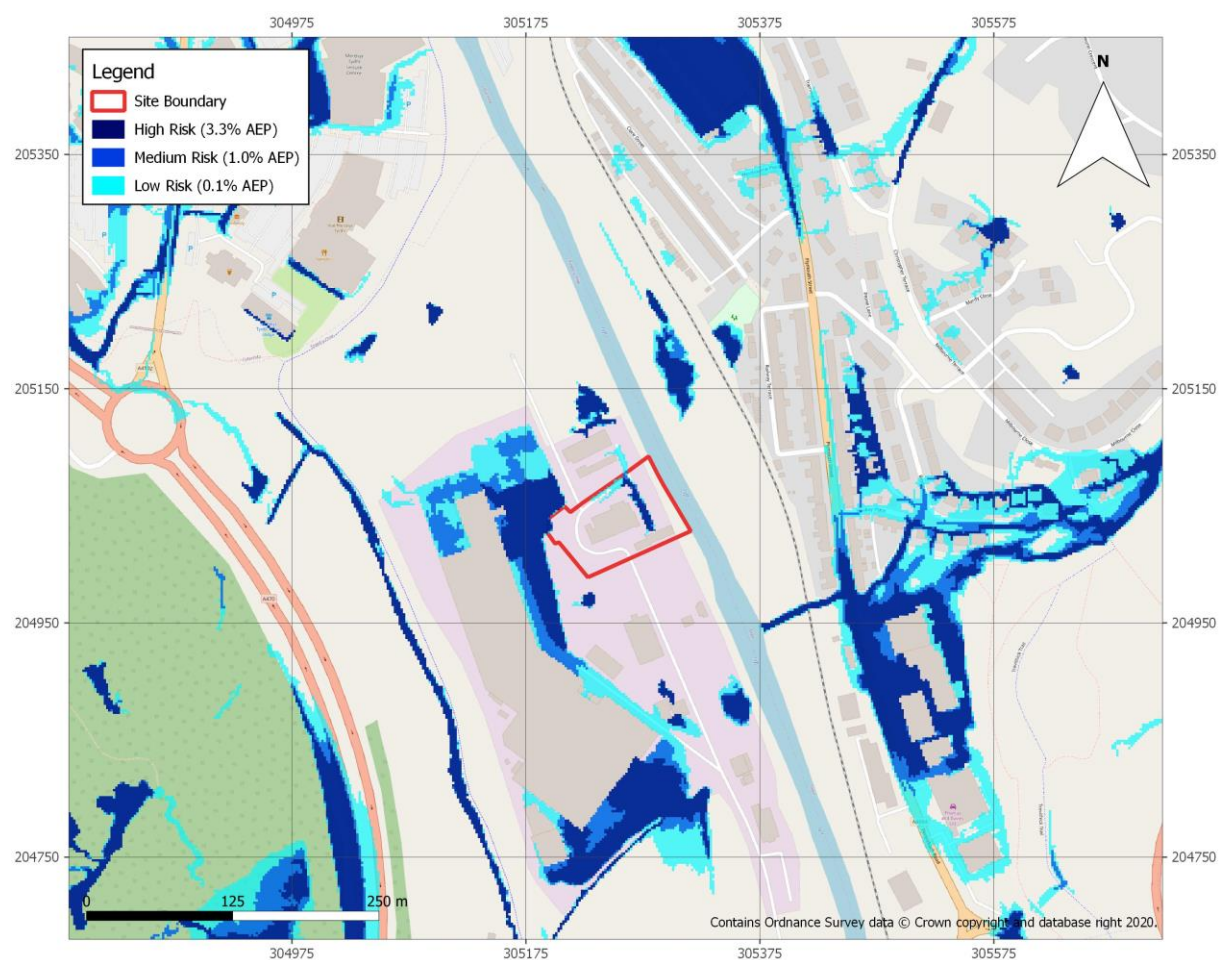


Figure 8 - Surface Water Flood Extents

3.5 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at ground level. A review of Soilsclapes⁶ online mapping service has indicated that the site is situated on freely draining soils, comprised of alluvium over mudstone, siltstone, or sandstone. The site's location adjacent to the River Taff means that groundwater levels are likely to be strongly correlated to river levels in the Taff, which means that any groundwater emergence will be fluvially driven. Therefore, the overall risk associated with groundwater flooding specifically is low.

3.6 Historical Flooding

There are no recorded historical flooding incidents that have affected the site, but the wider area has cases of past flooding. These include the Pentrebach floods located 150m downstream of the site, which occurred between the 2nd and 8th of December 1979. There are also past records of flooding 2km upstream of the site, namely the Merthyr Tydfil floods in early December 1979.

4 Flood Consequence Assessment

This FCA serves to quantify the current level of risk posed with regards to the development's use and its impact on flood risk elsewhere.

4.1 Planning Policy

TAN 15 outlines the requirements for planning policy in Wales in relation to development and flooding. TAN 15 requires that the development site will remain safe over its lifetime and will not increase flood risk elsewhere while ensuring minimal risk to life for site users.

The proposed site is shown to lie within Flood Zone C2 according to the Development Advice Map. The nature of the development is classed as "less vulnerable" due to it being an office building, as per paragraph 5.1 in TAN15.

This section demonstrates that the risks and consequences of flooding have been considered, with particular regard to flood risk impacts on 3rd party land.

4.2 Justification for Development

The office building is to be built on the established commercial site of the Abercanaid Industrial Estate. Its main purpose will be ensuring operation of the industrial site. This site is located adjacent to sites with similar permitted operations.

The office unit is located on land which does not flood within the design (1 in 100-year + 25% Climate change) event and it is proposed that it be raised above the 1000-year flood level (which is 158.59mAOD) to offer a further level of protection. Though the wider site is shown to flood within the design event, this is considered to be acceptable, since there is no change of function or proposed development within these affected areas.

4.3 3rd Party Flood Impacts

In order to quantify any 3rd party impacts of the development, the office building has been incorporated into the hydraulic model and compared to the baseline model to identify changes in flood risk. In terms of modelling, the unit has been incorporated as a "stubby building" as per the buildings in the existing model. This represents the unit as a raised slab level above existing ground

⁶ Soilsclapes Online Map Viewer <http://www.landis.org.uk/soilsclapes/> Accessed 12th January 2020

levels in order to capture its effects on conveyance and storage. Note the stubby building assumes that the unit presents a complete obstruction to flow, so should be considered a worst case analysis. As per the guidance given in TAN15, all development, with exception to emergency services, should be flood free in the 1 in 100-year with 25% climate change event, also known as “the design event”. A design flood level for this event has been provided in Section 3.3.2 of 158.35mAOD. As the footprint for the proposed office is already above this level (158.40mAOD minimum), it is recommended that the units are raised by 300mm above the existing ground levels, thus providing a 350mm freeboard above the design level.

The model has been run for both the 1 in 100-year event with 25% climate change and the 1 in 1000-year events. As the footprint for the unit was not shown to flood in the 1 in 100-year event with 25% climate change, there was no impact upon flood depths elsewhere. For the 1 in 1000-year event, the impact upon flood depths is minimal, with minor detriment of up to 7mm extending up to 7m north of the unit and betterment of up to 7mm to the south. There is no impact to flood depths outside of the red line boundary and therefore no third party impacts (see Figure 9).

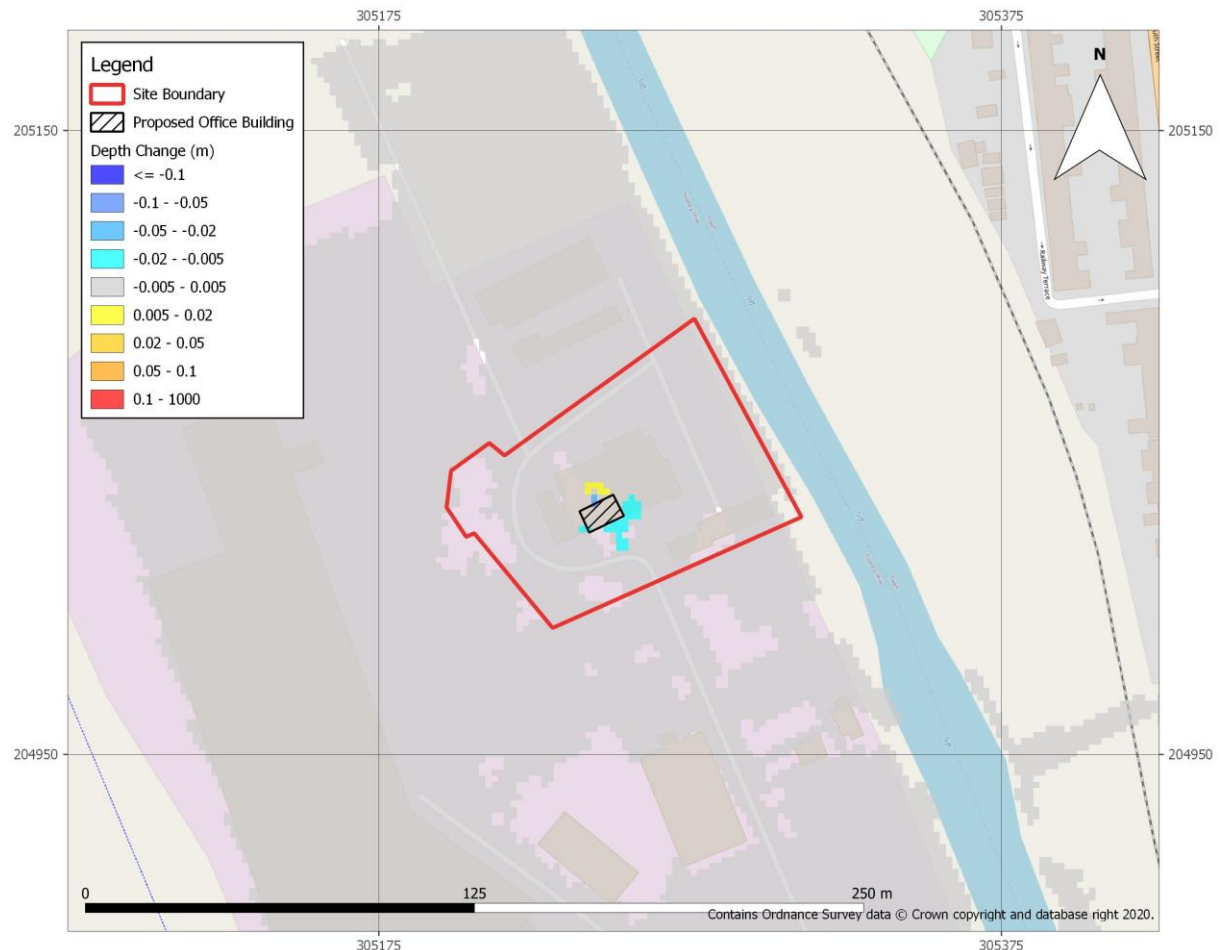


Figure 9 1000-year Depth change plot (post-development v baseline)

4.4 Access and Egress

For access and egress to and from the site it is proposed that the minor road to the south of the development be followed in a north to south direction. This will serve as an evacuation route for site personnel or an access route for emergency services if required. The route progresses southward before turning away from the river westwards.

The proposed route is subject to minor flooding in a 1 in 100-year with 25% climate change event, over a road length of approximately 100m. Here, flood depths peak at 0.08m and a hazard rating of 0.03. This hazard rating falls within the lowest flood hazard category and is considered relatively safe. During the extreme 1 in 1000-year event, the road length floods across a 170m length. Here, flood depths peak at 0.30m and the maximum hazard rating is 0.40, again, falling in the lowest hazard category. Overall, the access/egress route is considered safe in the events assessed for all users. Figure 10 shows the access/egress route and hazard map for the 1 in 1000-year event.

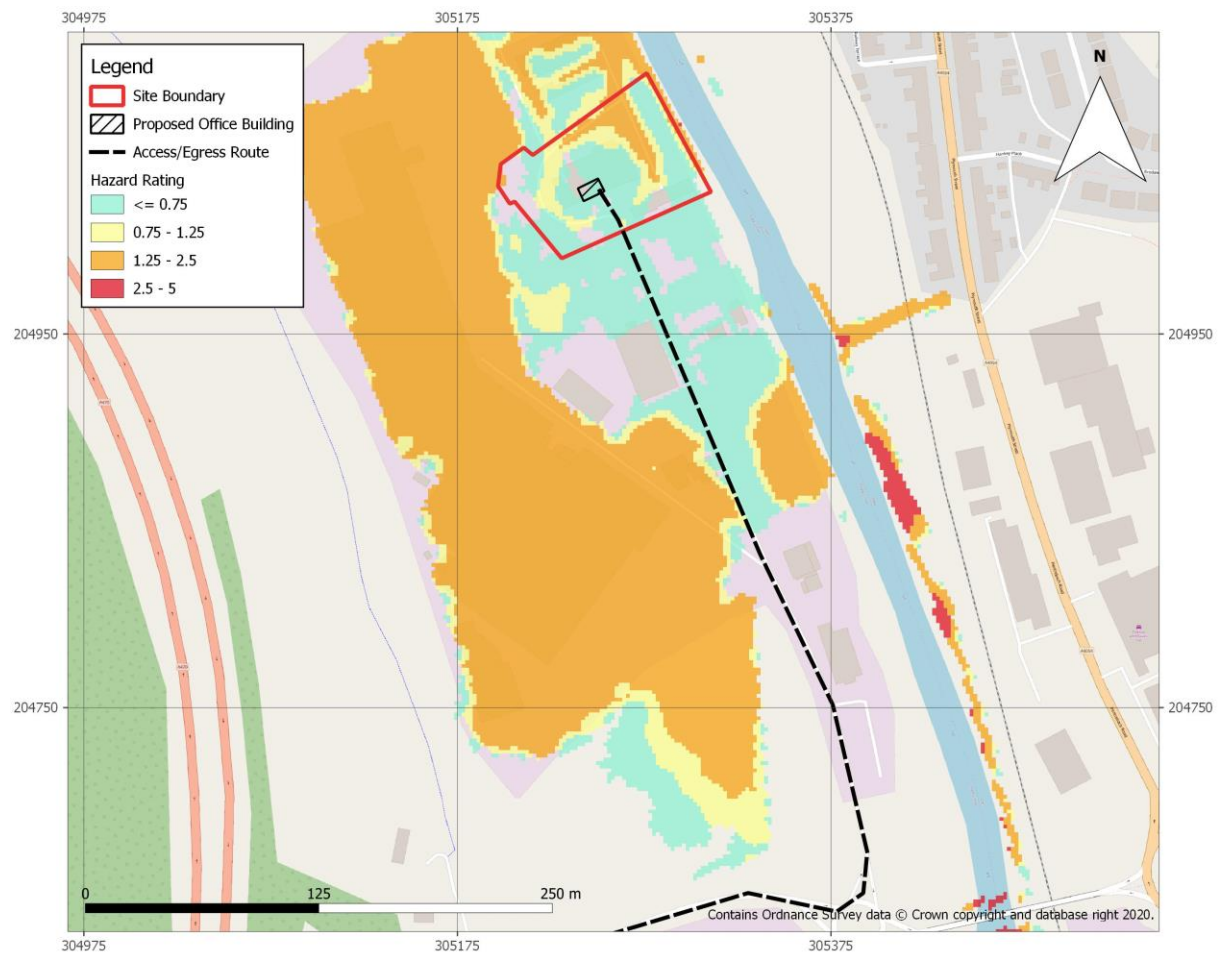


Figure 10 Access/Egress (1 in 1000-year event hazard map)

5 Conclusion

This FCA provides a robust understanding of flood risk to the site using the best available data. Please see the key points below.

- It is proposed that a single office unit is located on an industrial site west of the River Taff.
- According to coarse scale national mapping, the site lies in Flood Zone 3.
- The pluvial flood risk has been demonstrated to be low.
- A refined assessment of fluvial flood risk has been carried out based on a hydraulic model completed by WHS in 2017, which has been run on updated software versions for TuFLOW and Flood Modeller.
 - This shows that the footprint for the office unit remains flood free in a 1 in 100-year event and the 1 in 100-year with 25% climate change event (the design event).
 - Flood depths peak at 0.19m for the 1 in 1000-year event within the proposed footprint, which also inundates the majority of the red line boundary.
- It is proposed that the floor levels of the units are set 300mm above existing ground levels (158.40mAOD minimum existing ground level), which provides a 350mm freeboard above the design event flood levels.
- For the most extreme 1000-year event, there is no impact upon third party flood risk, with only minor depth changes of ± 7 mm immediately adjacent to the proposed unit.
- The access/egress route is considered safe and operational during the events assessed, including the extreme 1000-year event.