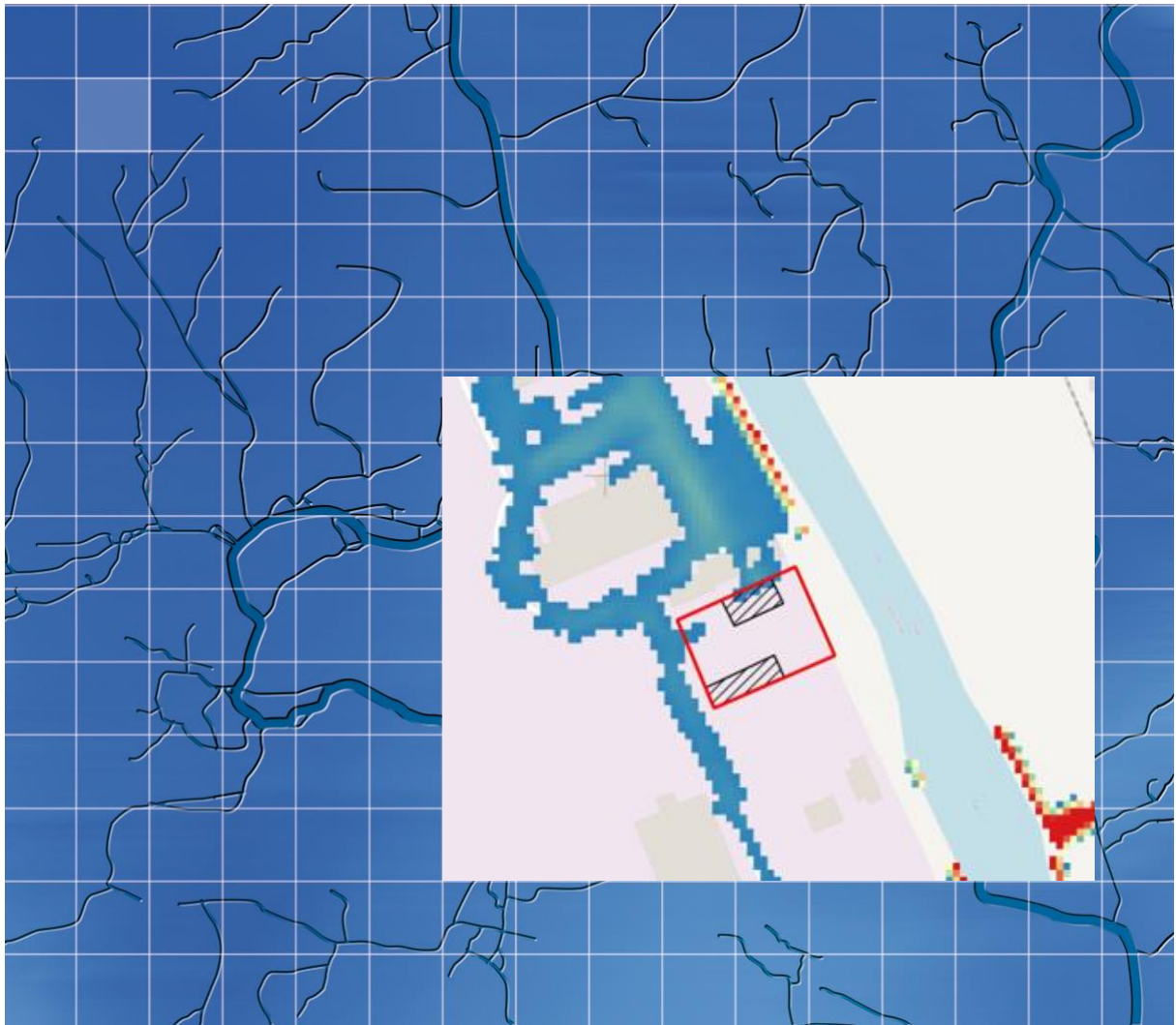


Louwís Commercial Properties LTD

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Abercanaid Storage Units



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For and on behalf of Wallingford HydroSolutions Ltd.

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1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd has been commissioned by Louwis Commercial Properties to undertake a Flood Consequences Assessment (FCA) for the development of 6 proposed storage units in the Abercanaid Industrial Estate, Merthyr Tydfil (NGR: 305294, 205004). The site is located on the western bank of the River Taff, with the dominant mechanism of flooding being fluvial. According to the NRW fluvial flood risk maps the site lies in Flood Zones 2 and 3, an area at risk of flooding during the 1 in 100-year event and 1 in 1000-year events. The Development Advice Map (DAM) defines this site to be in Zone C2, an area of the floodplain at risk without significant flood defence infrastructure.

Wallingford HydroSolutions (WHS) has previously built an NRW-approved hydraulic model of the area (2017 Willows-Taff Model). This detailed modelling provides a more refined picture of the flood risk posed to the site than online flood maps built using J-FLOW.

The main risk of flooding to the site is during the extreme, 1000-year event with only minor flooding encroaching into the red line boundary during the 100-year with a 25% allowance for climate change. This FCA seeks to demonstrate that the proposed development can remain compliant with TAN15 for the lifetime of the development and that the risk of flooding can be managed to an acceptable level.

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 flood risk information obtained from a desk-based review of available data to identify and quantify the flood risks associated with the development.
- Review the existing hydraulic modelling results to determine flood depths and velocities at the site.
- Incorporate the storage units into the 2017 WHS Taff-Willows model and run for the 100-year plus climate change and 1000-year event to determine 3rd party impacts of development.
- Review the acceptability of consequences as a result of any residual risk to the site.

1.3 Sources of Data

The main data source used to inform this FCA is the 2017 WHS Taff-Willows flood model. The full list and associated footnote references can be found below.

- WHS Willows Taff Model¹
- Technical Advice Note 15²
- NRW Flood Maps³
- Site layout plans⁴

¹ The Willows: Hydraulic Model. WHS1506. Wallingford HydroSolutions Ltd. May 2017.

² Technical Advice Note 15 Development and Flood Risk. Welsh Government. July 2004.

³ Natural Resources Wales (2020) Detailed Map View and Development Advice Map <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en>

⁴ Proposed Storage Units at: The Willows, Abercanaid, Merthyr Tydfil. Louwis Commercial Properties, 2020

2 Site Description

2.1 Location

The site is located in the Abercanaid Industrial Estate, Merthyr Tydfil, South Wales (NGR: 305294, 205004). This site is located on commercial land close to the River Taff and is in an urbanised setting. The wider area has a series of drains and minor water courses running across the industrial area, with general access available from the A4054 roundabout west across the river Taff. A site layout is provided in Figure 2-1.

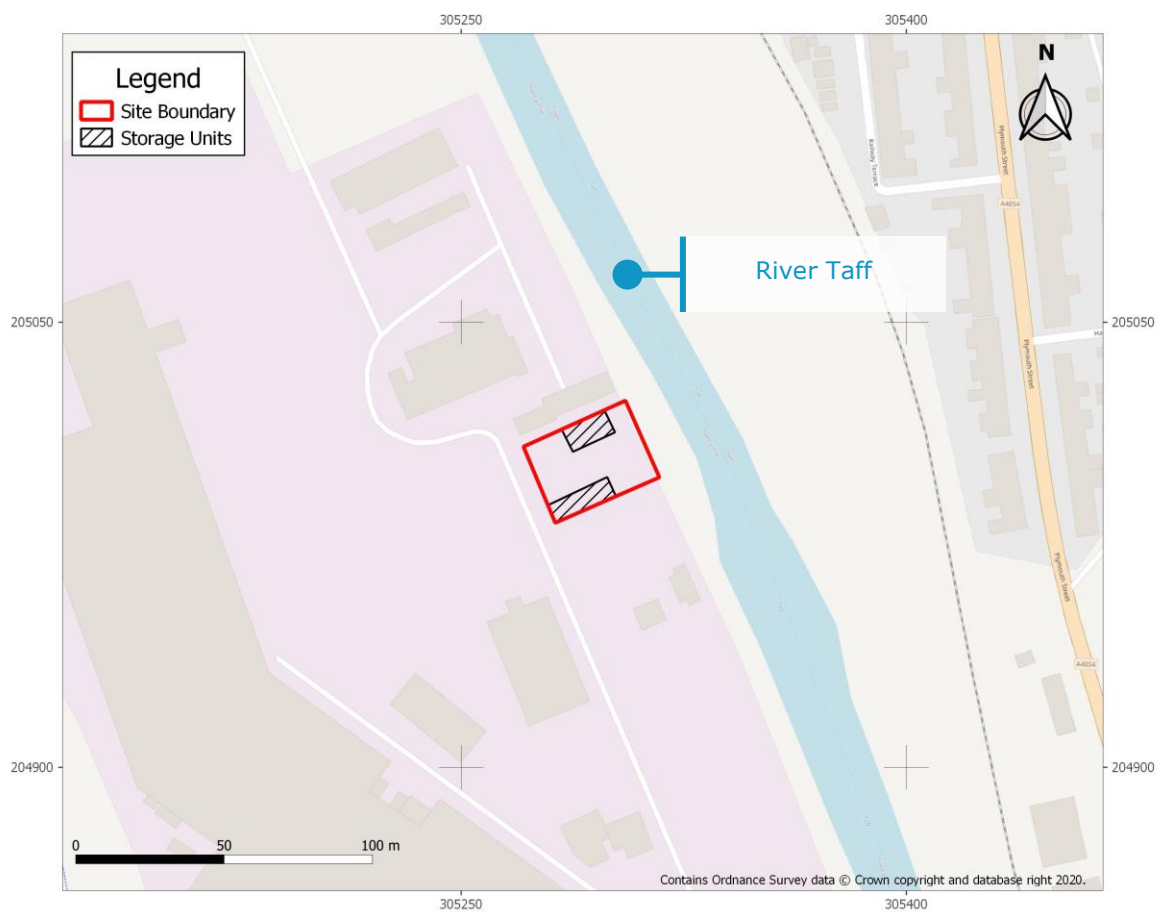


Figure 2-1 - Site Layout

2.2 Topography

The site is located on the valley floor of a south-draining valley typical of the South Wales valleys landscape. Levels across the site range from 158.3mAOD in the middle of the site, to 158.7mAOD in the south west. Approximately 70m to the west of the site, there is an area of depression in the floodplain where an existing industrial site is situated, sitting almost one metre lower than the surrounding land. The topography can be seen in Figure 2-2.

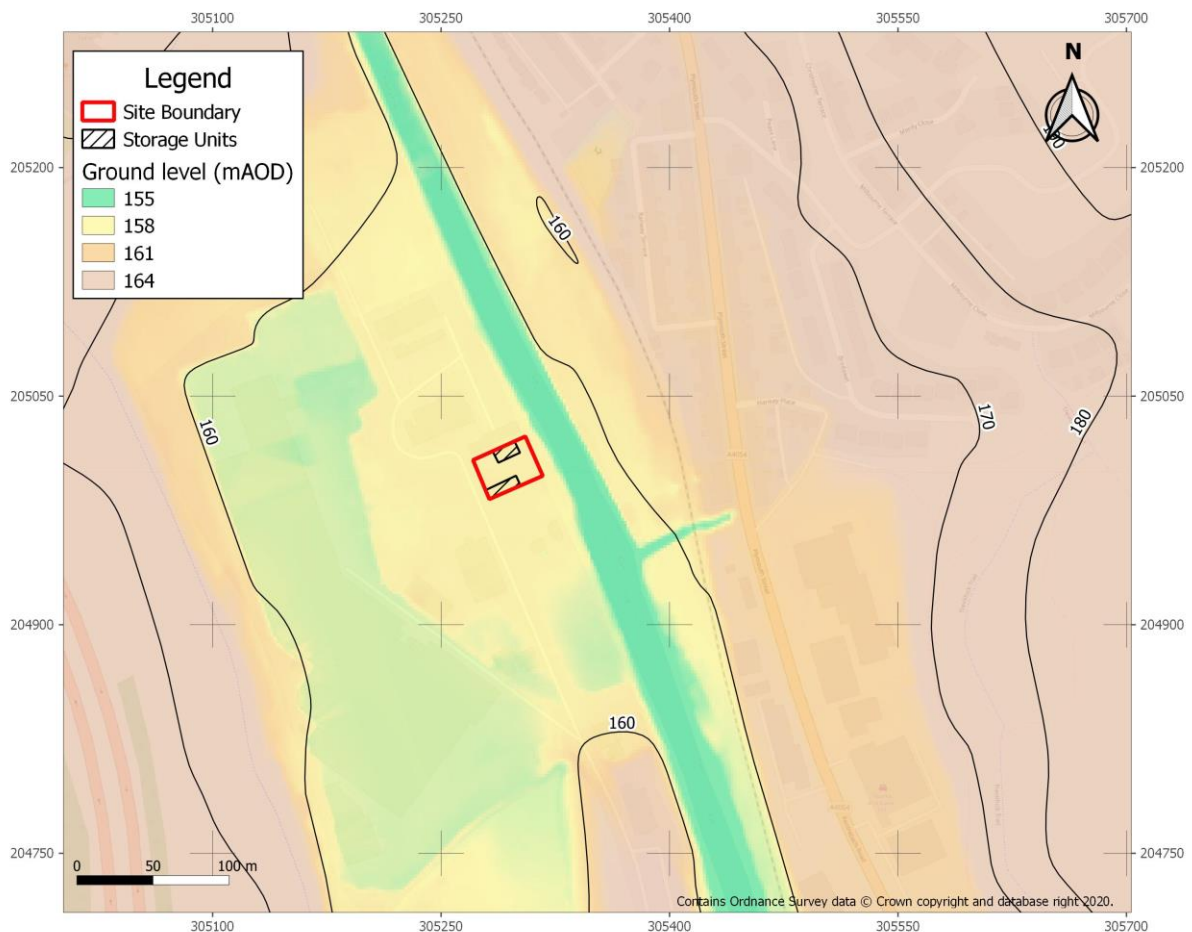


Figure 2-2 - Topography of the wider site

2.3 Proposed Development

The proposed development will comprise of 6 industrial storage units of total footprint area 254m², four of which are placed on the southern boundary of the site and two on the northern. It is proposed that these be rented out for self-storage usage. The site plan is shown in Figure 2-3.

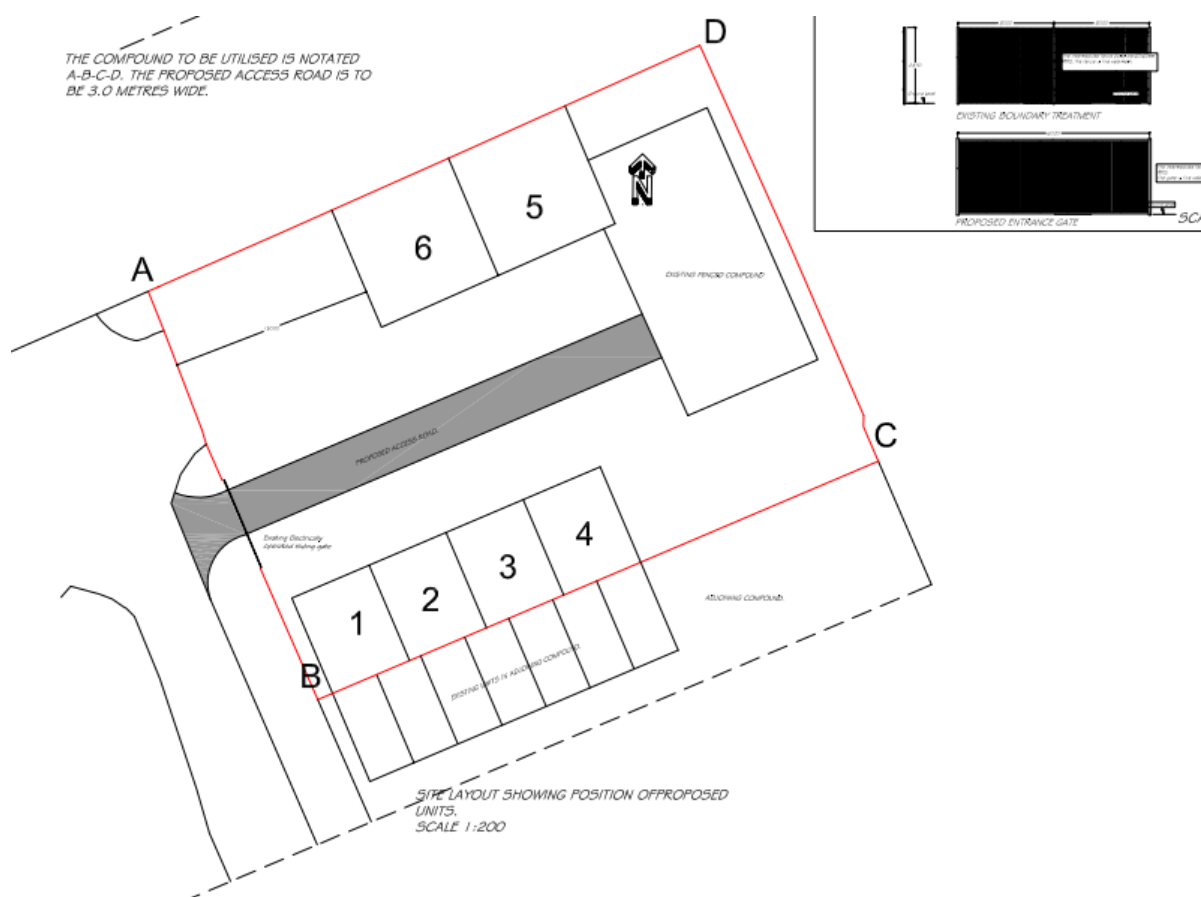


Figure 2-3 Site layout

3 Flood Risk

3.1 NRW Flood Map

The NRW Fluvial Flood Maps, shown in Figure 3-1, are based on coarse scale national mapping. They suggest that the entirety of the proposed development is located in Flood Zone 3, meaning that it would flood in a 1 in 100-year event. The dominant source of flood risk to the site is fluvial risk from the River Taff.

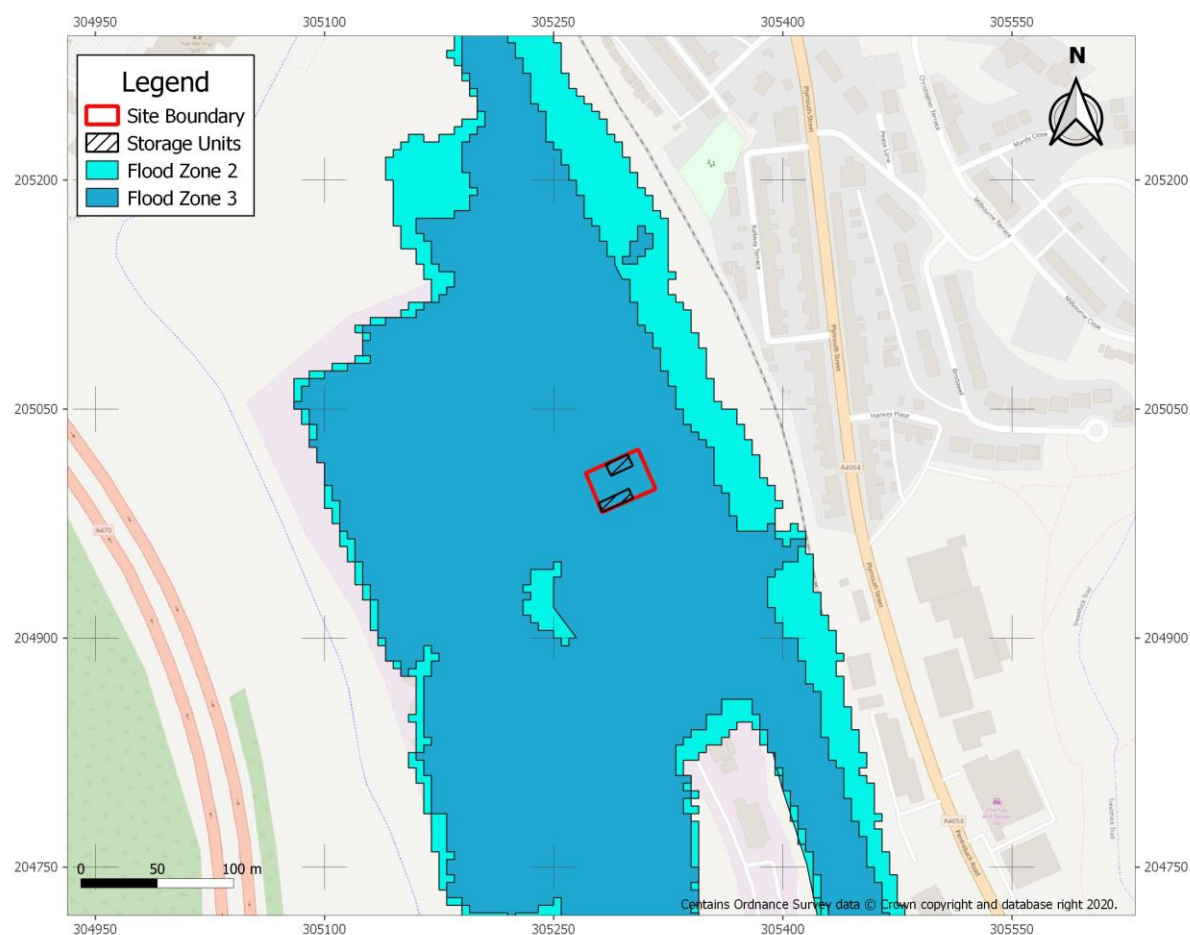


Figure 3-1 - Flood Zone designation of the site from NRW Fluvial Flood Mapping

3.2 DAM Zone Designation

The site lies within Zone C2 according to NRW's DAM, indicating that only less vulnerable development should be considered within the site (not served by significant flood defence infrastructure). The classification is shown in Figure 3-2.

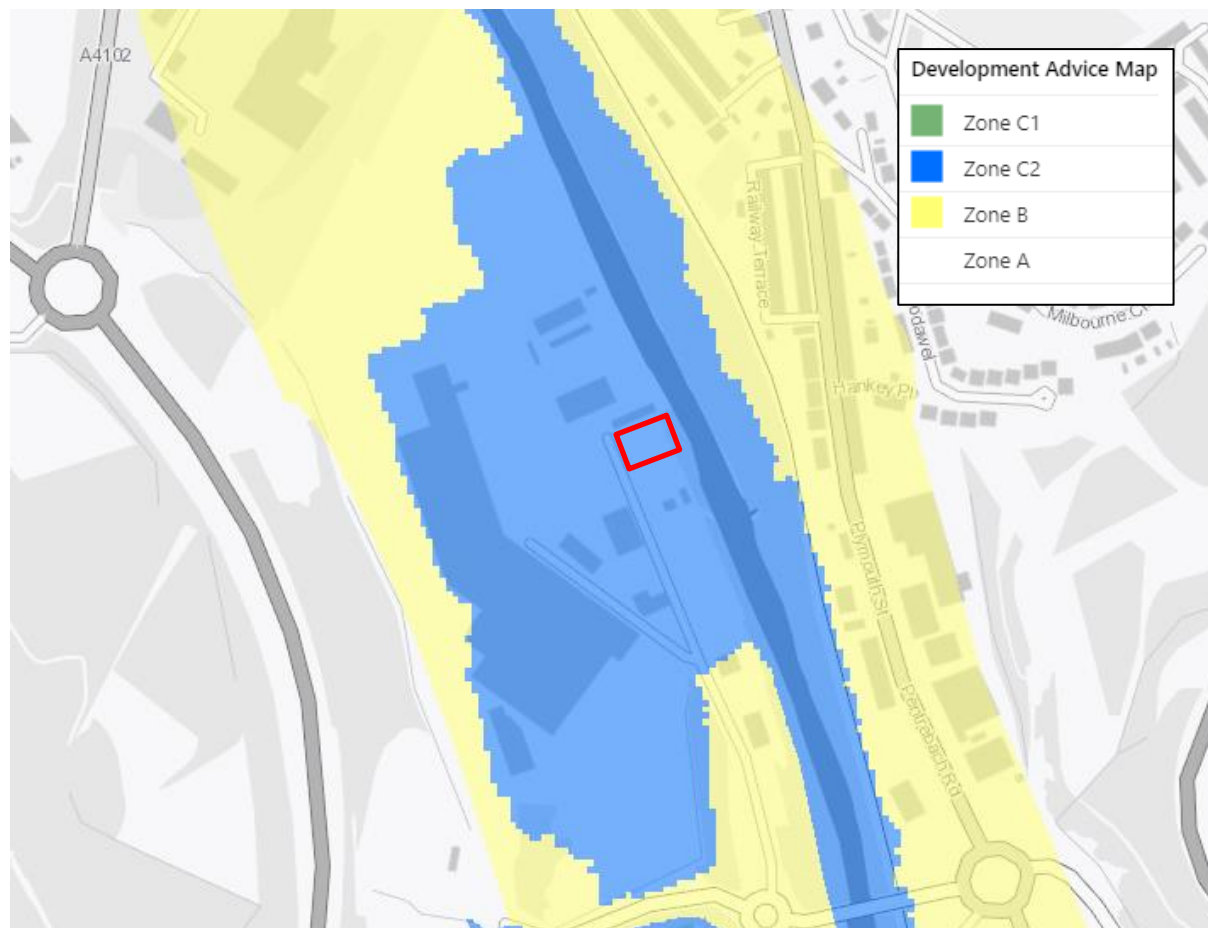


Figure 3-2 - NRW's Development Advice Map's Zone C2 classification

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 and Flood Modeller. 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 100yrCC 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 minor 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 the 2017 Taff-Willows hydraulic model for the River Taff in Merthyr Tydfil is suitable for site specific use⁵. The results from the model have been used to inform

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

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 plus 25% Climate Change Flood Event

As shown in Figure 3-3, there is minor flooding encroaching into the site. Maximum flood depths reach 0.03m along the norther boundary of the proposed development. Velocities reach a maximum of 0.01m/s. A maximum water level for this event is 158.34mAOD, as sampled from the access road.



Figure 3-3 – Model results for the 1-in-100-year +25% Climate Change allowance event

3.3.3 1 in 1000-year Flood Event

The results from the 1-in-1000-year event are presented below in Figure 3-4. Flood depths at the low point within the red line boundary that exists in the centre of the site reach a maximum of 0.15m. More commonly, flood depths are in the region of 0-0.06m. Within the proposed storage unit location, flood depths peak at 0.15m locally, but are mostly below 0.1m, whilst the southern two units (labelled one and two in the Figure 2-3) are not inundated. Velocities peak at 0.26m/s and a maximum flood level for this event is 158.49mAOD.

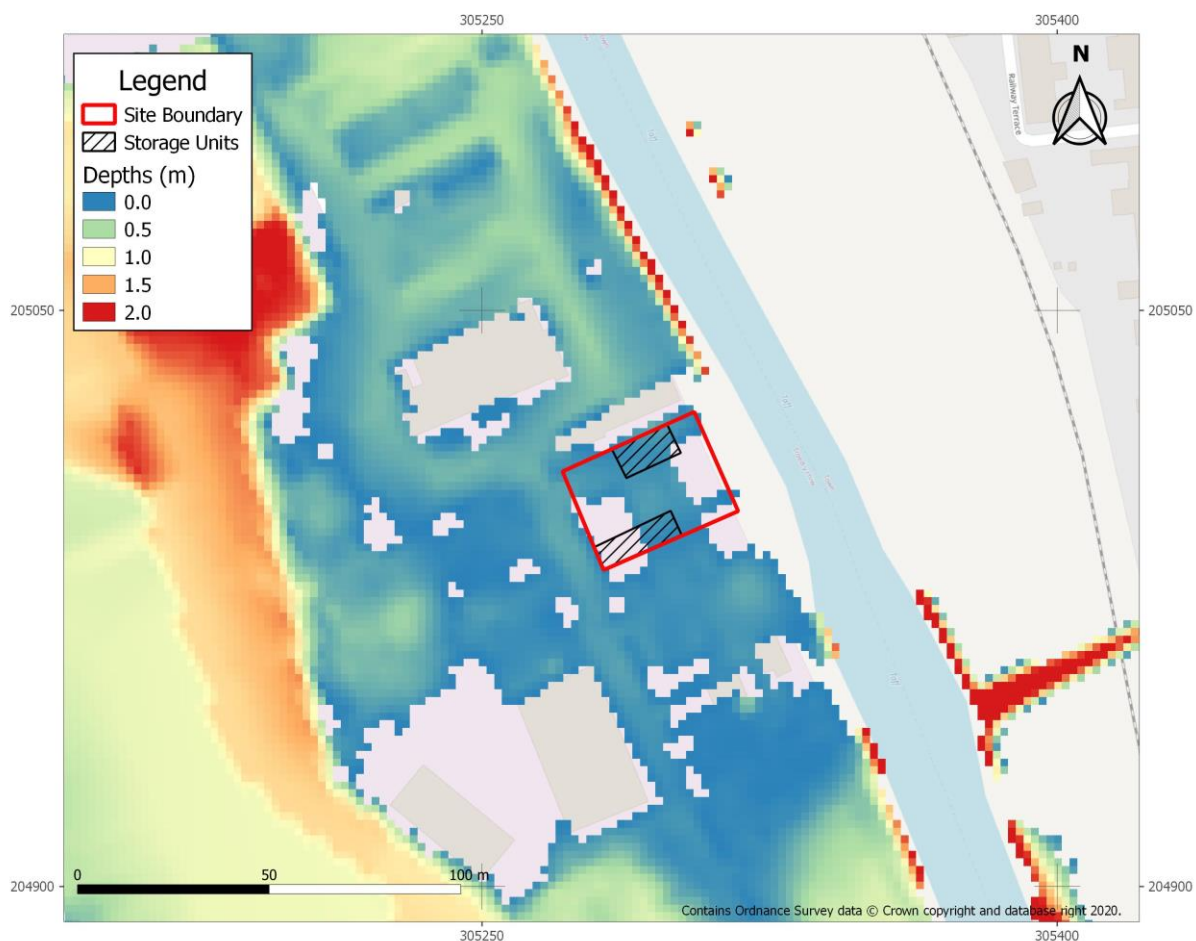


Figure 3-4 - Model results for the 1-in-1000-year event

3.4 Surface Water Flooding

The NRW surface water flood map has been reviewed to identify the risk of pluvial flooding at the site (see Figure 3-5). The site is observed to not be at risk from pluvial flooding. The 1 in 1000yr flood extent lies just outside the site boundary along the access road to the west.

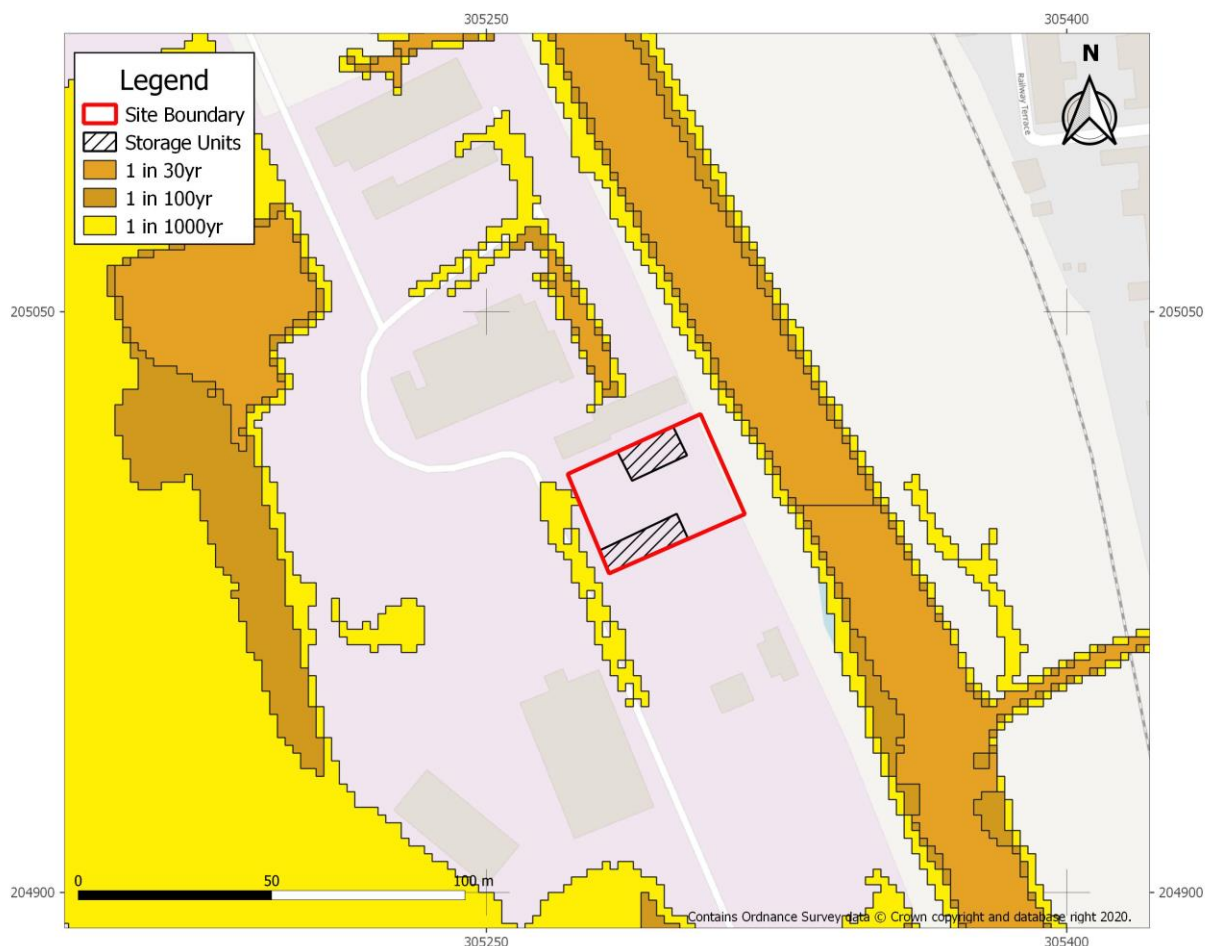


Figure 3-5 - Surface water flood risk

3.5 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 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.

3.6 Groundwater Flooding

A review of Soilscares online mapping service has indicated that the site is situated on freely draining floodplain soils, comprised of sand and gravel and underlain by mudstone, sandstone and siltstone. For these soils it is concluded groundwater flooding is not a risk posed to this site, with the dominant risk being fluvial.

4 Flood Consequence Assessment

This FCA serves to quantify the current level of risk posed with regards to the developments 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 can be classed as "less vulnerable" due to it being industrial storage infrastructure development 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 storage units are built on the pre-established commercial site of the Abercanaid Industrial Estate with the main purpose of storing industrial materials and ensuring operation of the industrial site. This site is located next to adjacent sites to the north and south hosting storage containers and are sites with similar permitted operations.

4.3 3rd Party Flood Impacts

In order to quantify any 3rd party impacts of the development, the eight storage units have been incorporated into the hydraulic model and compared to the baseline model to identify changes in flood risk. The model has been run for both the 1 in 100-year event with 25% climate change and the 1 in 1000-year events. In summary, the results show that changes in flood levels are small and localised, due to the relatively small area compared to the wider floodplain. Please see the following figures showing changes in flood level.

In terms of the modelling, the units have been incorporated as "stubby buildings" as per the buildings in the existing model. This represents the units as a 300mm slab level above existing ground levels, to represent their effects on conveyance and storage and therefore assumes that the units present a complete obstruction to flow. It is proposed that the site is levelled to 158.35mAOD, which is above the 1 in 100-year event with 25% climate change. The impact of this is shown in the mapped results below.

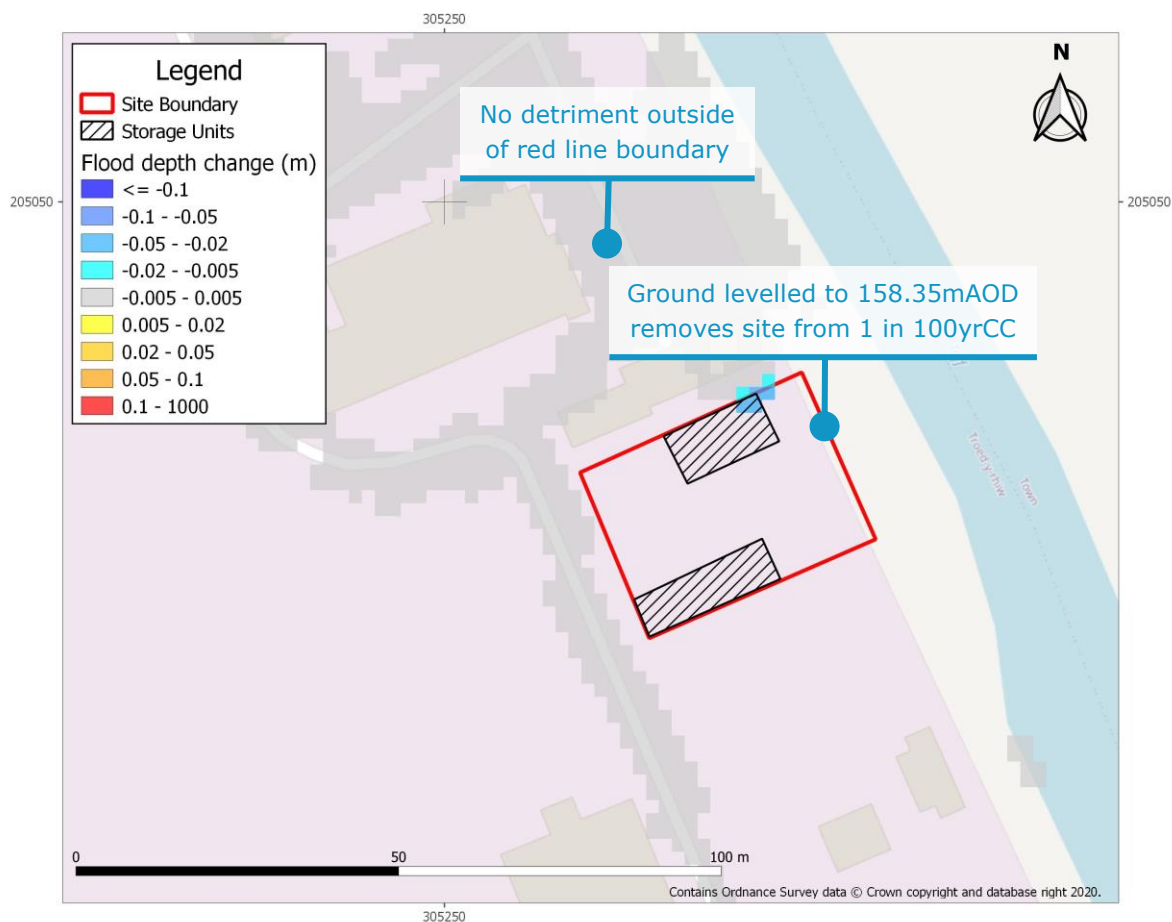


Figure 4-1 - Changes in flood level during the 1 in 100-year event with 25% allowance for climate change

The site boundary has been removed from the extent of the 100yr with climate change event, whilst there are observed to be no detrimental impacts upon flood depths outside of the site boundary as a result of the ground levelling and the raised containers. The small encroachment of the flood extent observed in Figure 4-1 to the north of the site is a result of the resolution of the model (a grid cell straddling the site area) and it is anticipated that once the site is levelled to 158.35mAOD, none of the site will be inundated.

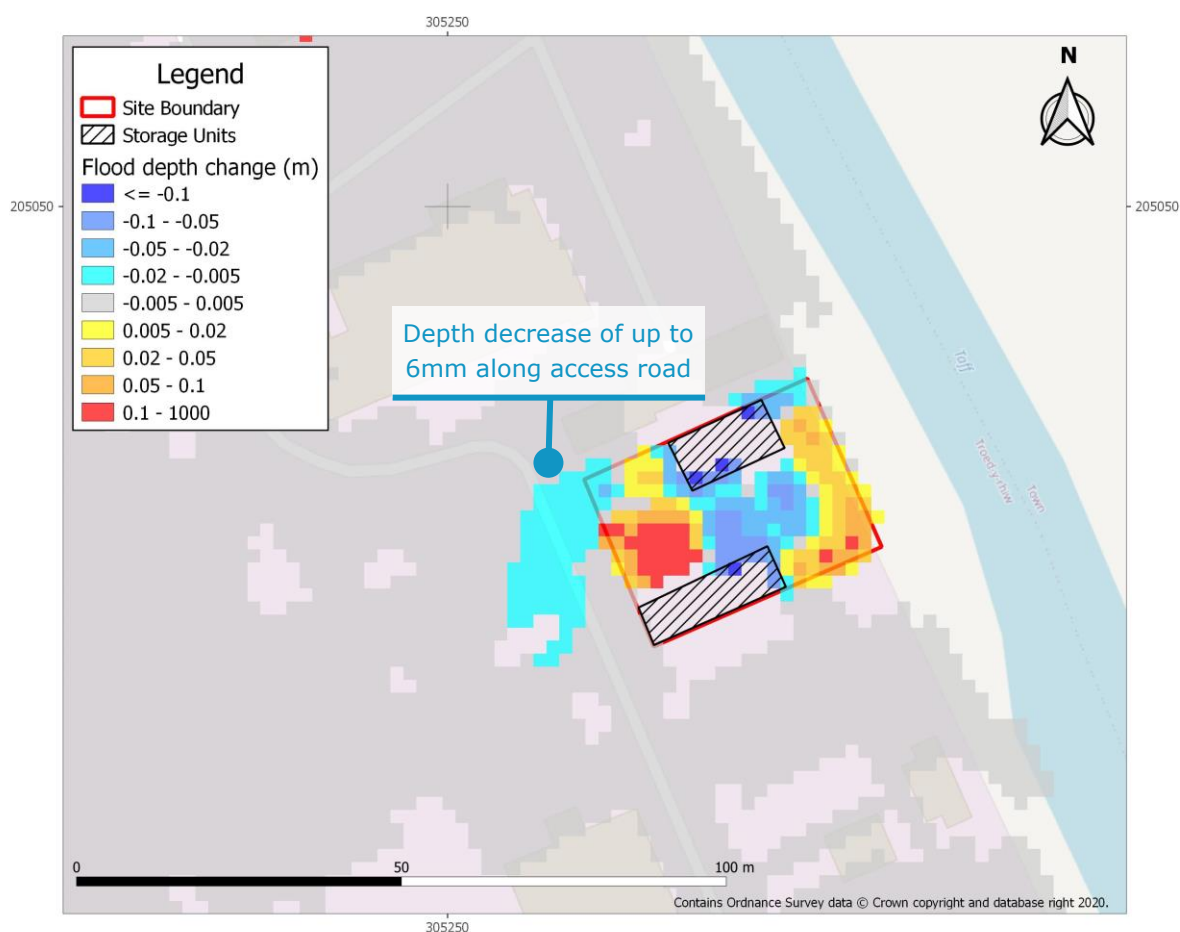


Figure 4-2 - Changes in flood level during the 1 in 1000-year event

The depth changes for the 1000yr event show a small decrease in depths of up to 6mm to the west of the site boundary along the access road- this is likely a result of slightly increased storage within the western portion of the site, as a result of the levelling. Detriment to flood depths is mainly restricted to within the site boundary and are a result of the ground levelling, wherein the areas experiencing an increase in depths relative to the baseline, are a result of the ground level having been lowered, to create a uniform level of 158.35m AOD.

There is predicted detriment along the perimeter of the site boundary, however this is a result of the coarseness of the grid used in the model (4m) and relates to the lowering of the ground level within that grid cell, which is located partially within the site boundary, as illustrated below.

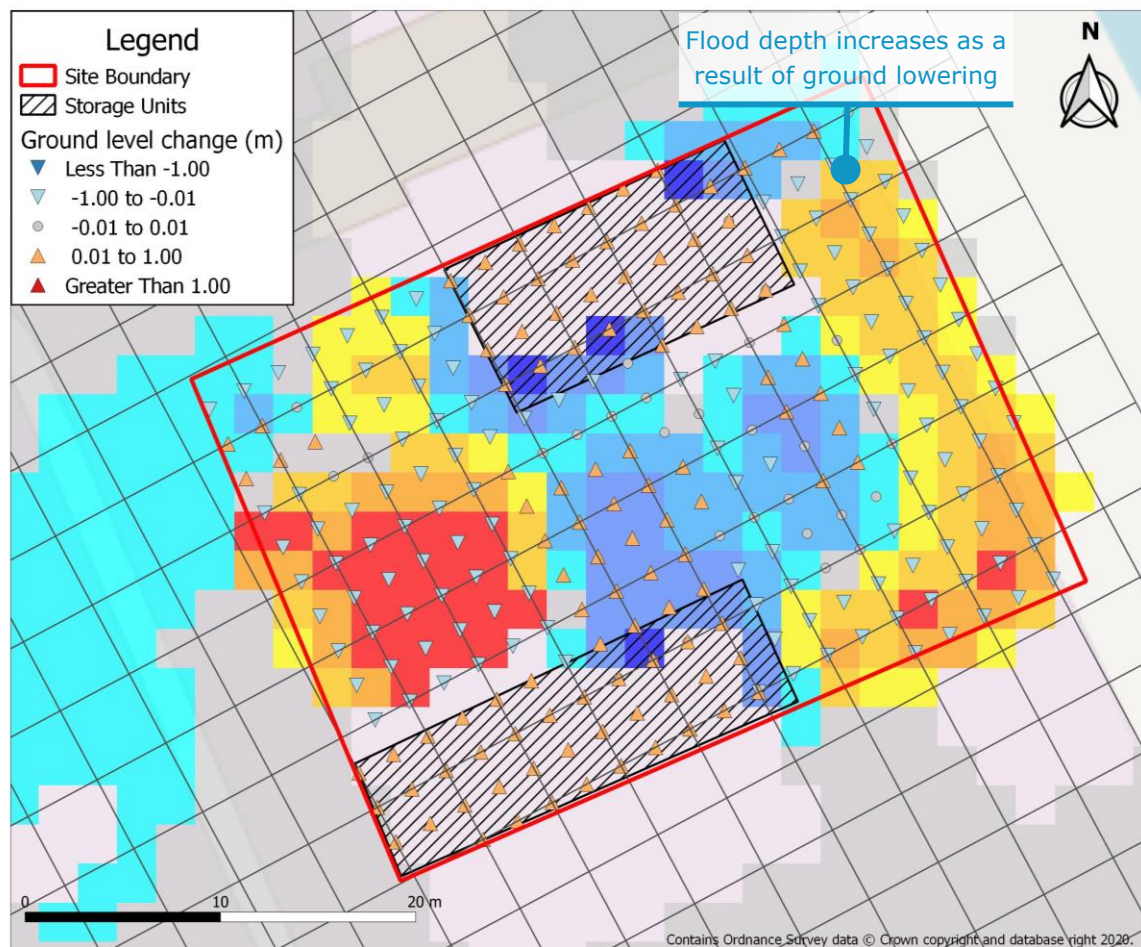


Figure 4-3 Ground level changes to achieve uniform 158.35m AOD level

4.4 Finished Floor Levels

As per the guidance given in TAN15, all development, with exception to emergency services, should be flood free in the 1 in 100-year plus climate change event, also known as “the design event”. A flood level for this event has been provided in Section 3.3.2 as 158.34m AOD. It is therefore recommended that the units are raised above this level to 158.64m AOD, which includes a 300mm freeboard to minimise the consequences of flooding.

4.5 Residual Risk

Beyond the design event, it is expected that development can flood, providing that the risk and consequences are managed to an acceptable level. Table A1.15 in TAN15 provides indicative values of flood depths and velocities for industrial type development that are described as “tolerable” during an extreme event. These, along with the modelled values at the site, are displayed in Table 4-1. Please note that the comparisons are made against the existing ground levels within the site as opposed to the proposed ground level and finished floor levels of the storage units and therefore presents a conservative assessment.

Table 4-1 - Residual Flood Risk

Flood Parameter	TAN15 Guidance Value	Modelled Value (maximum)
Depth (m)	1.00	0.15
Velocity (m/s)	0.30	0.26
Rate of Rise (m/hr)	0.30	0.40
Speed of Onset (hrs)	2.00	6 hours 15 minutes into flood event

As shown above, the site meets the criteria for both flood depths and velocities. The rate of rise is slightly higher than the indicative guidance value due to the flashiness of the catchment, however, it is considered appropriate that this risk be negated by the preparation of an emergency flood plan, whereby personnel should vacate the site following receipt of a flood warning. Flood warnings and alerts are provided by NRW at the site which occupiers should sign up to. Overall, the residual risk is considered acceptable.

4.6 Access and Egress

It is proposed that the minor road to the west of the development be followed in a north to south direction for access and egress to and from the site. This relates to evacuation routes for site personnel or to enable access for emergency services if required. The route progresses southward where a river crossing enables access to the A4054.

The proposed access route is subject to minor flooding in a 1 in 100-year plus climate change event, over a road length of approximately 100m. Here, flood depths peak at 0.08m and a hazard rating of 0.03, which 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 150m length. Here, flood depths peak at 0.30m and hazard ratings are limited to 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 4-4 shows the access/egress route and hazard map for the 1 in 1000yr event.



Figure 4-4 - Access/Egress (1 in 1000yr 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 6 storage units are 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 flood risk has been carried out based on a hydraulic model completed by WHS in 2017, which has been now been run on updated software versions for TuFLOW and Flood Modeller.
 - This shows that the site remains flood free in a 1 in 100-year event, with minor flooding encroaching into the site during a 1 in 100-year with climate change event (the design event).
 - Flood depths peak at 0.15m locally, but are mostly below 0.1m for the 1 in 1000yr event, which inundates the majority of the site.
- It is proposed that the floor levels of the units are set to 158.64mAOD, which includes a 300mm freeboard above the design event flood levels.
- Ground levelling is also proposed across the site, to maintain a consistent level above the 1 in 100-year plus CC event (158.35mAOD), thereby removing the site from this flood extent.
- The residual risk of the development is considered acceptable following a review of the model results and comparing them to Table A1.15 of TAN15.
- The access/egress route is considered safe and operational during the events assessed, including the extreme event.
- For the most extreme 1000yr event, there is betterment to the west of the site, with all detriments restricted to within the site boundary, where depths increase only as a result of localised ground lowering.

Appendix A – NRW Liaison