Cardiff Council – Stage 2 Strategic Flood Consequence Assessment

Final Report

January 2025

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Prepared by	Charlotte Lickman (BSc) Hons PGCert Analyst
Reviewed by	Peter Rook BSc MSc MCIWEM C.WEM FGS Chartered Senior Analyst
Authorised by	George Baker BEng AIEMA CEnv IEng MCIWEM C.WEM Associate Director

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JBA Project Manager	Peter Rook
Address	Kings Chambers, 8 High Street, Newport, NP20 1FQ
JBA Project Code	2023s1700

This report describes work commissioned by Cardiff Council, by an instruction dated 19 December 2023. The Client's representative for the contract was Stuart Williams of Cardiff Council. Peter Rook, Charlotte Lickman and George Williams of JBA Consulting carried out this work.

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The methodology adopted and the sources of information used by JBA in providing its services are outlined in this Report. The work described in this report was undertaken between December 2023 and August 2024 and is based on the information available during the said period. The scope of this Report and the services are accordingly factually limited by these circumstances.

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Executive Summary

Introduction and Context

This Stage 2 Strategic Flood Consequence Assessment (SFCA) document was prepared with the purpose of providing part of the evidence base for the Local Plan. It follows on from the South-East Wales Stage 1 Strategic Flood Consequence Assessment which was produced in November 2022.

This report should be read alongside the South-East Wales Stage 1 SFCA.

The primary purpose of the Stage 2 SFCA is to provide an appropriate understanding of the level of actual risk affecting the development included in the Local Plan Review. The assessment takes into account all sources of flooding and considers other factors affecting flood risk such as residual risk. The information provided as part of the Stage 2 SFCA enables Cardiff Council to apply the Justification Test and Acceptability of Consequences in accordance with TAN-15 and Planning Policy Wales.

SFCA Objectives

Natural Resources Wales provides guidance on the tiered approach to completing SFCA's. The aim of the Stage 2 assessment is to build on identified risks from Stage 1 for proposed development sites, to provide a greater understanding of fluvial, surface water, groundwater, and reservoir related flooding risks to the sites. From this, the Local Council and developers can make more informed decisions and pursue development in an effective and efficient manner. The Stage 2 assessment also identifies sites for further risk analysis at the site-specific Flood Consequence Assessment (FCA) stage.

Stage 2 SFCA outputs

The Stage 2 assessment includes detailed assessments of the proposed site options. These include:

- An assessment of all sources of flooding including fluvial flooding, surface water flooding, groundwater flooding, mapping of the functional floodplain and the potential increase in fluvial and surface water flood risk due to climate change.
- Reporting on conditions of flood defence infrastructure, where applicable.
- An assessment of existing flood warning and emergency planning procedures including an assessment of safe access and egress during an extreme event.
- Advice and recommendations on the likely applicability of sustainable drainage systems for managing surface water runoff.
- Advice on whether the sites are likely to pass the Justification Tests and Acceptability of Consequences in accordance with TAN-15 and Planning Policy Wales.

Summary of the Stage 2 SFCA

Cardiff Council provided 18 sites for further assessment. These sites were screened against flood risk datasets to assess the potential viability and provide flood risk recommendations.

Summary tables were prepared for all of the sites where multiple sources of flood risk were assessed. The summary tables set out the flood risk to the site taking into account the potential benefit and residual risks from flood defences. Maps of extent, depth, and velocity of flooding as well as hazard mapping have been produced where modelled outputs were available. The Flood Map for Planning risk of Flooding from Surface Water and Small Watercourses mapping has also been used as an indication of flood risk for smaller watercourses where detailed modelling does not exist.

Each table sets out the TAN-15 and Planning Policy Wales requirements for the site, as well as guidance for site-specific Flood Consequence Assessments.

1 Introduction

1.1 Study area

Cardiff is one of the main urban areas in Wales and a key area to the industrial history of mining in South Wales. Cardiff County covers approximately 150KM² in the context of this report and has an estimated population of 362,000. A number of key watercourses classified as Main Rivers are present within the district, including the River Taff, River Ely and River Rhymney.

1.2 Project overview

This Stage 2 Strategic Flood Consequence Assessment (SFCA) has been commissioned by Cardiff Council. This SFCA forms part of the evidence base to inform the Council's Local Development Plans (LDP) and informs the development of LDP policies and land allocation decisions. The SFCA has been carried out in accordance with the Welsh Government's development planning guidance, Planning Policy Wales (PPW), Technical Advice Note 15: Development, flooding and coastal erosion (TAN-15) and associated Welsh Government's Chief Planning Officers letters and Welsh Government FCA Climate Change allowances.

This Stage 2 SFCA builds on the work undertaken in the Stage 1 SFCA and assesses actual flood risk at potential site allocations.

1.3 Stages of an SFCA

To provide a robust assessment of the potential flood risk, SFCAs should involve the collection, analysis, and presentation of all the available information from all sources of flood risk in the study area.

Typically, SFCAs are completed in three stages, with an increasing level of detail required in the analysis at each stage. The three stages of SFCAs are summarised below in Figure 1-1.

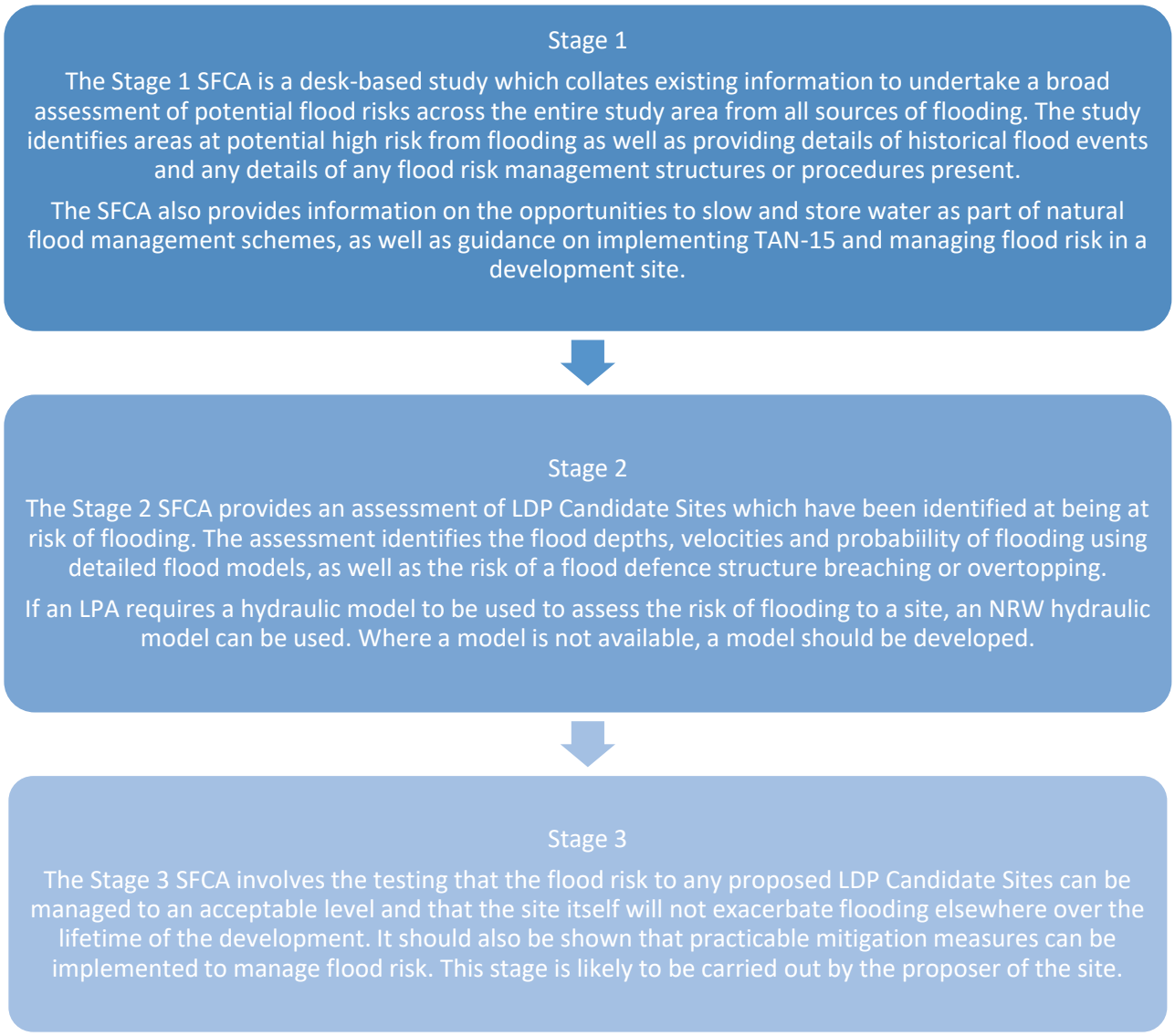


Figure 1-1 Outline of the SFCA process

1.4 Aims of the Stage 2 SFCA

Objectives of this Stage 2 SFCA are to:

- Assess the flood risk to potential development sites using the latest available flood risk data and climate change uplifts where available.
- Provide information and mapping to show flood risk from all sources for each site option.
- Provide recommendations for making the site safe from flooding throughout its lifetime of development in accordance with the Justification Test and Acceptability Criteria as outlined in TAN-15.
- Take into account, as far as practically possible the most recent policy legislation in the Planning Policy Wales, TAN-15, Lead Local Flood Authority (LLFA) and SuDS guidance.

- Provide further assessment of cumulative development impacts on high-risk catchments as indicated in the Stage 1 SFCA.

1.5 Consultation

SFRAs should be prepared in consultation with other Risk Management Authorities (RMAs). The following parties have been consulted during the preparation of this SFCA:

- Cardiff Council
- Natural Resources Wales
- Welsh Government
- Dŵr Cymru Welsh Water

2 Local Policy and Guidance

2.1 Latest Consultation draft of TAN15

Technical Advice Note 15: Development, flooding and coastal erosion (TAN-15) sets out the criteria against which the consequences of a development in an area at risk of flooding can be assessed.

TAN-15 also states that Local Planning Authorities should ensure that development is set back appropriately from flood zones to allow for extreme surface water and small watercourse events.

TAN-15 was introduced in 2004 by the Welsh Government. It is technical guidance related to development planning and flood risk using a sequential characterisation of risk based on the Development Advice Map (DAM). An update to TAN-15, which is supported by the Flood Map for Planning (FMfP), was initially released in September 2021 for implementation from December 2021. However, on the 24th November 2021 Welsh Government suspended the implementation of the new TAN-15. It is not currently known when the new TAN-15 will come into force.

On the direction of the Minister for Climate Change, provided in guidance accompanying the decision notice to delay its implementation, this SFCA has been prepared in accordance with the updated TAN-15 and associated FMfP.

TAN-15 reflects the core principles of the National Strategy for Flood and Coastal Erosion Risk Management in Wales to adopt a risk-based approach in respect of new development in areas at risk of flooding and coastal erosion. TAN-15 comprises technical guidance related to development planning and flood risk and provides a framework within which the flood risks arising from rivers, the sea and surface water, and the risk of coastal erosion can be assessed.

Its initial requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions. An indicative sequence to negotiating the various elements of TAN-15 is provided below in Figure 2-1.

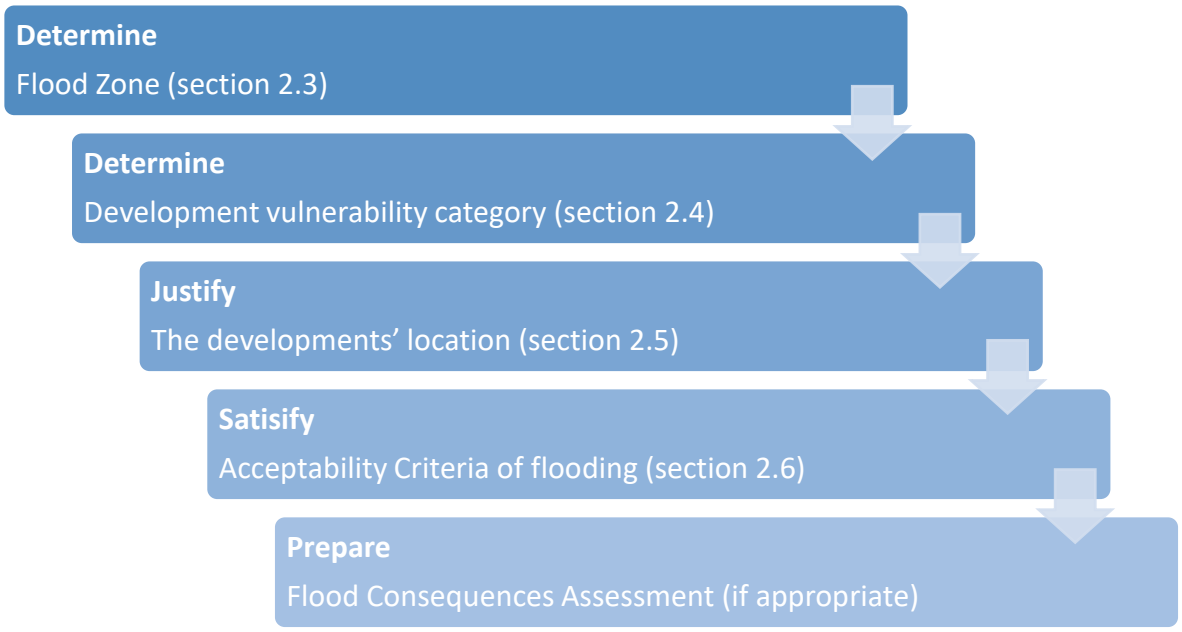


Figure 2-1 Navigating TAN-15 requirements

2.1.1 Flood Map for Planning

TAN-15 defines a number of flood zones based on the likelihood of flooding. Table 2-1 summarises the definition of the flood zones in the Flood Map for Planning (FMfP). The FMfP flood extents are based on the central estimates of climate change, assuming a 100-year lifetime of development.

Table 2-1 TAN-15 Definition of FMfP Flood Zones

Zone	Flooding from Rivers	Flooding from the Sea	Flooding from Surface Water and Small Watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in any given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.

Zone	Flooding from Rivers	Flooding from the Sea	Flooding from Surface Water and Small Watercourses
TAN-15 Defended Zone	Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2.2 Flood and Water Management Act – Schedule 3

The Flood and Water Management Act (FWMA) 2010 aims to improve both flood risk management and the way water resources are managed by creating clearer roles and responsibilities and instilling a risk-based approach.

Schedule 3 of the FWMA (2010) was enacted in January 2019, leading to the requirement for all new developments to incorporate the four pillars of SuDS design, as shown in Figure 2-2. SuDS aim to mimic the natural processes of Greenfield surface water drainage by allowing water to flow along natural flow routes and also aims to reduce the runoff rates and volumes during storm events, whilst providing water treatment benefits.

As part of Schedule 3, the Flood and Water Management Act (2010) established each LLFA as a SuDS Approval Body (SAB). A such, the SAB has responsibility for the approval of proposed drainage systems in new developments and redevelopments. Approval must be given before the developer commences construction, and the SAB are also responsible for adopting and maintaining SuDS which serve more than one property.

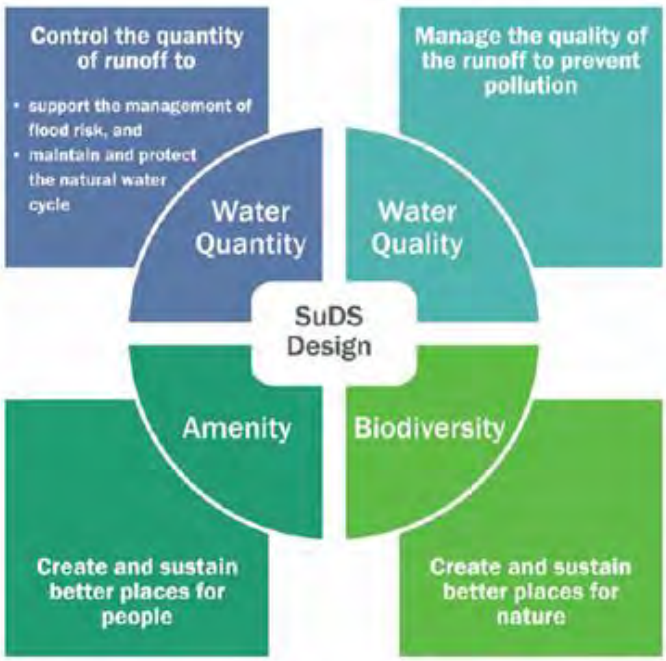


Figure 2-2 Four Pillars of SuDS design (CIRIA 2015)

2.3 Local Flood Risk Management Strategy

The LLFA is required to develop, maintain, apply, and monitor its local strategy for flood risk management in its area. The local strategies will build on information such as national risk assessments and will use consistent risk-based approaches across different Local Authority areas and catchments. The local strategy will not be secondary to the National Strategy; rather it will have distinct objectives to manage local flood risks important to local communities. The Cardiff Council LFRMS was adopted in July 2014[1]. The strategy objectives seek to achieve the following outcomes:

- Ensure a clear understanding of the local risks of flooding and erosion, so that investment in risk management can be prioritised more effectively.
- Set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the residual risk.
- Encourage innovative management of flood and coastal erosion risks, taking account of the needs of communities and the environment.
- Form links between the local flood risk management strategy and local spatial planning.
- Ensure that emergency plans and responses to flood incidents are effective and that communities are able to respond properly to flood warnings.
- Help communities to recover more quickly and effectively after incidents.

1 https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Documents/Flood/Local%20Flood%20Risk%20Management%20Strategy.pdf

3 Flood Risk in Cardiff

3.1 Historic flooding

Cardiff has a history of recorded flood events. Significant flood events within the Cardiff Council area (which have been taken from NRW's recorded flood outlines dataset) have been recorded in the Stage 1 SFCA. An outline of these flood extents is shown below in Figure 3-1. The main sources recorded are fluvial and surface water flooding.

It is important to note that the absence of historic flood records does not mean that an area has never flooded, only that records are not held. For previously undeveloped sites, it is likely that historic flooding incidents may have gone unreported due to a lack of site use or interest. In addition, it is also possible that flooding mechanisms have changed since the date of a recorded flooding incident, making it more or less likely for flooding to occur on site.

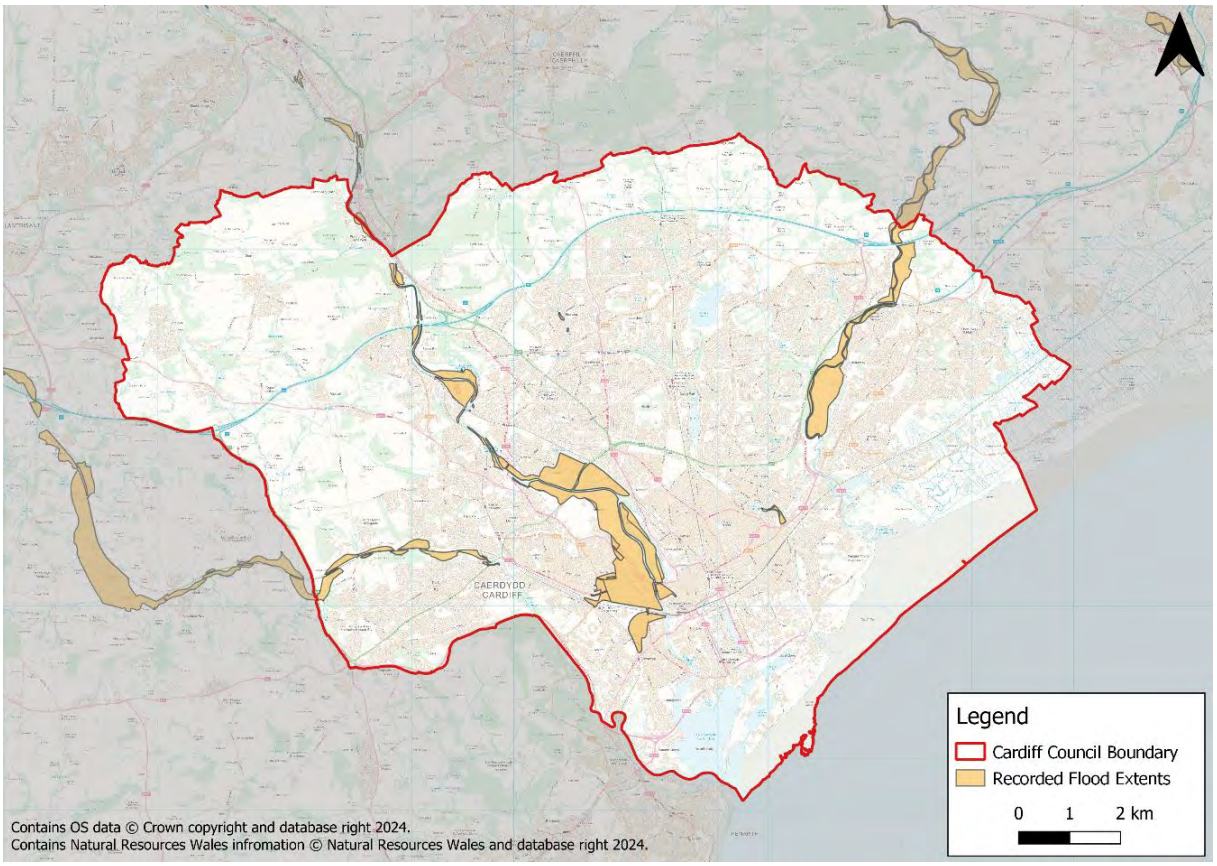


Figure 3-1 FMfP Recorded Flood Extents

3.2 Flooding from Rivers

Fluvial flood risk is notable throughout the district, particularly along the principal watercourses which are the River Ely, River Taff and River Rhymney. These watercourses are all classified as NRW Main Rivers. An overview of fluvial flood risk across the Cardiff Local Authority area is summarised below in Figure 3-2. Sites located within the mapped fluvial extent and therefore at risk of flooding from rivers are:

- Cardiff Central Enterprise Zone
- Former Gas Works, Ferry Road
- Land at Wentloog Avenue
- Porth Teigr and Alexandra Head
- Wholesale Fruit Market, Bessemer Road

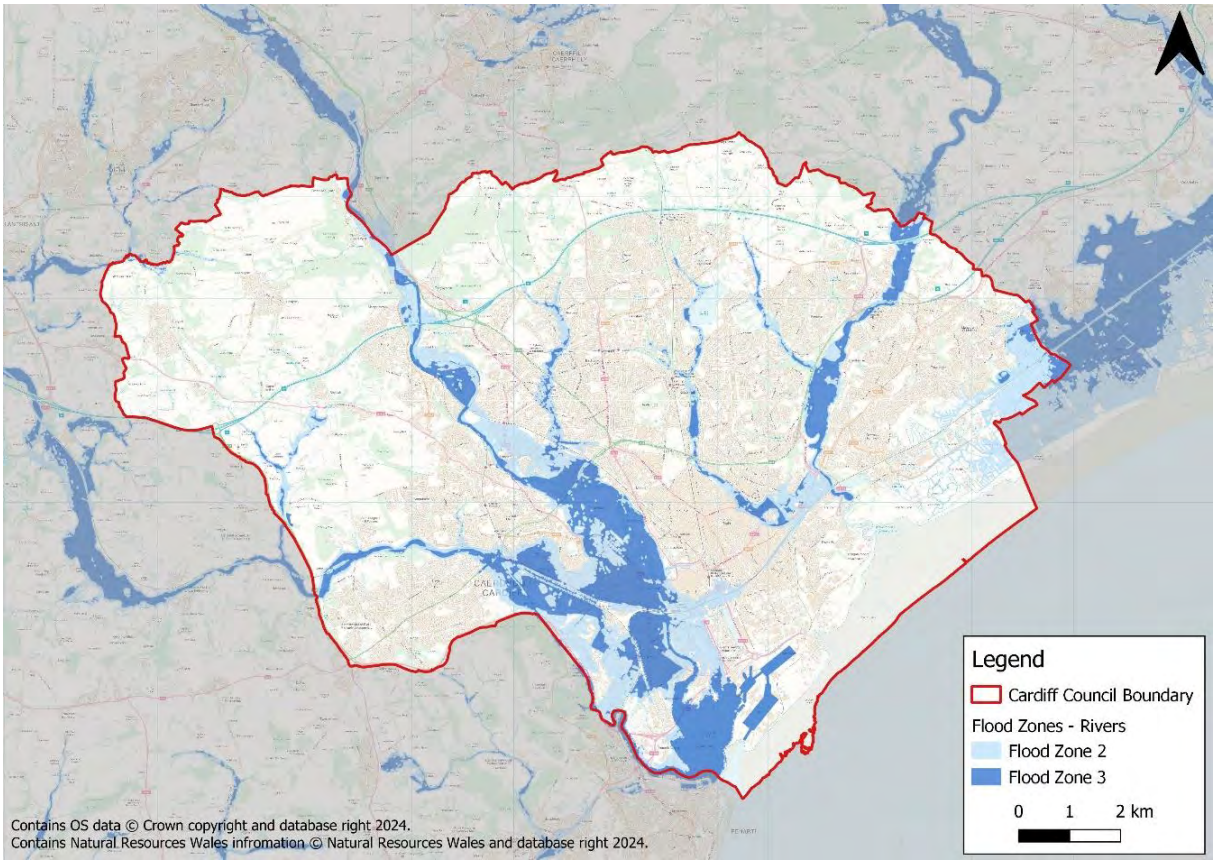


Figure 3-2 FMfP - Rivers

3.2.1 Impact of climate change on fluvial flood risk

Climate change is expected to increase risk of flooding over the coming decades. Welsh Government guidance of climate change for Flood Consequence Assessments[2] sets out climate change allowances to support planning applications and inform development plans. In line with TAN-15, the allowances are informed by latest available information on climate

2 https://www.gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf

change projections. Table 3-1 indicates the anticipated increase in peak river flows for the Severn Basin District, which Cardiff County falls into.

It is recommended that the central estimate for the 2080s is used to assess the potential impact of climate change as part of an FCA. For a precautionary approach, the upper end estimate should be used to inform mitigation measures to help ensure the long-term resilience of a development.

Table 3-1 Peak river flow allowances for Severn basin district

	Total potential change anticipated by the 2020s	Total potential change anticipated by the 2050s	Total potential change anticipated by the 2080s
Upper end estimate	25%	40%	70%
Central estimate	10%	20%	25%
Lower end estimate	0%	5%	5%

3.3 Flooding from the Sea

An overview of tidal risk within the Cardiff Local Authority area, based on the Flood Map for Planning is shown in Figure 3-3. Just more than half of the sites considered in this Stage 2 SFCA are located within the tidal extent and are therefore at risk of flooding from the sea. This includes:

- 9-12 St Mellons
- Bute East Dock
- Cardiff Central Enterprise Zone
- Former Gas Works, ferry Road
- Image House, East Tyndall Street (2 sites)
- Land at Rover Way, Pengam green (Business and Industrial)
- Land at Wentloog Avenue
- Porth Teigr and Alexandra Head
- Proposed Gypsy / Traveller Site, Pengam Green.
- Wholesale Fruit Market, Bessemer Road

Risk of tidal flooding in these areas are also potentially from a combination of fluvial, coastal, and groundwater sources, along with existing drainage ditches.

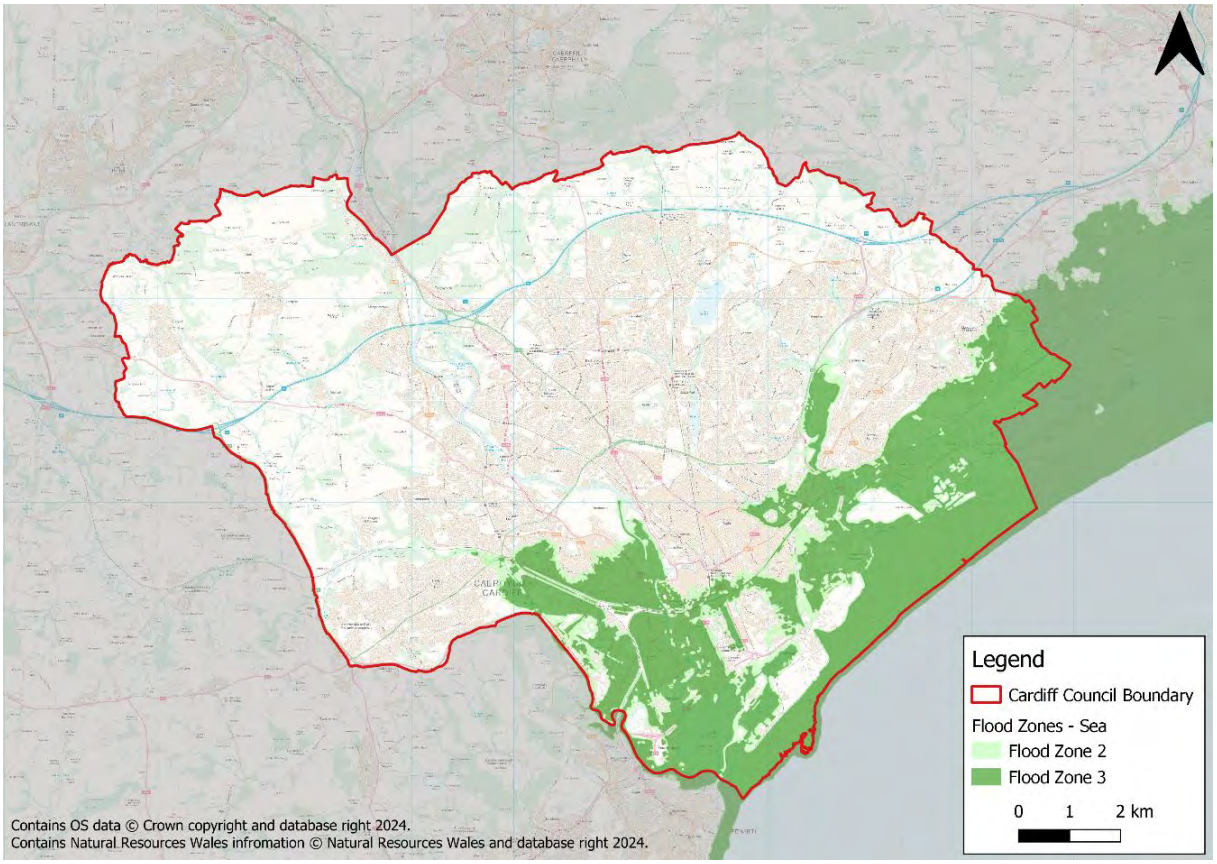


Figure 3-3 FMfP - Sea

3.3.1 Impact of climate change on tidal flood risk

Welsh Government guidance has been updated to reflect an increase in global mean surface temperature. Table 3-2 sets out estimates of cumulative sea level rise for Cardiff County to 2100 and 2120 (to reflect the 100-year lifetime of development for residential development). The allowances are derived using the UKCP18 2100 dataset.

As a minimum, development proposals should be assessed against the 70th percentile; however, an assessment against the 95th percentile should also be made to inform mitigation measures, access and egress routes and emergency evacuation plans.

Table 3-2 Estimated mean sea level rise for Cardiff Local Authority area

Cardiff Local Authority Area	Mean sea level rise (metres) by 2100	Mean sea level rise (metres) by 2120
70th Percentile	0.85	1.01
95th Percentile	1.11	1.33

3.4 Detailed Hydraulic Modelling

3.4.1 Cardiff VDM Model

The original Natural Resources Wales's (NRW's) Cardiff VDM hydraulic model was developed by Mott MacDonald in 2013. The original Mott MacDonald model is referred to as version v2.2. Subsequently, the model was further updated by Mott MacDonald in 2016 to extend the model domain so that new climate change allowances did not exceed the existing model extents. This version of the model is referred to as v2.3.

In 2019, JBA received the Cardiff VDM models (v2.2 and v2.3) from NRW and updated the River Ely hydrology using the Flood Estimation Handbook (FEH) Statistical method as QMED was based on local data. For flows above the 1% AEP event, the ratio from ReFH2 was applied. Additionally, 13 new cross-sections covering approximately 750m of the River Ely downstream of the A48 road bridge were added to the model based on survey data collected in 2019. This model was reviewed and accepted by NRW as part of the Lansdowne Hospital Development FCA (Planning Application REF: 21/02054/MJR) in 2020 and has subsequently supported several other successful FCAs across Cardiff. As such the JBA flood modelling of Cardiff is considered to represent the best available information to support this assessment.

3.4.2 Lower Taff Fluvial Model

Detailed fluvial flood risk modelling data for Cardiff has been used to inform a more detailed assessment of fluvial flood risk. This data is taken from the recently updates Lower Taff Model (2022). NRW have reviewed and accepted the model update completed by Arup in June 2022. Updates to the hydraulic modelling assessment of flood risk on the lower reaches of the River Taff were made following extensive flooding in February 2020. The model update also utilises the hydrological modelling exercise conducted by JBA Consulting in 2019.

Key updates are highlighted below:

- New topographical surveys.
- Modelling the whole reach from Pontypridd to Western venue Cardiff in a single unified model.
- Calibration and verification of the model across a wide range of conditions (in particular data collected from Storm Dennis, February 2020).
- Integration of recent LiDAR and new floodplain and defence survey data.

For the climate change scenario, the Lower Taff study applied a 25% uplift to all model inflows in line with the central estimate guidance for climate change allowances after 2100.

The Lower Taff model was reviewed and approved by NRW in 2022 and uses the best available data for modelling in the Lower Taff catchment.

3.4.3 NRW Wentlooge Tidal Model

The NRW Wentlooge tidal model was developed in 2016 and extends from the River Rhymney estuary in Cardiff to the River Usk estuary in Newport. This model has recently been updated by JBA, applying the new Coastal Flood Boundary (CFB) dataset, released in 2019. For this study, extreme sea level estimates were taken from Node 396 (River Usk) and 408 (River Rhymney) and applied across the tidal boundary of the model. Wave overtopping values have not been recalculated since the 2016 version, and therefore remain precautionary.

For all coastal locations, future sea level rise is a major consideration and should be applied to the extreme sea level estimates. The UKCP18 User Interface has therefore been used by Welsh Government Guidance on Climate Change Allowances for Planning Purposes (September 2021) to provide climate change uplifts for the study area. The predicted tidal flood levels, including the impacts of climate change, which were applied to the updated Wentlooge model are shown in Table 3-3.

The Wentlooge model results for the present day (2022) and for 100 years (2122) have therefore been used to assess the flood risk at the site.

Table 3-3 Predicted tidal flood levels

	Modelled Tide Levels (mAOD)			
Year	2022		2122	
AEP	0.5%	0.1%	0.5%	0.1%
CFB_396	8.36	8.7	9.38	9.72
CFB_4080	7.94	8.3	8.96	9.32

3.4.4 East Tyndall Tidal Model

A detailed tidal flood model for Cardiff and the River Rhymney was developed by JBA Consulting in 2020 and updated in 2022. The updated model was used to simulate results for a 100-year lifetime of development, to the year 2122. Furthermore, the model simulated the risk of flooding both with and without the Cardiff Coastal Flood Defence Scheme. For this assessment, only the defended scenario with the new defences has been used as it would be anticipated that the construction of the Cardiff Coastal Defences shall be progressed in 2024.

3.4.5 Generalised mapping

In places where no detailed modelling is available, flood zones are based of national scale generalised mapping prepared by NRW and has been incorporated into the Flood Map for Planning. This is the ‘best available data’ at the time of writing, although may not provide a comprehensive understanding of flood risk. As a result, detailed hydraulic modelling work may be required to inform development at certain locations, where appropriate.

3.5 Surface Water flooding

The Flood Map for Planning – Risk from Surface Water and Small Watercourses shows potential extent of flooding for the 100-year, and 1000-year rainfall events, including an allowance for climate change. Am overview of this mapping for the Cardiff Local Authority area is shown in Figure 3-4. The mapping uses generalised assumptions on the performance of local drainage systems.

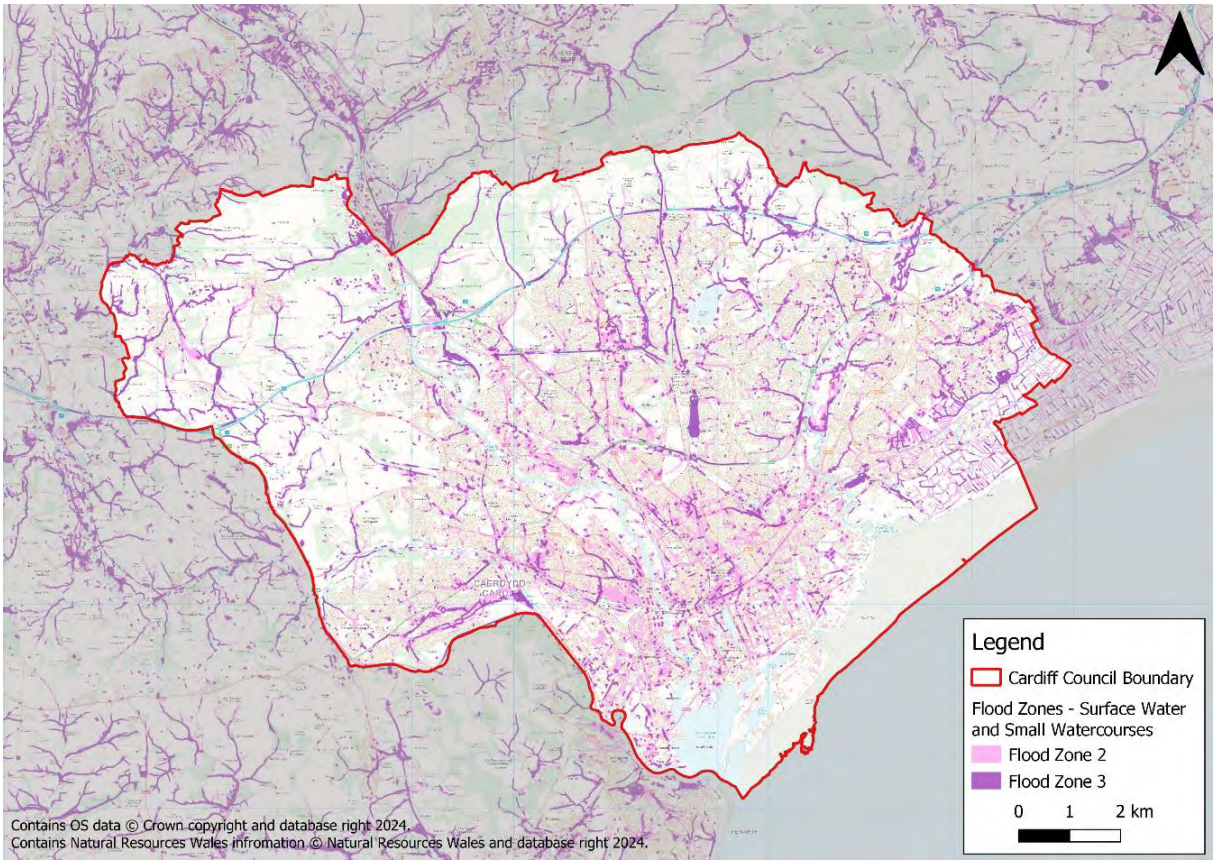


Figure 3-4 FMfP - Surface Water and Small Watercourses

3.5.1 Impact of climate change on flood risk from surface water and small watercourses

Climate change is predicted to result in wetter winters and increased summer storm intensity in the future. This increased rainfall intensity will affect land and urban drainage systems, resulting in surface water flooding, due to the increased volume of water entering the system.

Anticipated changes in peak rainfall intensity for small catchments (less than 5km²) is shown in Table 3-4, which is extracted from the Welsh Government guidance. Both the central and upper estimates should be assessed to understand the range of impact, and as a minimum, development proposals should be assessed against the central estimate to inform design levels. Where assessment indicates a significant flood risk for the upper estimate, the FCA will need to indicate mitigation measures required to protect people and property.

For river catchments over 5km², the peak flow ranges in section 3.2 should be used.

Table 3-4 Peak rainfall intensity (for small catchments only)

	Total potential change anticipated for 2020s (2015-2039)	Total potential change anticipated for 2050s (2040-2069)	Total potential change anticipated for 2080s (2070-2115)
Upper estimate	10%	20%	40%
Central estimate	5%	10%	20%

3.6 Groundwater flooding

Risk of flooding from groundwater is most prevalent in areas near to the River Taff in the west of the catchment, and also within the predominantly residential and urban area which encompasses Roath, Splott, Adamsdown and part of Cardiff City Centre.

The bedrock of Cardiff is predominantly comprised of Mudstone. Mudstone typically has a low porosity and permeability; however, this is dependent on grain size percentages and level of compaction. Superficial deposits overlaying bedrock in the Cardiff Council area are comprised of a mixture of clay, sand, and gravel. The variation of superficial deposits suggests that groundwater flooding could present a localised risk to some areas.

JBA has developed a range of Groundwater Flood Map products at the national scale. The 5m resolution JBA Groundwater map has been used within this SFCA and is displayed in Figure 3-5. The modelling involves simulating groundwater levels for a 100-year rainfall event. Groundwater levels are then compared to ground surface levels to determine the head difference in metres. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 100-year model outputs. these are outlined in Table 3-5.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property, in high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding.

Table 3-5 JBA Groundwater flood risk map categories

Flood depth range during 1% AEP flood event	Groundwater flood risk
Groundwater levels are either at or very near (within 0.025m of) the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
Groundwater levels ate between 0.025m and 0.5m below the ground surface.	Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
Groundwater levels are between 0.5m and 5m below the ground surface.	There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.
Groundwater levels are at least 5m below the ground surface.	Flooding from groundwater is not likely.
No risk.	This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

Candidate sites that have a possibility of being at risk from groundwater flooding include:

- Cardiff Central Enterprise Zone
- Image House, East Tyndall Street (2 sites)
- Land at Cwm Farm, Morganstown
- Land off Forest Road, Tongwynlais

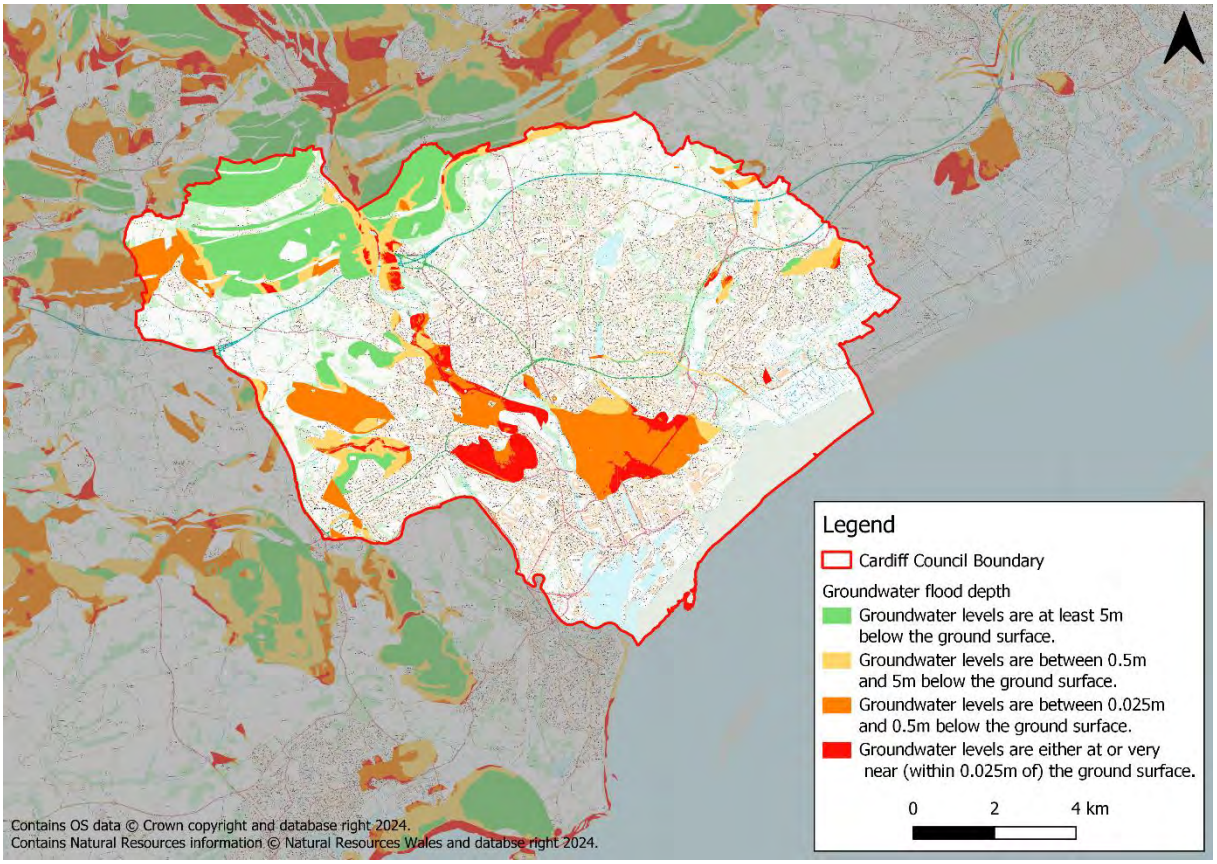


Figure 3-5 Flood Risk from Groundwater

3.6.1 Impact of climate change on groundwater flooding

The impact of climate change is more uncertain for groundwater flooding associated with rivers and land catchments and those watercourses where groundwater has a large influence on winter flood flows. Changes in frequency and intensity of groundwater flooding due to climate change would depend on the flooding mechanism and geological characteristics.

Milder, wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months.

In the coastal floodplain it is possible that the rise in mean sea level could affect the influence of groundwater and affect the capability of watercourse and drainage systems. In circumstances where such effects could be material over the lifetime of development, more detailed assessment should be performed to identify and address any matters that could affect the proposed development.

3.7 Reservoir flooding

The risk of inundation as a result of reservoir breach or failure has been identified using the Flood Map for Planning – Flood Risk from Reservoirs extent dataset. An overview of this mapping for the Cardiff Local Authority area is shown in Figure 3-6. The failure of a reservoir can cause catastrophic damage due to the sudden release of large volumes of water. Reservoirs in the UK have an excellent safety record, and NRW is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected, and essential safety work is carried out. These reservoirs, therefore present a minimal risk.

Sites shown to be within the mapped extent of reservoir flood risk are:

- Bute East Dock
- Cardiff Central Enterprise Zone
- Former gas Works, Ferry Road
- Image House
- Porth Teigr and Alexandra House
- Wholesale Fruit Market, Bessemer Road

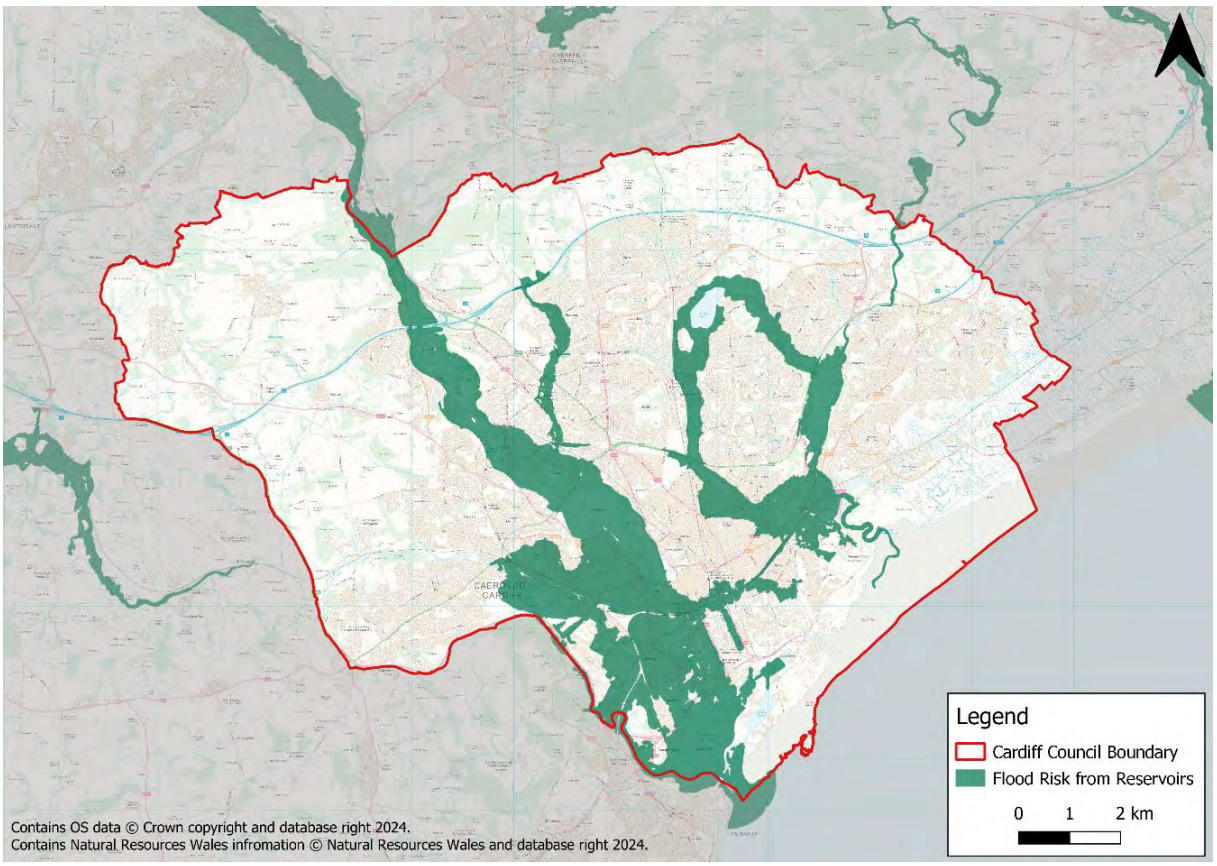


Figure 3-6 FMfP - Reservoir flood risk

3.8 Sewer flooding

Flooding from sewers occurs when rainfall exceeds the capacity of networks or when there is infrastructure failure. This includes combined and surface water sewers, sewer pumping stations and water treatment facilities. The impact of sewer flooding is usually confined to relatively small, localised areas. However, flooding associated with blockage or failure of the sewer network can be rapid and unpredictable. DCWW is responsible for sewer infrastructure across the study area and recording sewer flooding incidents.

3.8.1 Impact of climate change on sewer flooding

Climate change is likely to result in an increase in sewer flooding incidents as a result of its interaction with other flood risk sources. Where sewer flooding is known to be an issue, this should be considered at the planning application stage. The LLFA and DCWW should be consulted to provide specific advice on any known history of sewer flooding and any remedial action taken.

3.9 Residual risk

The existence of robust flood defences does not mean development should be allowed without further consideration of flood risks. Flood defences reduce the risk of flooding but do not eliminate it. The consequences of flooding can be particularly severe in the event of defences being overtopped or breached, resulting in rapid and hazardous flooding. Furthermore, hydraulic structures such as bridges and culverts can block, and pumps sluices, and flaps can fail to operate.

Where appropriate, a Flood Consequences Assessment (FCA) should demonstrate that in the event of overtopping, breach, or blockage, the consequences of flooding can be managed to an acceptable level. This will be needed for sites that benefit from the type of defences that can be breached or blocked, including flood embankments, sea walls and culverts. NRW and/or the LLFA should be consulted at an early stage to discuss the requirement for residual risk assessment, technical assumptions and the application to the acceptability criteria.

4 Stage 2 Site Appraisals

4.1 Candidate Site Appraisals

When allocating land for development, consideration should be given to the potential cumulative impact of the loss of floodplain storage volume and potential effects of increased volumes of runoff from proposed development. Whilst the loss of storage or potential increase in flow volume for individual developments may only have minimal impact on flood risk, the cumulative effect of multiple developments may be more severe.

Future development sites within the study area were provided by Cardiff Council. Predicted flood risk was assessed in the Stage 1 SFCA using a variety of datasets. Site summary tables are included for the 18 candidate sites in Appendix A, including recommendations for further evaluation and management of flood risk at each of the sites.

Notwithstanding the recommendations of this Stage 2 SFCA, site-specific assessments will need to be undertaken in accordance with the latest policy, guidance and flood risk, defence information and information in the SFCA.

Table 4-1: List of candidate site appraisals

Site name	Development proposals	Development type	Available modelling
Velindre Station	Proposed new metro station adjacent to forthcoming cancer centre site	new development	Flood Map for Planning/ National Flood Hazard Mapping
Velindre Cancer Centre	Residential and ancillary mixed uses	redevelopment	Flood Map for Planning/ National Flood Hazard Mapping
Land at Cwm Farm	Residential	new development	Flood Map for Planning/ National Flood Hazard Mapping
Land at Llwynioli Farm	Mixed use	redevelopment/new development	Flood Map for Planning/ National Flood Hazard Mapping
Land off Forest Road	Residential	new development	Flood Map for Planning/ National Flood Hazard Mapping
The Manor, Druidstone Road	Residential	redevelopment	Flood Map for Planning/ National Flood Hazard Mapping
Allied Bakeries	Mixed use (housing/ commercial)	redevelopment	Flood Map for Planning/ National Flood Hazard Mapping

Site name	Development proposals	Development type	Available modelling
Dwryln Cottage	Residential (single dwelling)	redevelopment	Flood Map for Planning/ National Flood Hazard Mapping
Land at Rover Way (business and industrial)	Business (use class B1), General Industrial (use class B2) & Storage & Distribution (use class B8)	new development	East Tyndall modelling
Bute East Dock	Mixed use development	water compatible	Flood Map for Planning/ National Flood Hazard Mapping
Image House, East Tyndall Street	Residential (affordable housing)	redevelopment	East Tyndall modelling
Proposed Gypsy / Traveller Site, Pengam Green	Gypsy and Traveller site	new development	East Tyndall modelling
Land at Areas 9-12 St Mellons (Housing)	Residential	new development	Wentlooge Model
Cardiff Central Enterprise Zone	Residential	redevelopment	Ferry Road modelling
Wholesale Fruit Market, Bessemer Road	Residential	redevelopment	Ferry Road modelling
Former Gas Works, Ferry Road (Housing)	Residential	redevelopment	Ferry Road modelling
Porth Teigr and Alexandra Head	Mixed use - Retail & Food & Drink, Business, Hotel, Residential, Assembly and Leisure, Car Parking and transport infrastructure	redevelopment	Ferry Road modelling
Land at Wentloog Avenue	Employment land (B1, B2 and B8)	new development	Wentlooge Model

5 Summary

This Stage 2 SFCA delivers site specific guidance and recommendations for a number of sites within the Cardiff Council authority area. It should be read in conjunction with the Stage 1 SFCA which delivers a strategic assessment of all sources of flooding in the area.

Recommendations from this report should be considered in addition to recommendations from the Stage 1 SFCA. Recommendations in the Stage 1 SFCA were made regarding (but not limited to):

- Locating new development according to the Justification Test and Acceptability of Consequences as outlined in TAN-15.
- Where there is an unknown risk from an ordinary watercourse, risk should be adequately assessed. This could include modelling the watercourse should the potential risk be found to be high.
- Ensure development has safe, dry pedestrian egress and emergency vehicular access for all residential development.
- Considering flood resilience measures for new development.
- Seeking opportunities for betterment where possible, where surface water flooding issues are present.

It is important to recognise that the SFCA has been developed using the best available information at the time of preparation. This related both to the current risk of flooding from all sources and the potential impacts of future climate change.

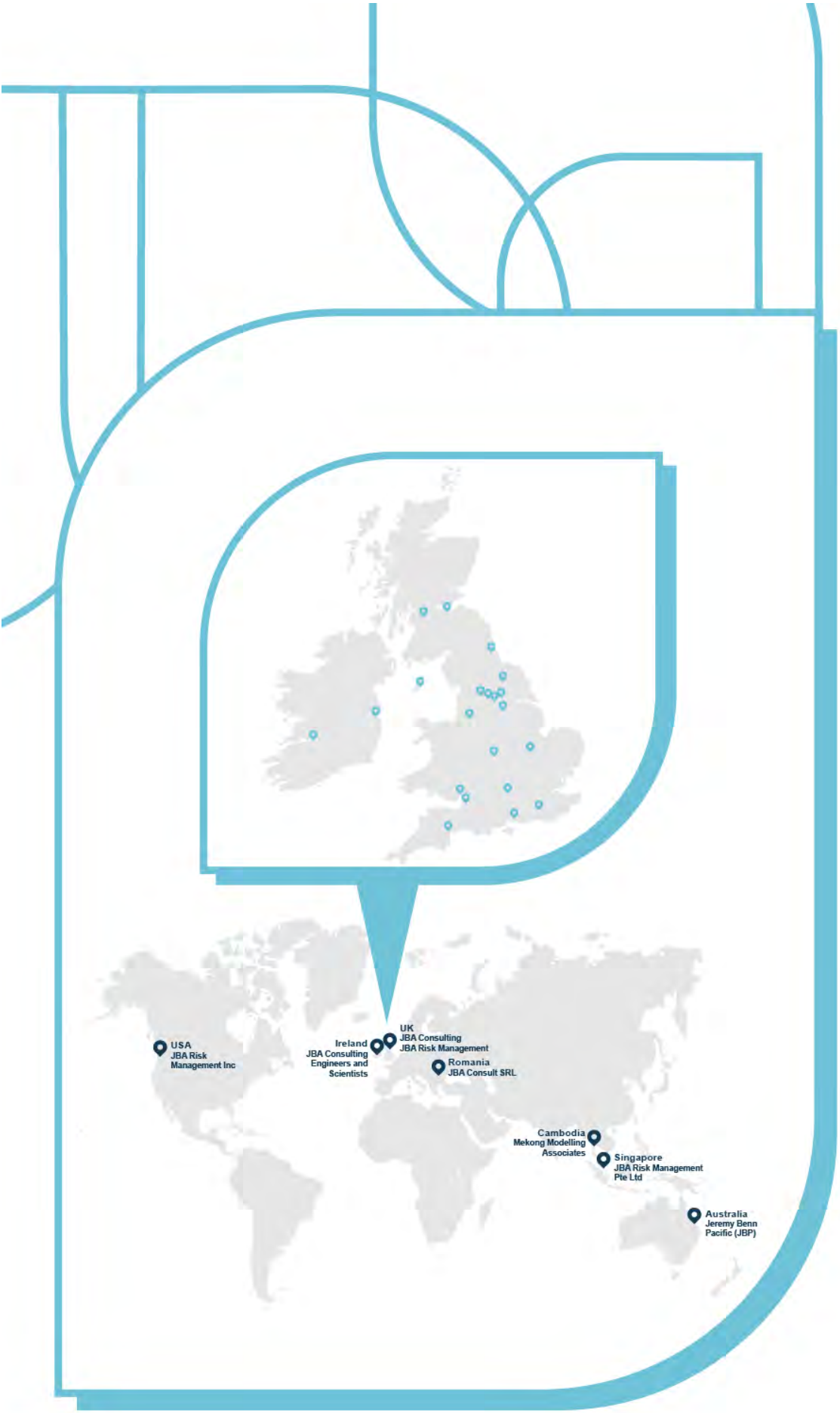
The SFCA should be treated as a 'live' document, and as a result should be updated when new information on flood risk, flood warning, or new planning guidance or legislation becomes available. Additional guidance should be sought from Cardiff Council, Natural Resources Wales, and Dŵr Cymru Welsh Water to ensure that the most up to date information is considered within any new assessments. Such information may be in the form of:

- Policy / legislation updates
- Flood event information following a flood event
- New hydraulic modelling results
- Flood Map for Planning updates
- New flood defence or alleviation schemes

Natural Resources Wales regularly reviews its flood risk mapping, and it is important that they are approached to determine whether updated information is available prior to commencing a Flood Consequences Assessment.

A Candidate Site Appraisals

B Broad scale mapping



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BD23 3FD
United Kingdom

+44(0)1756 799919
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Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	George Williams BSc MSc
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc MCIWEM C.WEM
Subject	Bute East Dock- Flood Risk Appraisal

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA) for a site considered for allocation in its replacement Local Development Plan; Bute East Dock. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in line with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flood Risk and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located at Bute East Dock, in the Butetown/ Cardiff Bay area of the city, as shown in Figure 2-1. The proposed candidate site is located approximately 800m southeast of the City Centre. The site is bounded to the north, south and west by a mix of residential and commercial office buildings, including the Cardiff Council offices located to the southwest of the dock. To the east, the site is bounded by the A4234 City Link road.

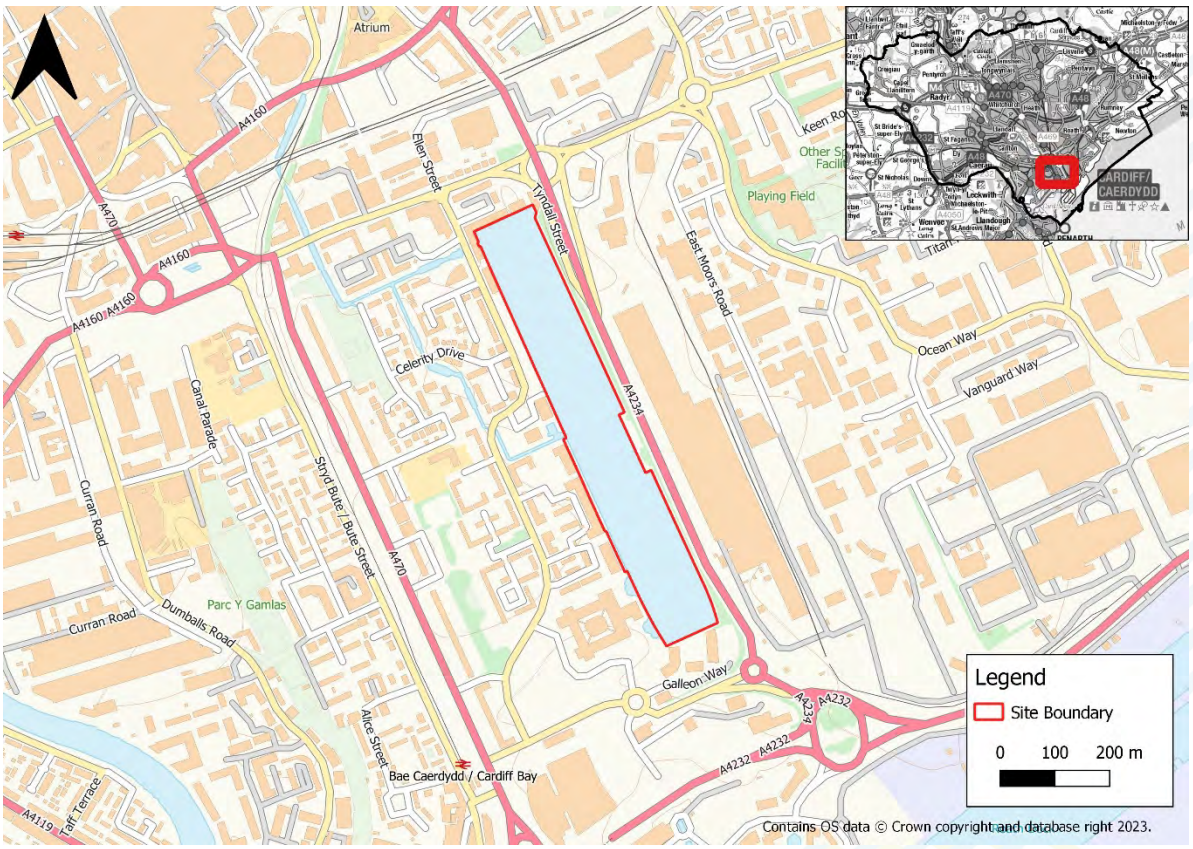

Figure 2-1 Site location

2.1 Development Proposals

The site is proposed for a mixed-use development. However, it's currently unknown what form this will take. Options could include the development of a mixed-use water-compatible development i.e. marinas or boating areas, or the dock could be partially filled to allow for non-water compatible developments such as commercial, residential, leisure and tourism uses. It is thought that the Bute East Dock could be seen as an additional development zone for the expansion of the Atlantic Wharf masterplan area.

2.2 Watercourses and Flood Defences

The site is currently an artificial waterbody and by nature of its historic use is located near watercourses and other water bodies as shown in Figure 2-2. The site is located approximately 905 m to the east of the River Taff, an NRW Main River that runs in a north-to-south direction through Cardiff City Centre towards its outfall into Cardiff Bay and then the Severn Estuary. The site is approximately 780m northeast of Cardiff Bay.

Although the site is shown to be outside an Area Benefiting from Flood Defences, as shown in Figure 2-2, the proposed site will likely benefit from the Cardiff Bay tidal barrage that lies between Alexandra Dock and Penarth Head as much of central Cardiff does. The barrage acts as a coastal defence and allows water levels to be artificially managed within the harbour.

Bute East Dock is fed by the Dock-Feeder canal, from two locations: one being on the northwestern boundary and the other on the central western boundary. Discharges from the Dock-Feeder canal occur twice daily and only for short durations. The outfall is located in the southern extent of the dock and connects to the dock feeder canal south of the A4232. The dock feeder canal then continues southwards before discharging into Roath Lock.

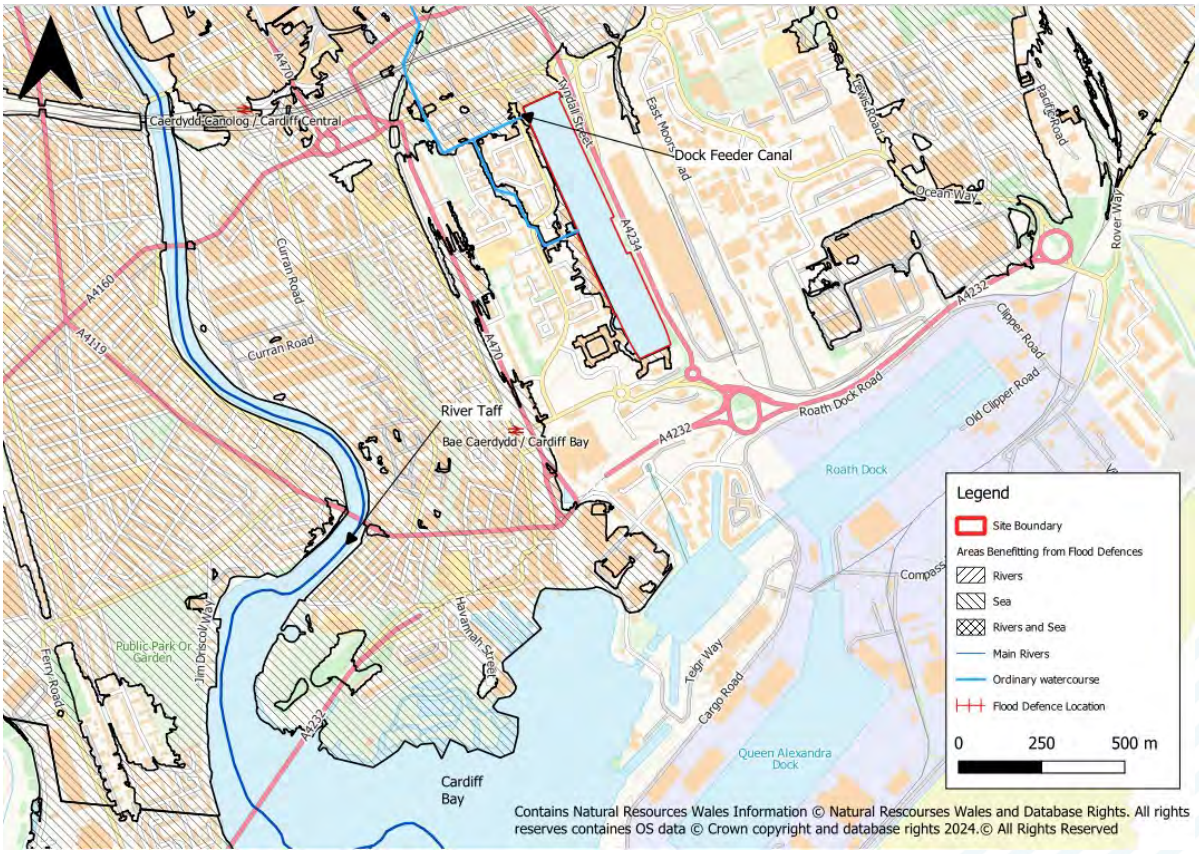

Figure 2-2 Watercourses

2.3 Topography

Due to the site's current use as a dock, the site topography has not been assessed in the usual way. Instead, the height of the dock walls has been provided to gain an understanding of the elevation of the dock in the context of the surrounding areas. The current height of the dock walls, as indicated by LiDAR data that is presented Figure 2-3 below, is approximately 8.35mAOD. The LiDAR data is unlikely to provide an accurate level of the water in the dock which is currently unknown. LiDAR data suggests that the basin is a topographic low point with the elevation of the A4234 being approximately 11.37mAOD and nearby developments surrounding the dock ranging from 9.21mAOD and 8.83mAOD.

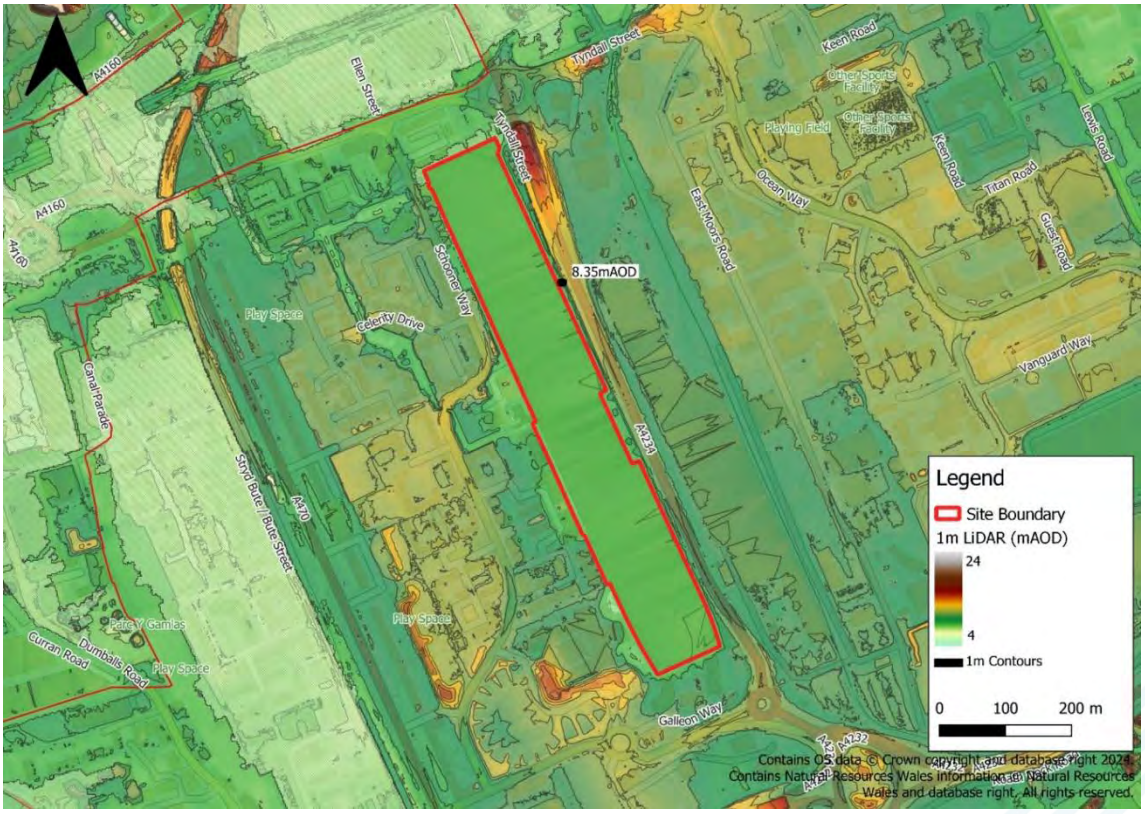

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at **very low risk** of flooding from fluvial mechanisms. No figure has been included as very low risk is depicted as a transparent layer on NRWs FRAW map.

3.2 Flood Risk from the Sea

The NRW FRAW mapping shows that the site is at **High** risk of flooding from the sea, as shown in Figure 3-1. This means that there is a greater than 0.5% (1 in 200 year) AEP chance of tidal flooding at the site.

The site is not located within an area designated as benefitting from defences. However, it is thought that the site will benefit from the presence of the Cardiff Bay tidal barrage that offers protection to much of Cardiff to a minimum standard of protection of 1 in 200 years for the sea as per NRW defences.

There is no detailed modelling available that includes this area of Cardiff. The FRAW dataset is based on broadscale modelling derived from projections of sea level estimates. Projection mapping highlights areas at risk based on topography and modelled flood level, often highlighting areas at risk that have no flood flow path towards them. Consequently, projection mapping should be used with caution and further consideration should be given to the actual risk of tidal flooding to the site. This is likely the explanation for the omission from the TAN-15 Defended Zone, and the sites' location in a high-risk area of flooding on the FRAW dataset.

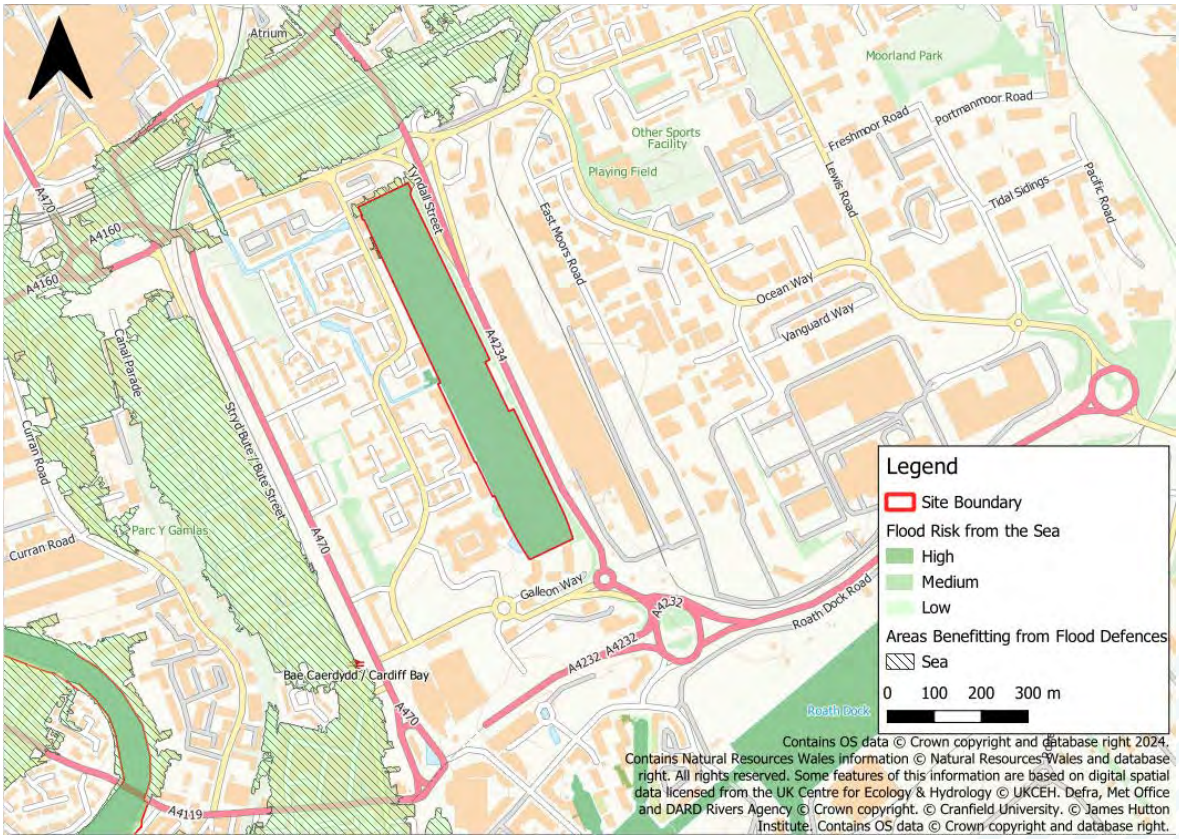

Figure 3-1 FRAW- Flood Risk from the Sea

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is at **very low risk** of flooding from surface water or small watercourses. No figure has been included as very low risk is depicted as a transparent layer on NRWs FRAW map.

Areas immediately outside the site's redline boundary do have some small areas of medium surface water flood risk as seen in Figure 3-2 Below. Medium risk is defined as areas that have a chance of flooding between 1% (1 in 100) and 3.3% (1 in 30) each year, without an allowance for climate change.

The surface water drainage infrastructure of the surrounding area is unknown. However, the proposed development site is sited lower than surrounding ground levels and it is therefore likely that Bute East Dock receives surface water flows from both runoff from the surrounding areas and point discharges from sub-surface drainage networks. Therefore, any future works shall need to account for surface water management to mitigate the risk of increasing surface water flooding to third parties.

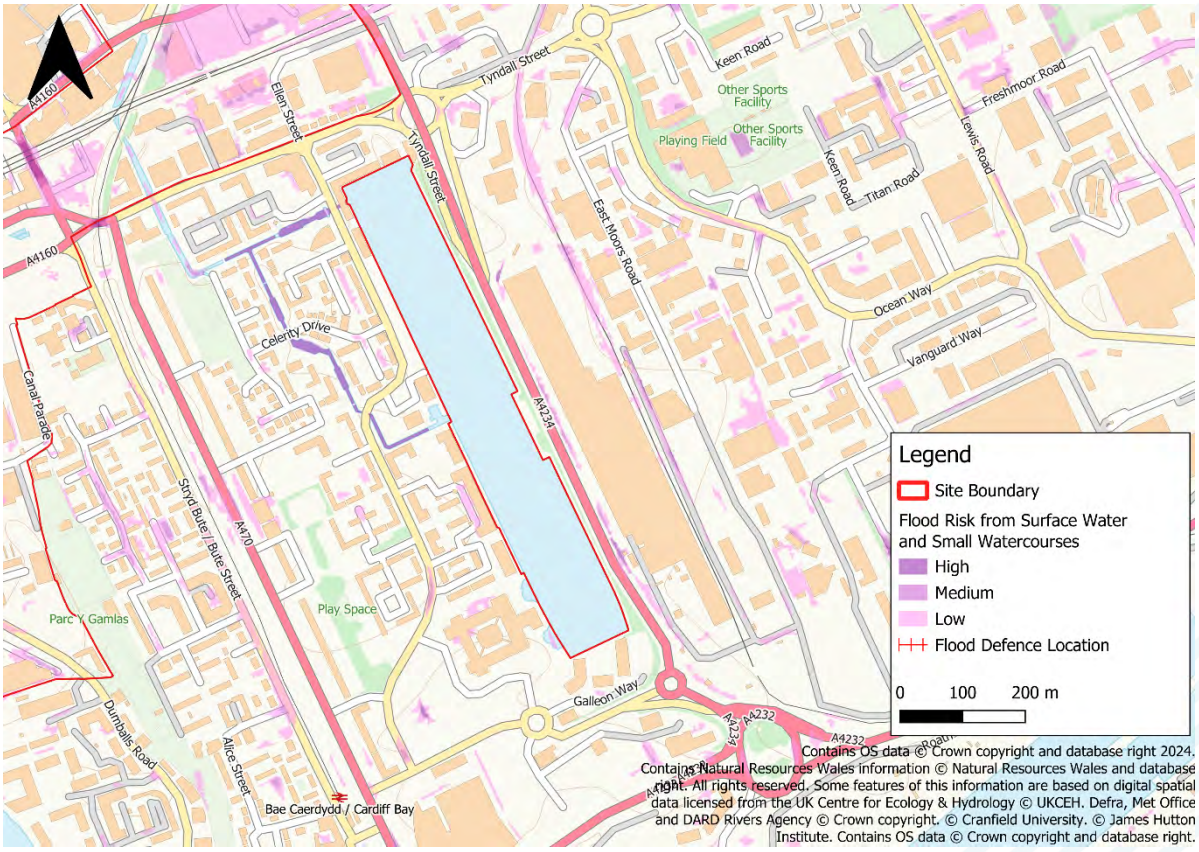

Figure 3-2 FRAW- Flood Risk from Surface Water and Small Water Courses

3.4 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at risk of flooding from reservoir failure, as seen in Figure 3-2.

However, it is worth noting that reservoir flooding is extremely unlikely to occur as all large reservoirs must be inspected and supervised by reservoir panel engineers under the Reservoirs Act 1975.

Section 5.3 of TAN-15 states that "*reservoirs are maintained to very high standards in Wales and therefore the location of homes and businesses in reservoir inundation areas should not raise alarm. This information is presented to ensure open and constructive dialogue between planning authorities and reservoir operators or owners should development plans have implications for the risk categorisation of the reservoir*".

Given the sites location in central Cardiff, it is unlikely that the risk categorisation of the reservoir would be re-categorised as a result of the proposals.

Therefore, the risk of flooding from reservoir failure has been assessed to be **low**.

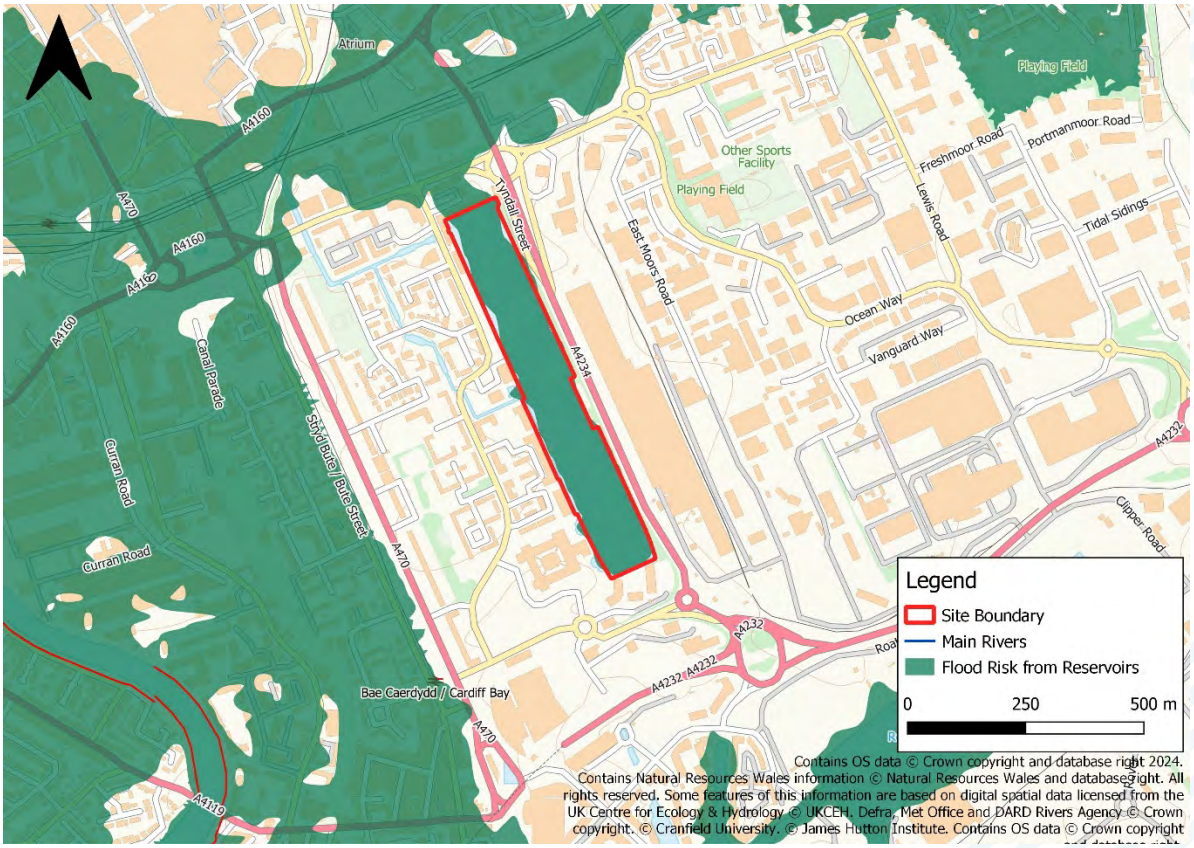

Figure 3-3 FRAW Flood Risk from Reservoir

3.5 Flood Risk from Sewers

The South East Wales Stage 1 SFCA has identified there to be a high number (95) of historic sewer flood incidents within the Butetown area of Cardiff. The current location of existing sewers is unknown and further assessment of sewer flood risk would need to be undertaken as part of the Flood Consequences Assessment for this site to demonstrate that sewer flooding doesn't pose a risk to any proposed development at the site.

It may be possible that surface water sewers from existing nearby areas drain into Bute East Dock. Should this be confirmed then effective management of these sewers will need to be considered when developing this site, more so if proposals include the infilling of the dock.

However, given the site's current use, the flood risk from sewers is thought to be **low**.

3.6 Summary of Flood Risk

Table 3-1 provides a summary of flood risk from all sources to the proposed development site.

Table 3-1Summary of Flood Risk

Source of Flooding	Risk
Rivers	Very Low
The Sea	Low
Surface Water and Small Watercourses	Very low
Reservoir	Low
Sewers	Low

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Flood Map for Planning Flood Zones[1]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

1 Figure 1, TAN15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – Flood Risk from Rivers shows the site is located in Flood Zone 1. No figure has been included as Flood Zone 1 is shown as a transparent layer on the FMfP.

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – Flood Risk from the Sea shows the site is located in Flood Zone 3 as shown in Figure 4-1.

The proposed site area is shown to be outside of the TAN-15 Defended Zones. However, like much of Cardiff the site is very likely to benefit from the flood protection provided by the Cardiff Bay Barrage and it is therefore not clear why the site has not been designated as Defended Zone.

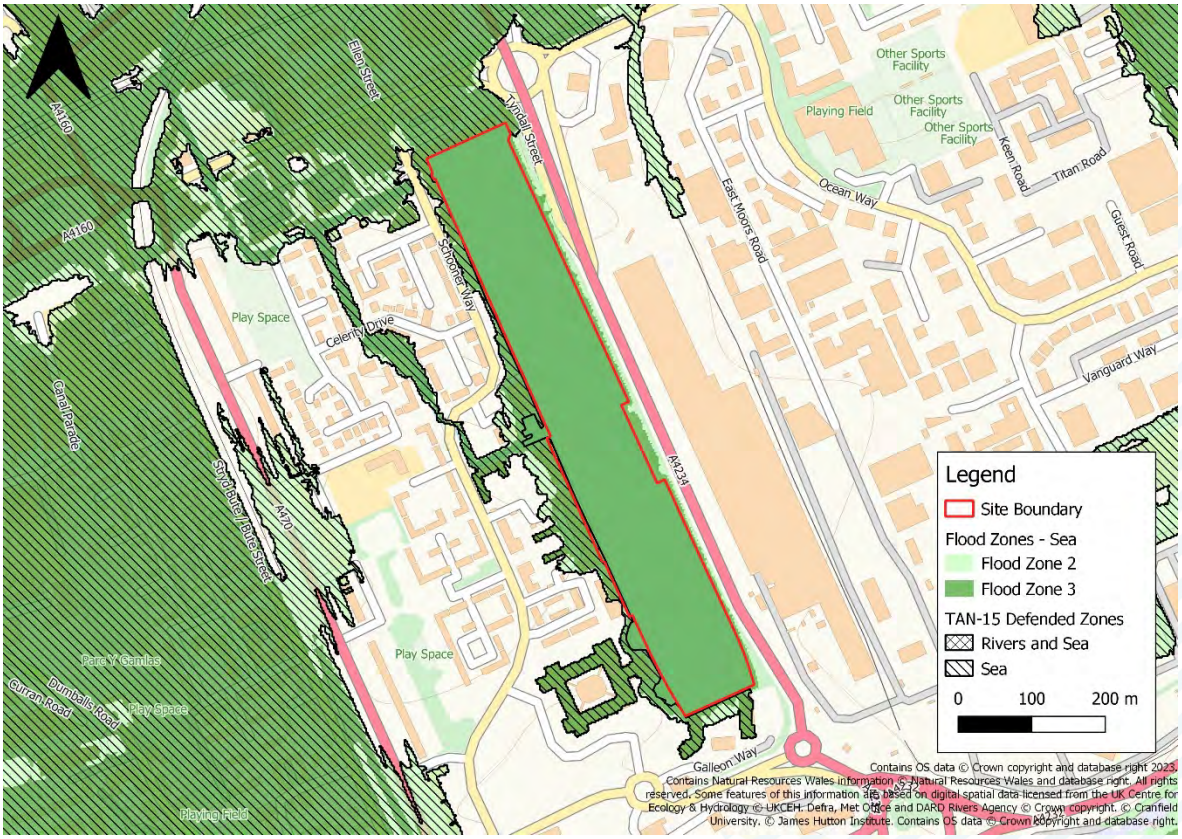

Figure 4-1 FMfP Flood Risk from the Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is located in Flood Zone 1 of the FMfP. No figure has been included as Flood Zone 1 is shown as a transparent layer on the FMfP.

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to development, as shown in Table 4-2 below. As the intended proposal for this 'mixed development' site is currently unknown a vulnerability category cannot be established at this stage. Therefore, reference will be made at each appropriate stage of the assessment as to viable means of development as per the requirements of TAN-15.

Table 4-2 Development vulnerability categories[2]

Development category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood.
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

2 TAN15, Figure 2

4.3 Justification Test

TAN-15 states that the Local Planning Authority (LPA) will need to be satisfied that a development location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and the vulnerability of the development. Currently, the intended development for this site is not yet known, therefore the vulnerability classification is unknown. Table 4-3 below shows the requirements for passing the Justification Test.

The site is currently located within Flood Zone 3 of the FMfP flood risk from the sea. This would mean that;

- All 'highly vulnerable' developments, such as residential, would not be justified in this location.
- Less vulnerable developments would need to demonstrate that there are exceptional circumstances that require the development in this location i.e. interests of national security, the location would have to be previously developed, and the consequences of flooding for the proposed development have been found 'acceptable' as per the TAN-15 acceptability criteria.
- Water compatible developments could be considered in this location so long as flood risk is not increased elsewhere. This would still require a full Flood Consequences Assessment to accompany any planning application.

It's not clear as to whether any development of the dock would be considered 'redevelopment' under TAN-15. If it is considered redevelopment then some less vulnerable developments may be justified in this location.

However, based on our current understanding, and using NRWs FMfP to assess the site, it is likely that only proposals for water compatible development shall be favorable across the proposed candidate site. Water compatible developments are not subject to the requirements of the Justification Test, but any built elements of the development that may be occupied by people will be subject to the acceptability of the consequences tests, and should be assessed against the criteria for less vulnerable developments.

Table 4-3 TAN-15 Justification Test

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>The development will be justified in the TAN 15 Defended Zones if:</td><td>The development will be justified in Zone 2 if:</td><td>The development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding.</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable by the criteria contained in section 11 of TAN-15.</td></tr>
</table>

4.4 Acceptability criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'Acceptability criteria'. There are three principal aspects to the Acceptability criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depend on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[3]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[4]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water-compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

Note: The extreme flood event is defined as the 0.1% AEP flood event

3 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
4 TAN15, Figure 6

4.5 Summary of policy position

The proposed development site is for mixed-use development at East Bute Dock, Cardiff. Exact proposals are unknown, and it is currently unclear whether proposals shall comprise 'water compatible development' or the infilling of the Dock.

Based on NRW's FMfP the site is located within Flood Zone 3 of the FMfP for the sea. Consequently, no highly vulnerable development shall be permitted, and less vulnerable development shall only be permitted by exception. Water compatible development shall likely be more favorable across the proposed candidate site.

Water compatible developments are not subject to the requirements of the Justification Test, but any built elements of the development that may be occupied by people will be subject to the acceptability of the consequences tests, and should be assessed against the criteria for less vulnerable developments.

Further consideration of this site is required to determine whether this site would be suitable for development. The draft TAN-15 does not currently provide sufficient clarity on the potential to develop artificial waterbodies. It is recommended that allocation of this site is supported by appropriate evidence to demonstrate how development will be able to comply with the requirements of TAN-15.

5 Conclusion

Site Description

- JBA Consulting has been commissioned to prepare a Flood Risk Appraisal in support of a candidate site for Cardiff Council for the replacement LDP. The site is located at the Bute East Dock and proposed for a mixed-use development.

Overview of flood risk

- The site has a low risk of flooding from tidal sources;
- The site is at very low risk of flooding from fluvial, surface water, sewers and groundwater sources.
- The site was found to be in an area at risk from reservoir flooding, however, the risk is assessed to be low.

Consultation draft of new TAN-15

- The proposed development site is for mixed-use development at East Bute Dock, Cardiff. Exact proposals are unknown, and it is currently unclear whether proposals shall comprise 'water compatible development' or the infilling of the Dock.
- Based on NRW's FMfP the site is located within Flood Zone 3 of the FMfP for the sea. Consequently, no highly vulnerable development shall be permitted, and less vulnerable development shall only be permitted by exception. Water-compatible development shall be more favorable across the proposed candidate site.
- Water compatible developments are not subject to the requirements of the Justification Test, but any built elements of the development that may be occupied by people will be subject to the acceptability of the consequences tests and should be assessed against the criteria for less vulnerable developments.
- Further consideration of this site is required to determine whether this site would be suitable for development. The draft TAN-15 does not currently provide sufficient clarity on the potential to develop artificial waterbodies. It is recommended that the allocation of this site is supported by appropriate evidence to demonstrate how development will be able to comply with the requirements of TAN-15.

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Land at Wentloog Avenue. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located at the current Land at Wentloog Avenue, Cardiff as shown in Figure 2-1. The site is approximately 6.8km east of Cardiff City Centre and comprises greenfield agricultural land. To the north of the site is the Great Western Railway Mainline between London and South Wales with industrial sites located to the west and southwest of the proposed development site.

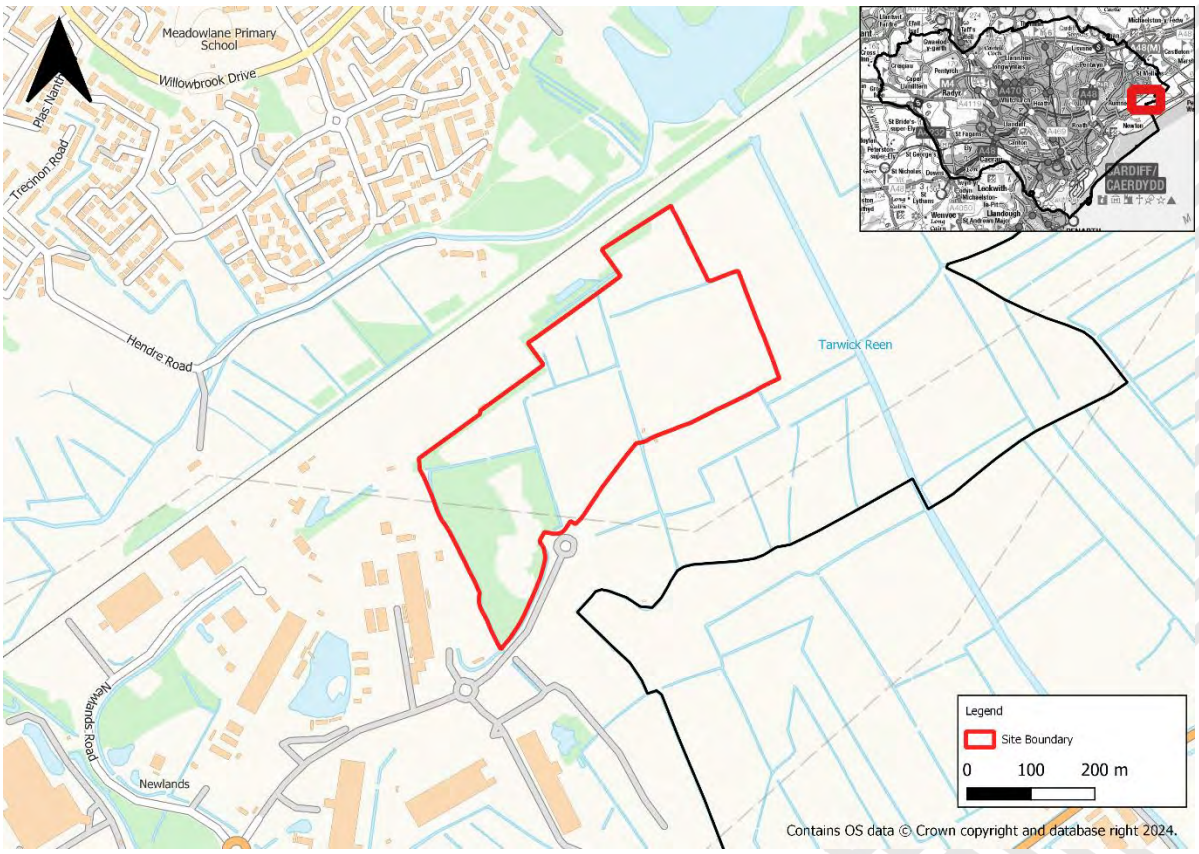

Figure 2-1 Site location

2.1 Development Proposals

The proposed development at this site is for employment land (use classes B1, B2 and B8).

2.2 Watercourses and Flood Defences

The site is crossed by several tidally influenced reens which form part of the wider Caldicot and Wentloog levels Internal Drainage Board (IDB). The IDB is responsible for managing water levels and reducing flood risk to properties within the IDB.

The Tarwick Reen is recognised as a Main River and is located approximately 120m to the east of the site, whereas the Pîl-du Reen is classed as an ordinary watercourse, as indicated Figure 2-2 below, and is located approximately 64m to the north of the site.

The entire site is in an area benefiting from coastal flood defences, with protection provided by the coastal embankments located approximately 1.1km to the south of the site, along the Severn Estuary.

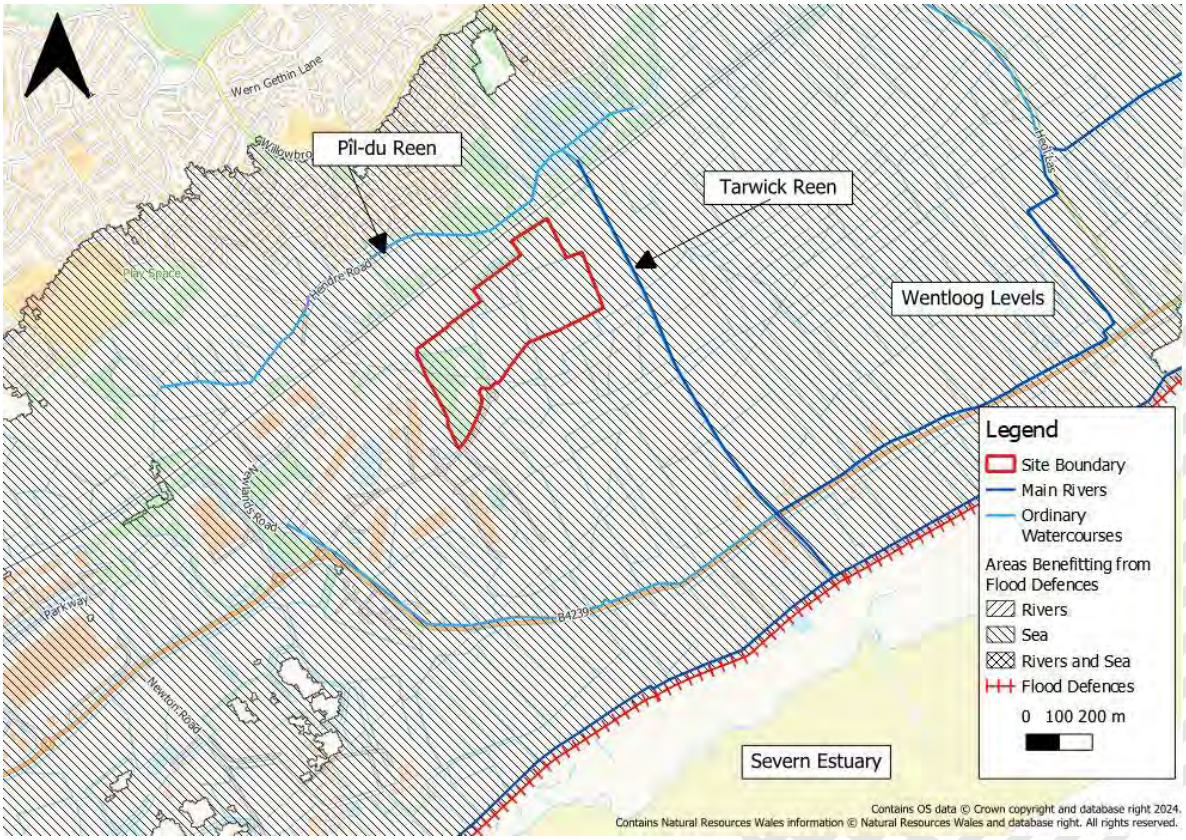

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data show the site to be relatively flat in topography with topographic depression associated with reen channels. The general fall of the site is in a north-to-south direction, noting the land drainage function of the reen network. The highest elevation on site is 7.32mAOD and is located towards the central north boundary of the site, whereas the lowest elevation on site is 4.42mAOD and is located on the southeast boundary of the site. This low point is associated with the banks of a reen channel.

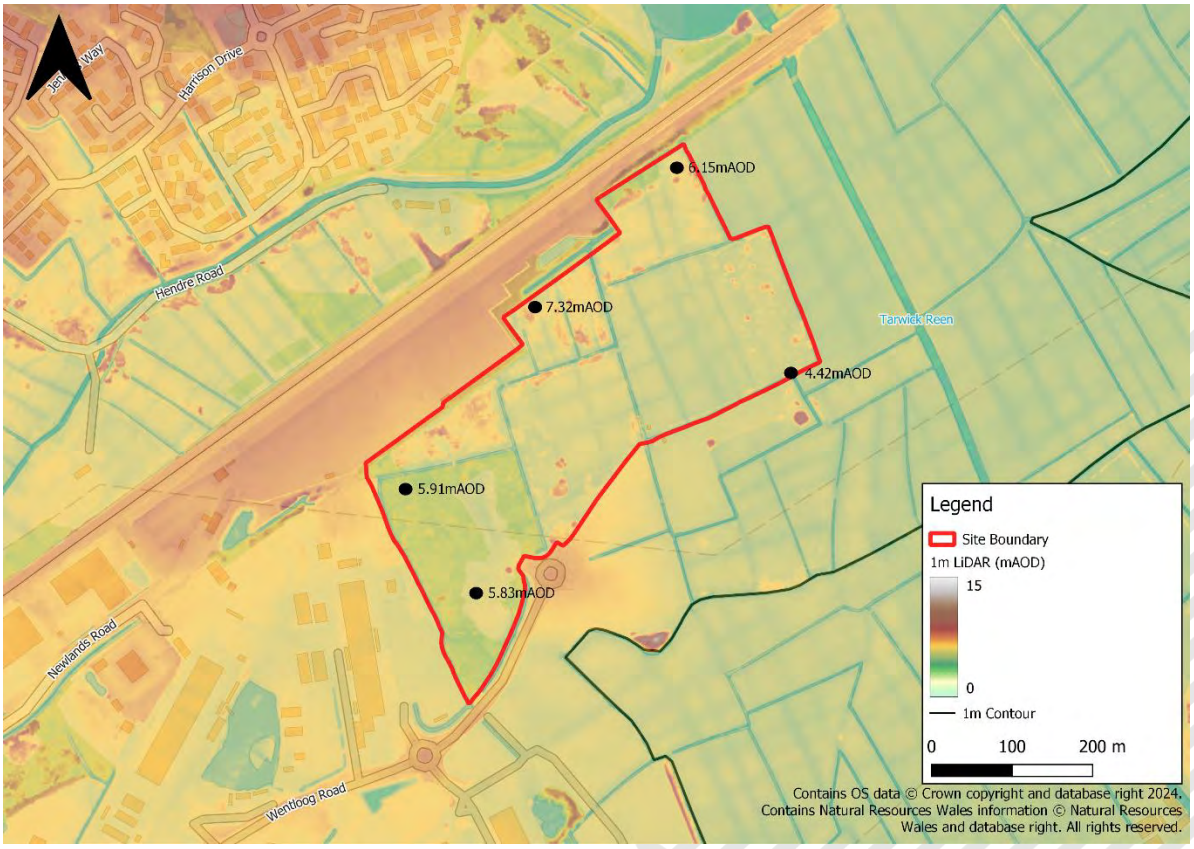

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from fluvial mechanisms. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

Detailed flood modelling has been used to assess the risk of tidal flooding to the site. This has been detailed further below.

3.2.1 Model Availability

The NRW Wentloog tidal model was developed in 2016 and extends from the River Rhymney estuary in Cardiff to the River Usk estuary in Newport.

This model was updated by JBA in 2022, applying the new Coastal Flood Boundary (CFB) dataset, released in 2019. Extreme Sea level estimates were taken from Node 396 (River Usk) and 408 (River Rhymney) and applied across the tidal boundary of the model. Wave overtopping values have not been recalculated since the 2016 version and therefore remain precautionary.

For all coastal locations, future sea level rise is a major consideration and should be applied to the extreme sea level estimates. The UKCP18 User Interface by Welsh Government Guidance on Climate Change Allowances for Planning Purposes (September 2021) was therefore used to provide climate change uplifts for the study area.

The Wentloog model results for the present day (2022) and for 75 years (2097) have therefore been used to assess the flood risk at the candidate site.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequence Assessment (FCA).

3.2.2 0.5% AEP Event

Figure 3-1 shows that the site is predicted to be flood-free during the 2097 0.5% AEP.

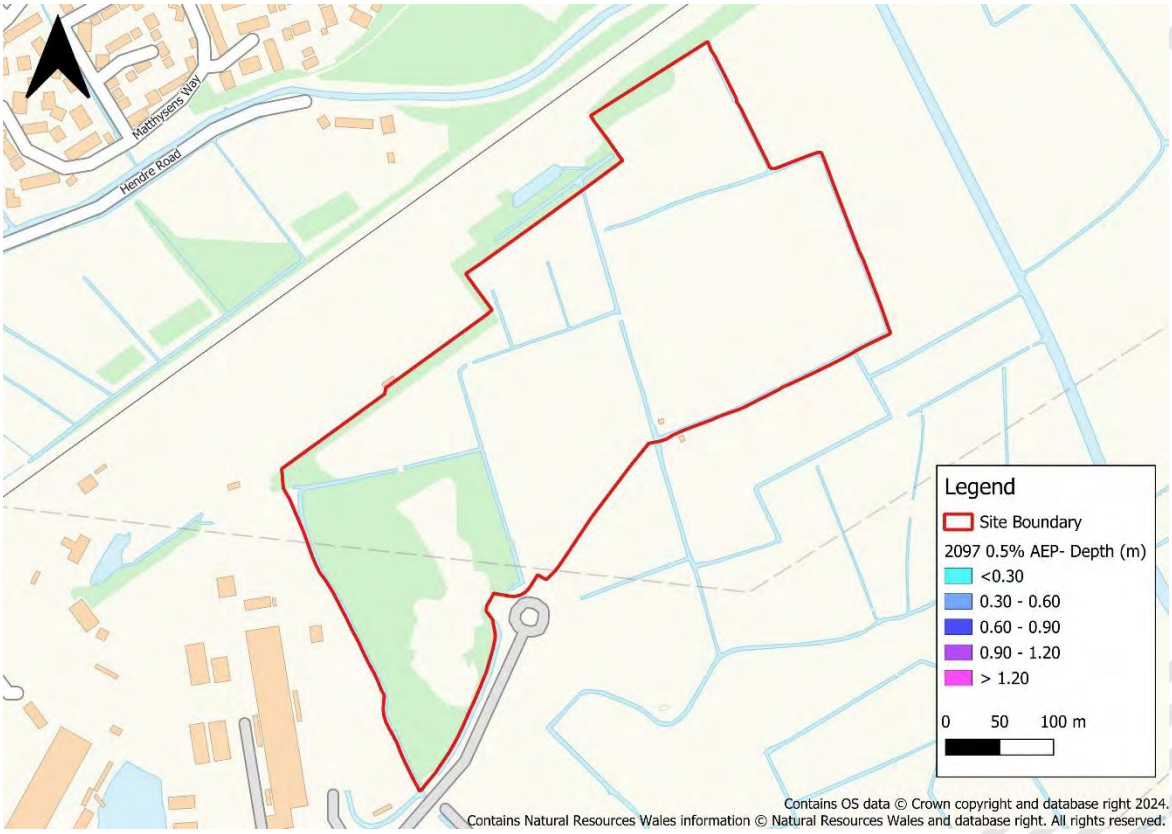

Figure 3-1 0.5% AEP plus Climate Change Event: Flood Depths

3.2.3 0.1% AEP Event

Figure 3-2 shows that the site is predicted to flood during the 2097 0.1% AEP event. The flood depths and maximum flood level at the site are summarised in Table 3-1 below. Flood depths are greatest in the east of the site with the greatest depths being associated with existing reen channels. Areas not associated with reen channels are modelled to have flood depths ranging from 10mm to 200mm in the northeast to 10mm to 290mm in the southwest. During the 2097 0.1% AEP event, large, areas remain flood free, mostly within the west of the site. Those areas that do flood are predicted to remain below the 0.6m that is considered tolerable under the TAN-15 guidance. Areas where depths are greater than 600mm are associated with existing reen channels.

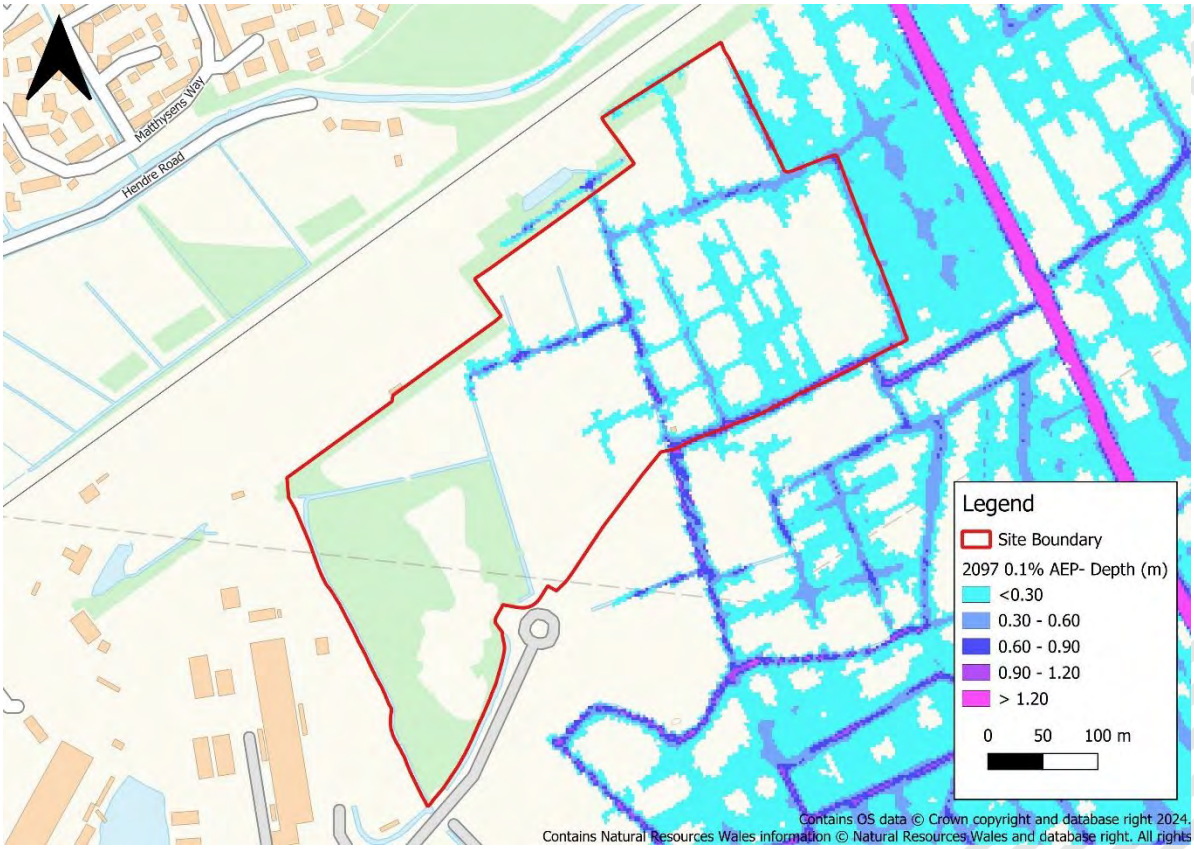

Figure 3-2 0.1% AEP Event: Flood Depths

Table 3-1 0.1% AEP Event: Flood Model Results Summary

Flood Event	Maximum Flood Depths (m)	Maximum Flood Level (mAOD)
0.1% AEP event	0.87	5.45

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is predominantly at **Very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-3. This means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site. However, areas of the site are considered at **Low Risk**. These areas at low risk are associated with the existing reens that are present on site. Low risk represents a between 1 in 1000 (0.1%) and 1 in 100 (1%) of flooding each year.

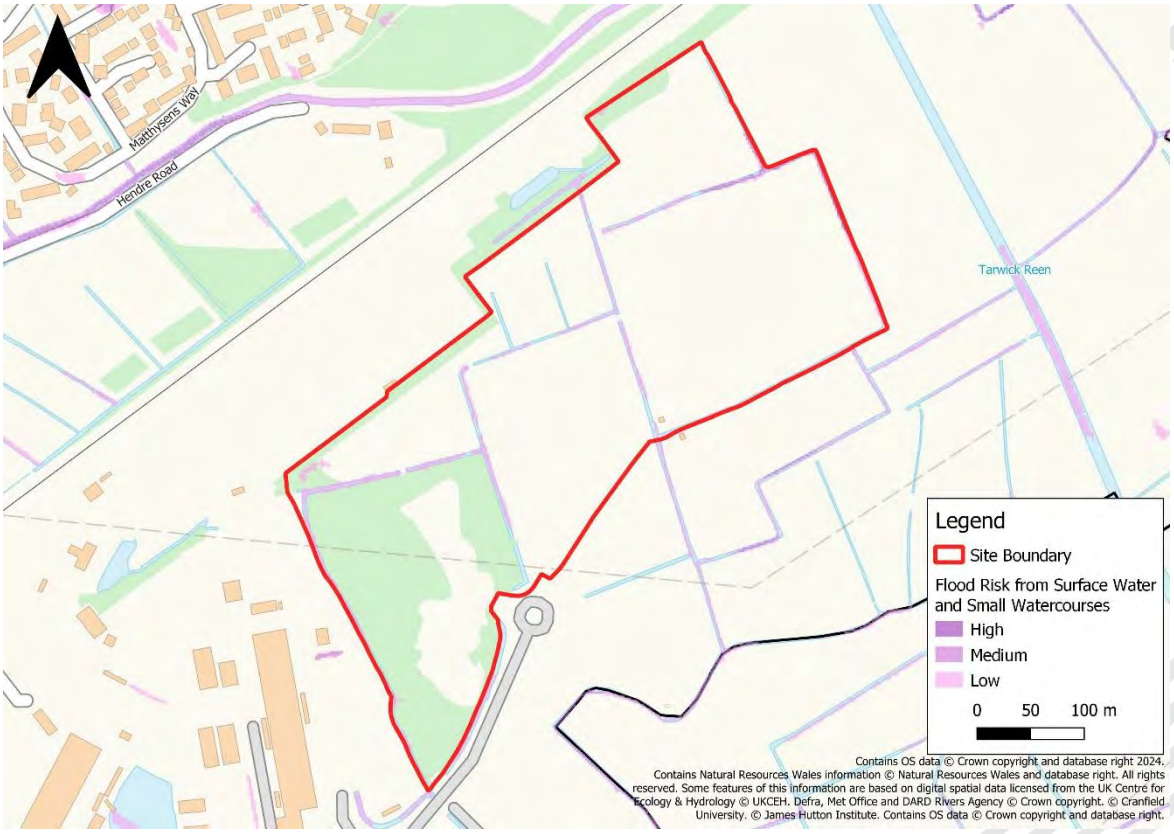

Figure 3-3 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months, and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography. The site's geology is comprised of Mudstone bedrock and Tidal Flat Deposit (TFD) superficial deposits. Both mudstone and TFD tend to be impermeable with limited preferential routes for emergence.

The South East Wales Stage 1 SFCA includes JBA's Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area that has a low risk of groundwater emergence. Furthermore, The Cardiff Local Flood Risk Management

Strategy[1] also states that 'there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small'. Therefore, the risk of flooding from groundwater has been assessed to be **low**.

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding with the nearest reservoir to the site being the Llanishhen Reservoir located approximately 5.5km to the northwest of the site. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South East Wales Stage 1 SFCA has identified there to be a low number (17). Due to the proposed site being greenfield land, it's unlikely there are existing sewers or sewage infrastructure that crosses the site. It has therefore been assessed that the flood risk from sewer flooding is **Low.**

3.7 Summary of Flood Risk

The main source of flooding at the proposed site is from coastal flooding. The site is shown to experience some flooding during the 0.5% AEP event and extensive flooding during the 0.1%AEP event. Depths were modelled to vary across the site with the greatest depths being associated with existing reens that transgress the site. An overview of the flood risk by other sources of flooding in presented Table 3-2 Overview of Flood Risk from All Sources below.

Table 3-2 Overview of Flood Risk from All Sources

Source of Flooding	Risk
River	Very Low
Sea	Medium
Surface Water	Low (small areas associated with existing reens Medium-high)
Groundwater	Very Low
Sewer	Low
Reservoir	Very Low

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx>

4 Consultation draft of new TAN-15

The following section provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard)	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard)	Not applicable

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – Flood Risk from Rivers shows that some of the site is located in Flood Zone 2, as shown in Figure 4-1. This area is focused to in the east of the site; however, it does extend to the western boundary. The checkered-like pattern is like associated preferential routes created by the existing reen network and man-made high and low points designed to encourage drainage at the site. Flood Zone 2 represents a Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change. The site does not in a TAN-15 Defended Zone for Rivers.

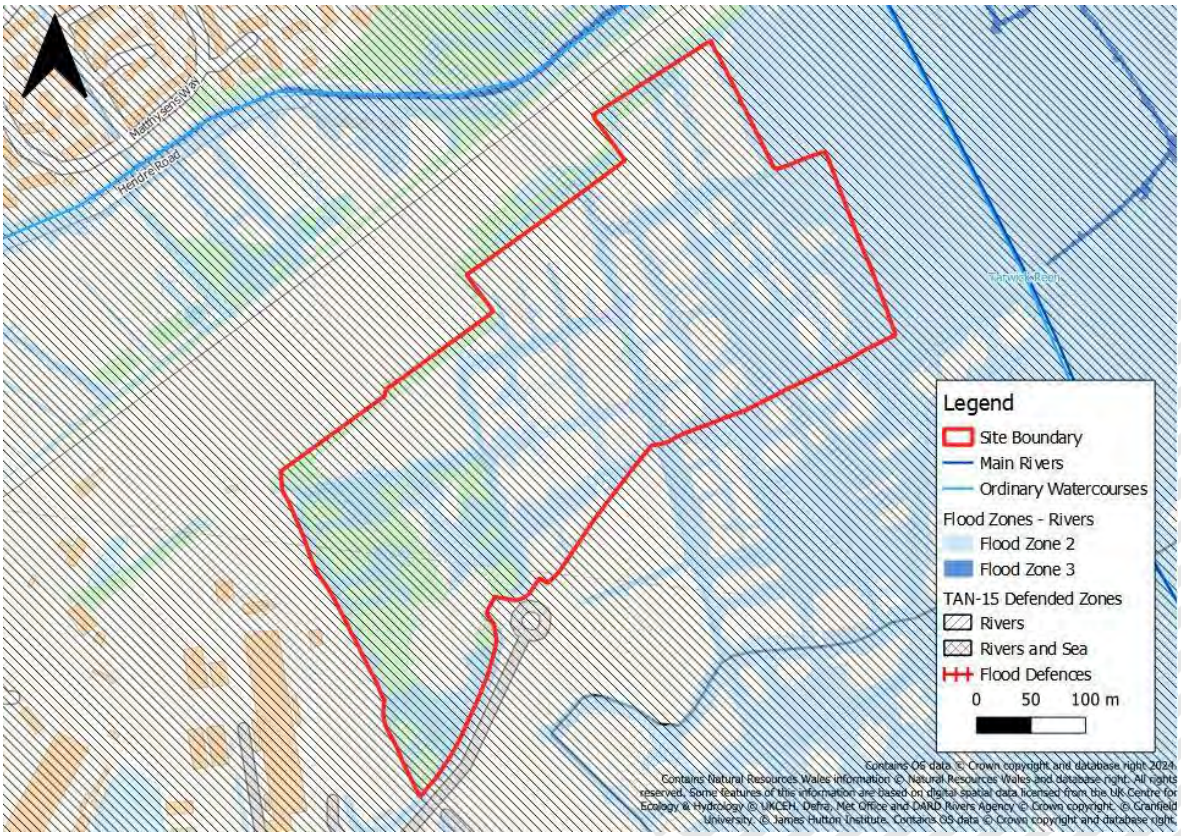

Figure 4-1 Flood Map for Planning- Rivers

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – Flood Risk from the Sea shows the site is located in Flood Zone 3 as seen in Figure 4-2. Flood Zone 3 represents a greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change. However, the site is located within a TAN-15 Defended Zone, meaning it is protected up to the 1 in 200-year (0.5%) event. However, as the defences were constructed pre-2016 its is unlikely that they include an allowance for climate change.

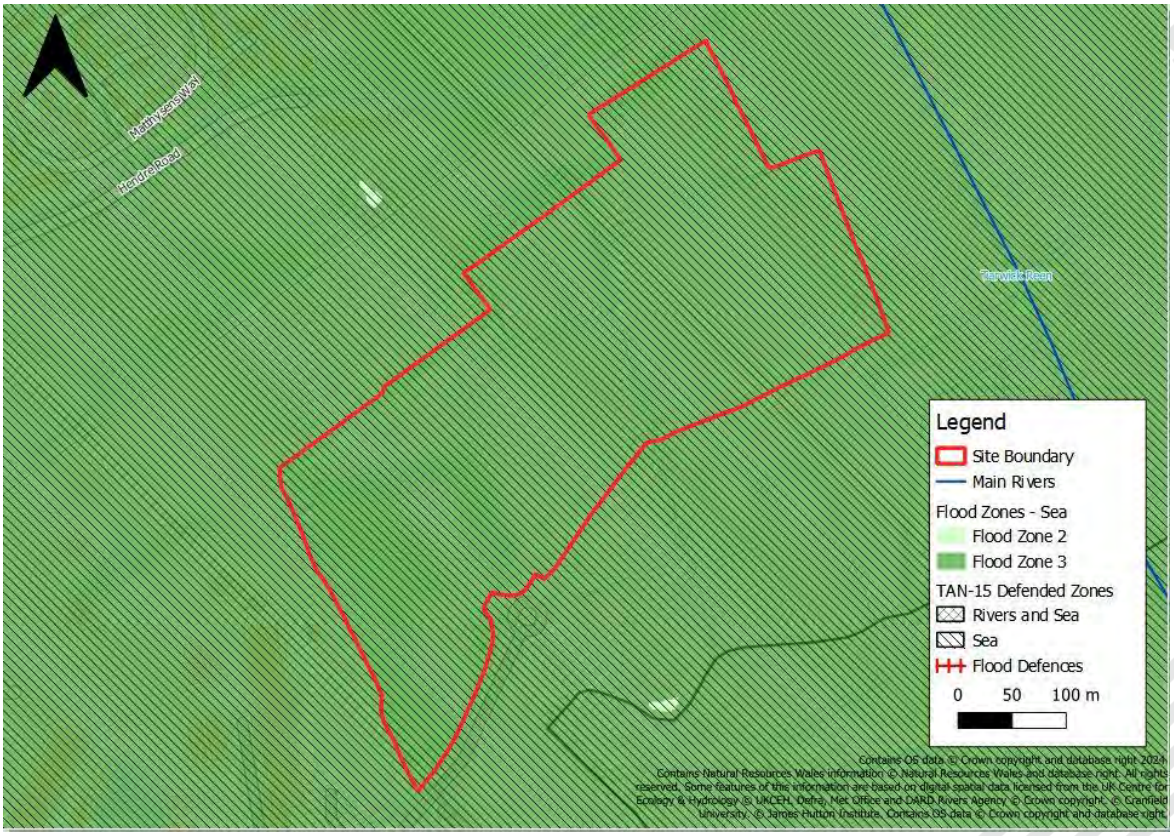

Figure 4-2 Flood Map for Planning- Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is located predominantly in Flood Zone 1, as shown in Figure 4-3. However, there are areas of the site located within Flood Zone 2 and Flood Zone 3. Areas in Flood Zone 2 have a Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change. Whereas the areas located in Flood Zone 3 have a greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.

Areas located in Flood Zone 2 and 3 are mostly associated with the existing reens on the site and therefore the risk is associated with small watercourse flooding. There are a few small, isolated areas located in the southwest, northwest, and northeast of the site that are shown to be in Flood Zone 2 and 3 that are associated with surface water flooding, most likely ponding within a natural topographic depression.

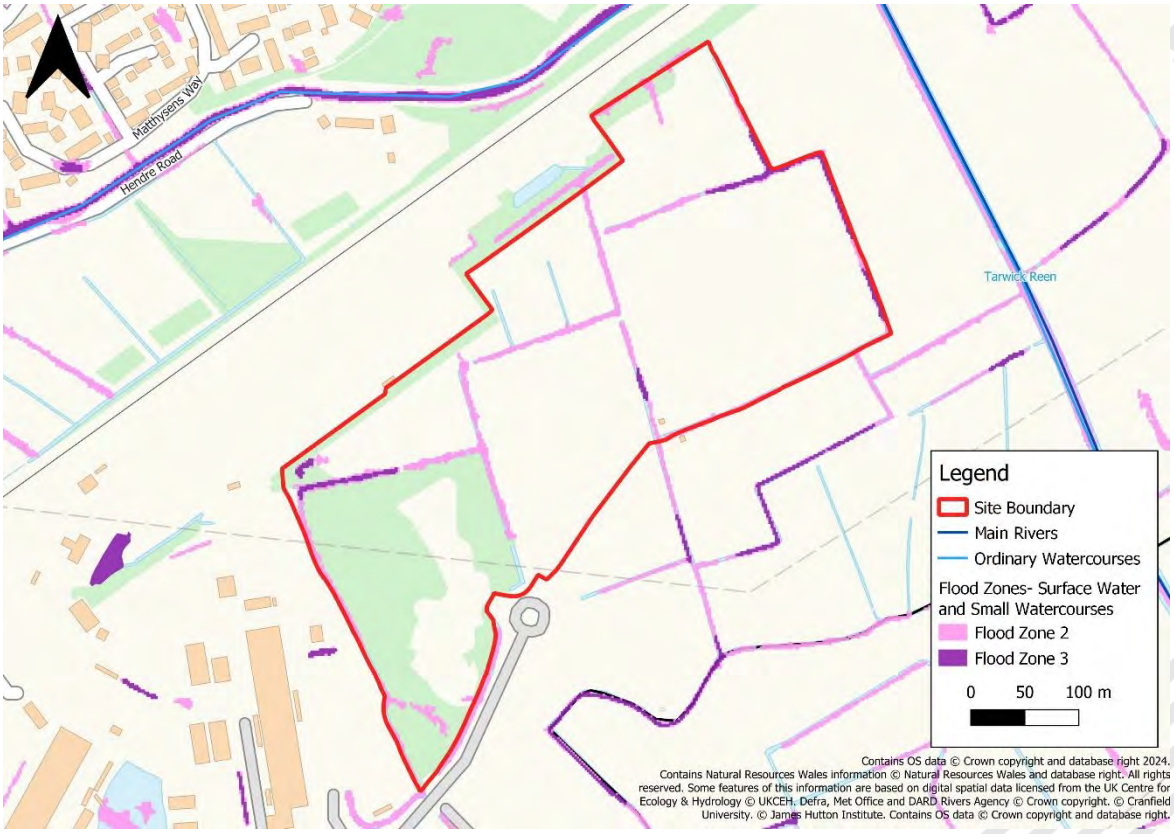

Figure 4-3 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for employment land it is classified as less vulnerable development.

Table 4-2 Development Vulnerability Categories [3]

Development category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	**General industrial, employment, commercial and retail development.** Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The requirements of the Justification Test are summarised in Table 4-3.

Table 4-3 Justification Test[4]

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>Development will be justified in the TAN 15 Defended Zones if:</td><td>Development will be justified in Zone 2 if:</td><td>Development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="3">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="3">The scheme results in a development that is resilient to flooding</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.</td></tr>
</table>

4 TAN-15, Section 10

4.4 Acceptability criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'Acceptability criteria'. There are three principal aspects to the Acceptability criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depend on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[5]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[6]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

Note: The extreme flood event is defined as the 0.1% AEP flood event

5 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
6 TAN-15, Figure 6

4.5 Summary of Policy Position

Development proposals for the site are for the construction of new employment land (use classes B1, B2 and B8). The proposed development is considered to be 'less vulnerable' development.

Based on NRW's Flood Map for Planning, the proposed development site is located within the TAN-15 Defended Zone. All forms of development are permissible within the TAN-15 Defended Zone, subject to either there being a Community Adaptation and Resilience Plan in place, **or**, the demonstration that the consequences of flooding have been considered and found to be acceptable.

Flood risk across the site is currently defined by the NRW Wentlooge model. Within the 2097 0.5% AEP, the site is flood free.

During the2097 0.1% AEP event, flooding of the site is predicted, however this is mainly confined to the east of the site and originates from the reen network. With a sequential approach to development planning, and careful retention of the reen network, it is likely that flood risk to the site can be suitably managed in this event to located built development outside of the predicted flood extent. Depths outside of reen channels were found to be less than 600mm across the site meaning they are within the tolerable conditions of TAN-15, therefore mitigation may not be required at the site, dependent upon developer aspirations. Any proposed should consider the impact of proposals on third parties in terms of flood risk. Consequently, detailed modelling may be required to demonstrate these considerations.

No assessment of the residual risk, including breach of the existing tidal defences, has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequences Assessment (FCA).

5 Conclusion

Site Description

- JBA Consulting has been commissioned to prepare a Flood Risk Appraisal in support of a candidate site for the Cardiff Council replacement LDP. The site is located on Land off Wentloog Avenue and is proposed for employment land. The site generally falls in a north-to-south direction and is transgressed by several reens.

Overview of flood risk

- The primary risk of flooding to the site is from tidal sources with portions of the site flooding during the 2097 0.1% AEP event. Flood depths remain lower than 600mm across the site, with areas with greater flood depths associated with existing reen channels;
- The site is at very low risk of flooding from fluvial, reservoir and groundwater sources;
- The site is at low risk of flooding from sewers and surface water/ small watercourses.

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- The site is located within a TAN-15 Defended Zone. Consequently, development can be justified subject to there being a Community Adaptation and Resilience Plan in place, or, the demonstration that the consequences of flooding have been considered and found to be acceptable;
- All forms of development are permissible within the TAN-15 Defended Zone, subject to the above. The proposed nature of the site means that it is classified as less vulnerable.
- A sequential approach to development and careful management of the reen network is likely to be required to satisfy the requirements of TAN-15 for this candidate site. Mitigation may not be required at this site. If mitigation is required the impact of mitigation work on third parties shall need to be considered within a site-specific assessment.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals currently comply with the aims and objectives of TAN-15 and Planning Policy Wales. Flood risk and associated mitigation measures should be set out in a site-specific Flood Consequences Assessment.

Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	Charlotte Lickman BSc Hons
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc MCIWEM C.WEM
Subject	Cardiff Central Enterprise Zone - Flood Risk Appraisal

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Cardiff Central Enterprise Zone. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with the Welsh Government's policy, as set out in Technical Advice Note 15 (TAN-15): Development, Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The site is located within the centre of Cardiff, as shown in Figure 2-1, and is approximately 79.09 ha in size. The site is predominantly developed land made up of a mixture of development types including residential and commercial, as well as transport infrastructure and a sports ground. The site is bound by the River Taff to the west, and commercial and residential development surround the east, north and south of the site. Bute East Dock and its feeder are located to the south-east.

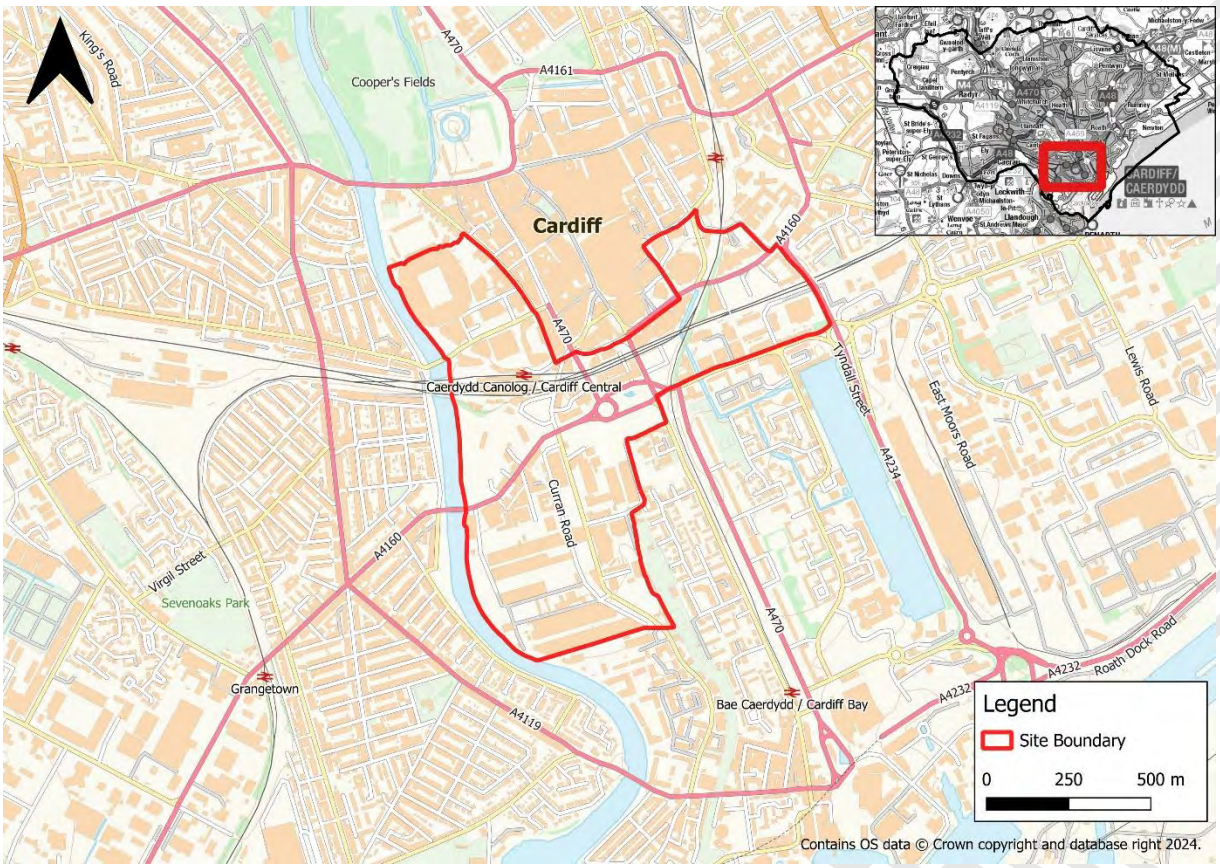

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development at this site is for residential use.

2.2 Watercourses and Flood Defences

The River Taff, an NRW Main River, is located adjacent to the western boundary of the site and flows in a southerly direction, as shown in **Error! Reference source not found.**. The River Taff benefits from several NRW flood defences along its banks which provide a standard of protection of 1 in 200 (0.5% AEP) against fluvial and/or tidal sources. Tidal flooding is also mitigated by the Cardiff Bay Barrage which is located approximately 2.5km to the south of the site.

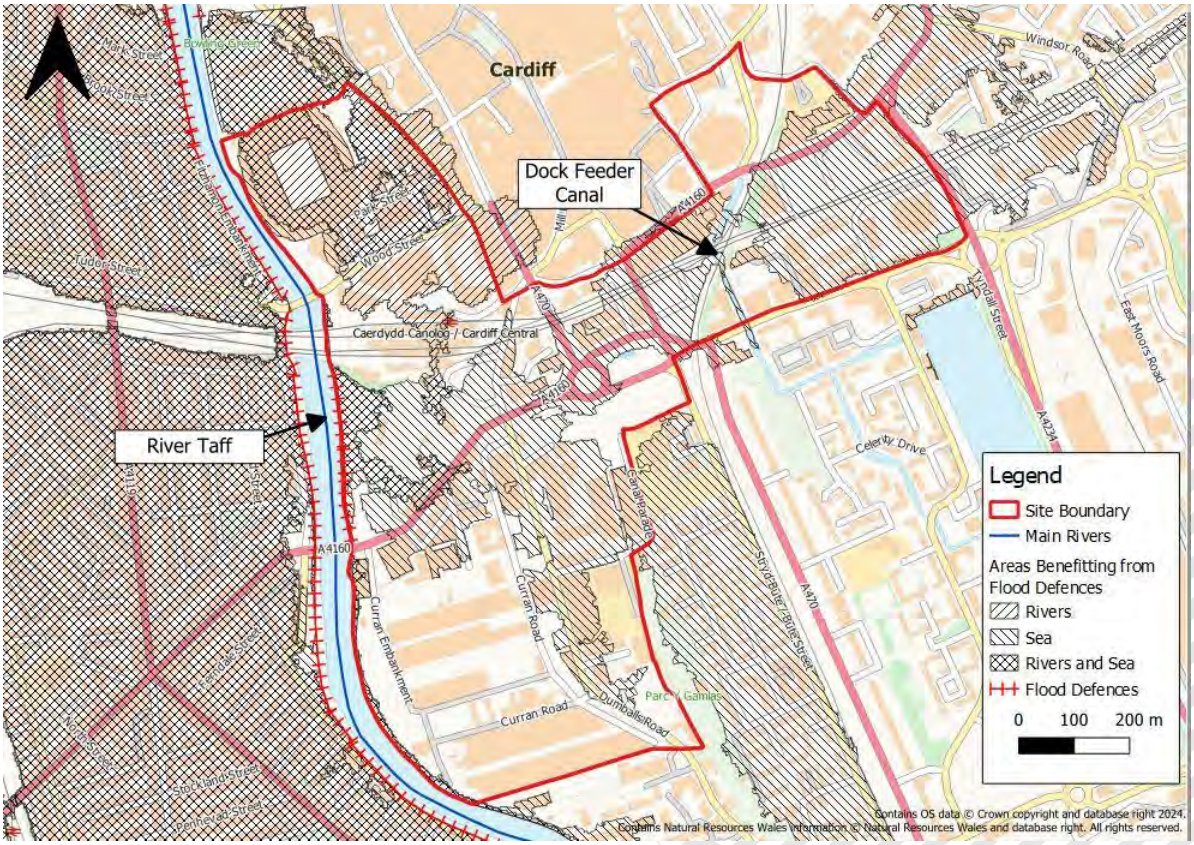

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the site is predominantly flat with topographic depressions in the centre of the site around the A4160 Penarth Road, Bute Street, Tyndall Street and the Principality Stadium. Higher areas are present along the railway lines at Cardiff Central Station and the railway line in the east of the site.

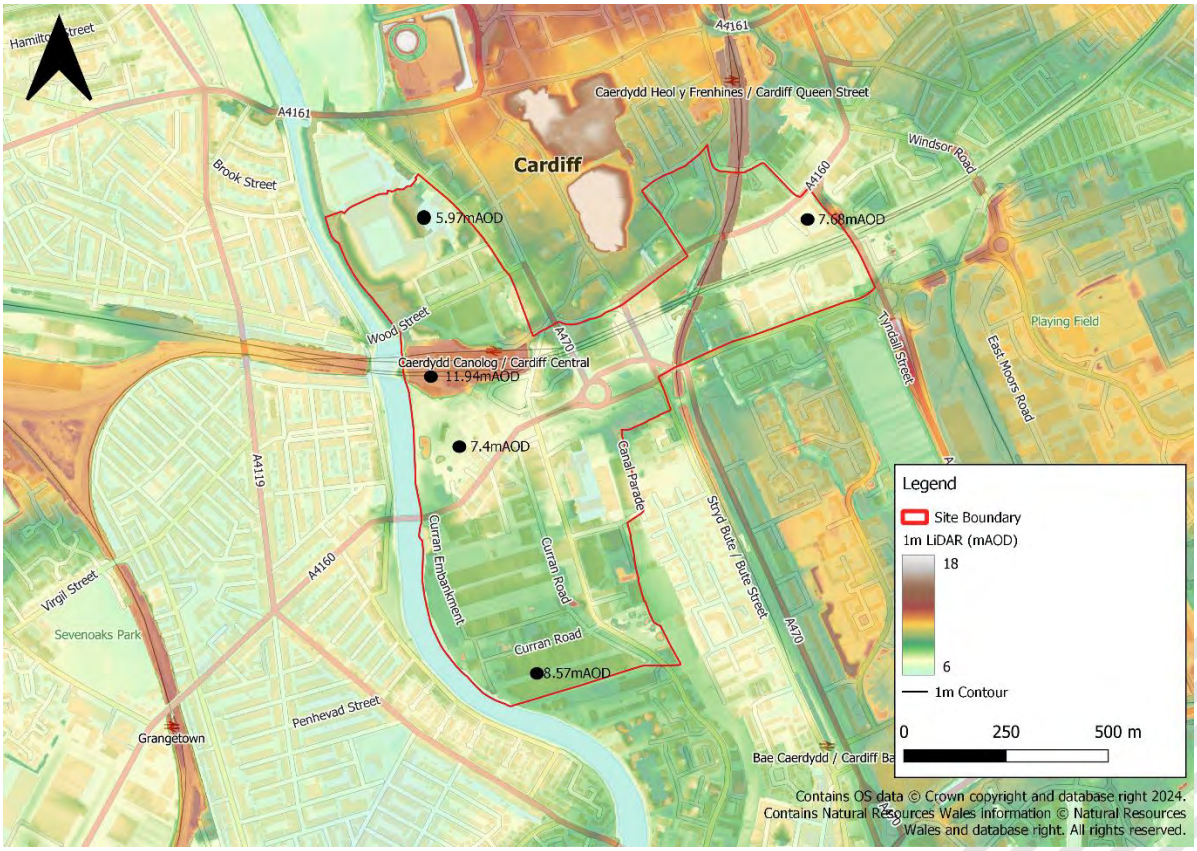

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

Detailed flood modelling has been used to assess the risk of fluvial flooding to the site from the River Taff. This has been detailed further below.

3.1.1 Model Availability

The original Natural Resources Wales's (NRW's) Cardiff VDM hydraulic model was developed by Mott MacDonald in 2013. The original Mott MacDonald model is referred to as version v2.2. Subsequently, the model was further updated by Mott MacDonald in 2016 to extend the model domain so that new climate change allowances did not exceed the existing model extents. This version of the model is referred to as v2.3.

In 2019, JBA received the Cardiff VDM models (v2.2 and v2.3) from NRW and updated the River Ely hydrology using the Flood Estimation Handbook (FEH) Statistical method as QMED was based on local data. For flows above the 1% AEP event, the ratio from ReFH2 was applied. Additionally, 13 new cross-sections covering approximately 750 m of the River Ely downstream of the A48 road bridge were added to the model based on survey data collected in 2019. This model was reviewed and accepted by NRW as part of the Lansdowne Hospital Development FCA (Planning Application REF: 21/02054/MJR) in 2020 and has subsequently supported several other successful FCAs across Cardiff. As such the JBA flood modelling of Cardiff is considered to represent the best available information to support this assessment.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequence Assessment (FCA).

3.1.2 1% AEP plus Climate Change Event

Error! Reference source not found. Figure 3-1 shows that the site is not predicted to flood during the 1% AEP plus climate change event. Flood water in this event is confined within Bute Park to the north of the A4161.

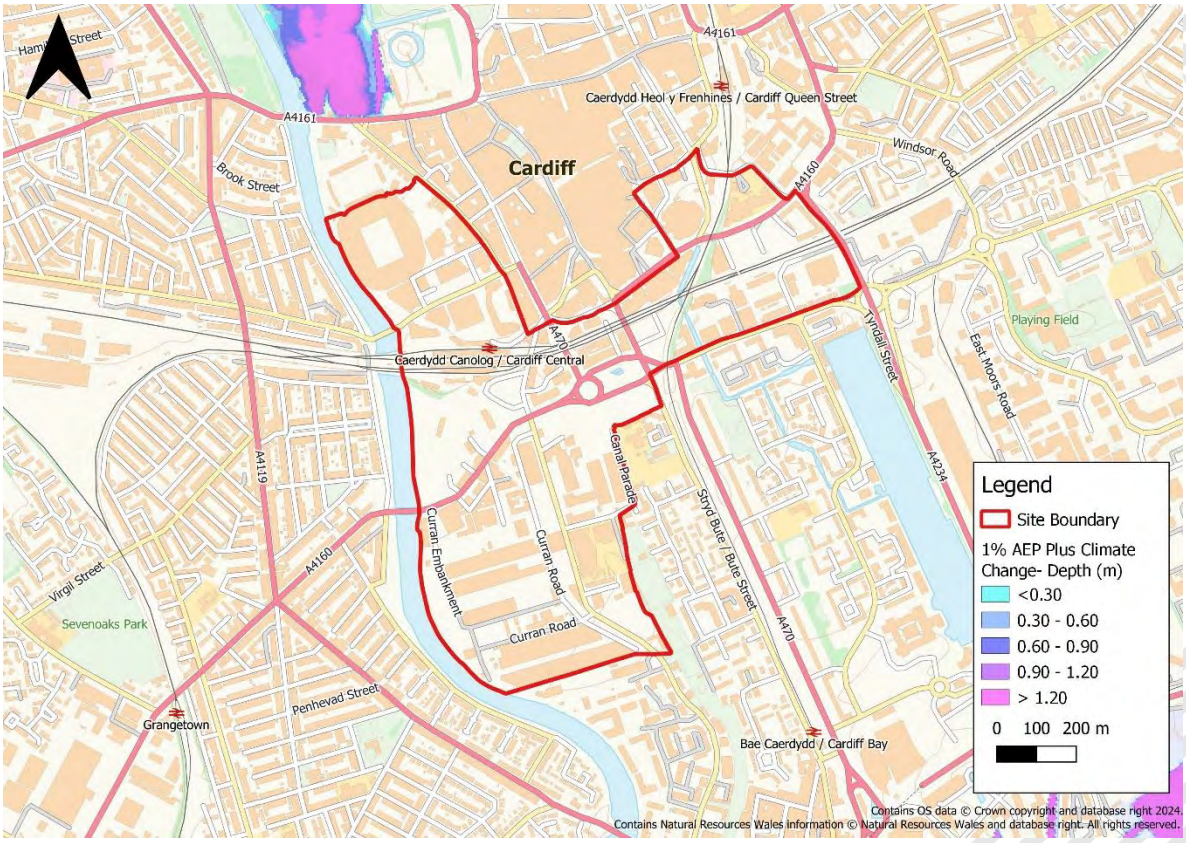

Figure 3-1 1% AEP plus climate change event: flood depths

3.1.3 0.1% AEP event plus Climate Change

During the 0.1% AEP plus climate change event, the flooding extent and flood depths are predicted to be greater than those predicted in the 1% AEP plus climate change event, as shown in Figure 3-2**Error! Reference source not found.**. The flood depths, velocities and flood level at the site are summarised Table 3-1**Error! Reference source not found.** below.

Flood depths across the majority of the site are highest in the northern vicinity, with flood depths of up to 3.4m predicted close to the Millennium Stadium and Cardiff Arms Park – north of the railway line.

Generally, flood depths are lower in the southern extent of the site, where ground levels are higher. South of the Cardiff Central Station depths are shown to exceed 1.2m, with the greatest depths found to the west of Canal Parade at 2.6m. Some areas in the far southwest of the site adjacent to Curran Road, and areas in the Northeast close to Churchill Way, remain flood-free during this event.

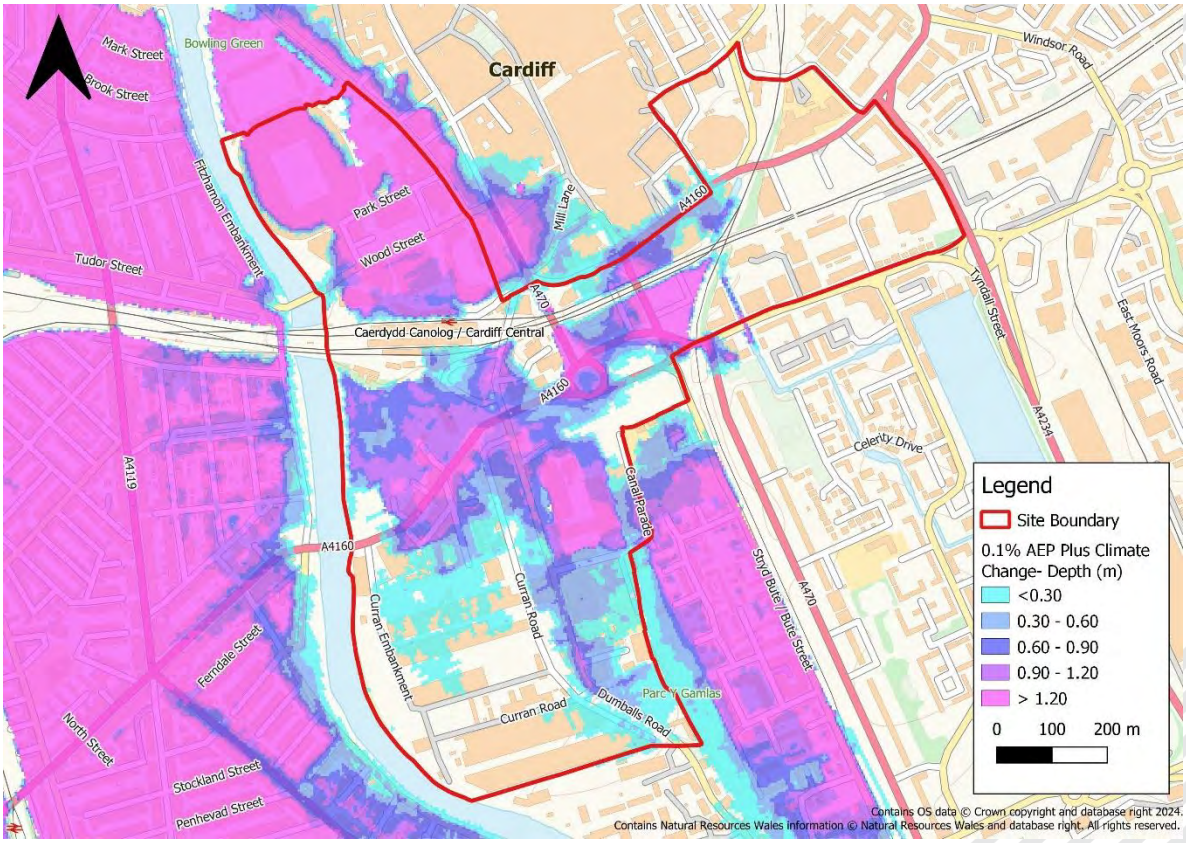

Figure 3-2 0.1% AEP plus Climate Change Event: Flood Depths

Table 3-1 0.1% AEP plus Climate Change Event Flood: Flood Model Results Summary

Flood Event	Flood Depths (m)	Maximum Flood Level (mAOD)	Flood Velocities (m/s)
0.1% AEP event	0 - 5.23	9.84	0-2.26

3.2 Flood Risk from the Sea

The NRW FRAW mapping shows the site to be predominately at very low risk from flooding via coastal mechanisms as seen in Figure 3-3. Areas of low risk are found to the far north of the site near Park Street and the Principality Stadium, the central areas south of Cardiff Central Station and land in the east of the site. These areas shown to be at tidal flood risk are also located within an area benefitting from flood defences, which is provided by the Cardiff Bay Barrage.

The water levels within Cardiff Bay are managed through the Cardiff Bay Barrage. The Cardiff Bay Barrage provides substantial tidal protection to Cardiff with a standard of protection greater than the 0.1% AEP plus climate change event. As such no further assessment is considered necessary from this waterbody.

As such, the site is deemed to be at **low risk** from coastal flooding as the risk is managed by defences and expected to be further managed and maintained in the future.

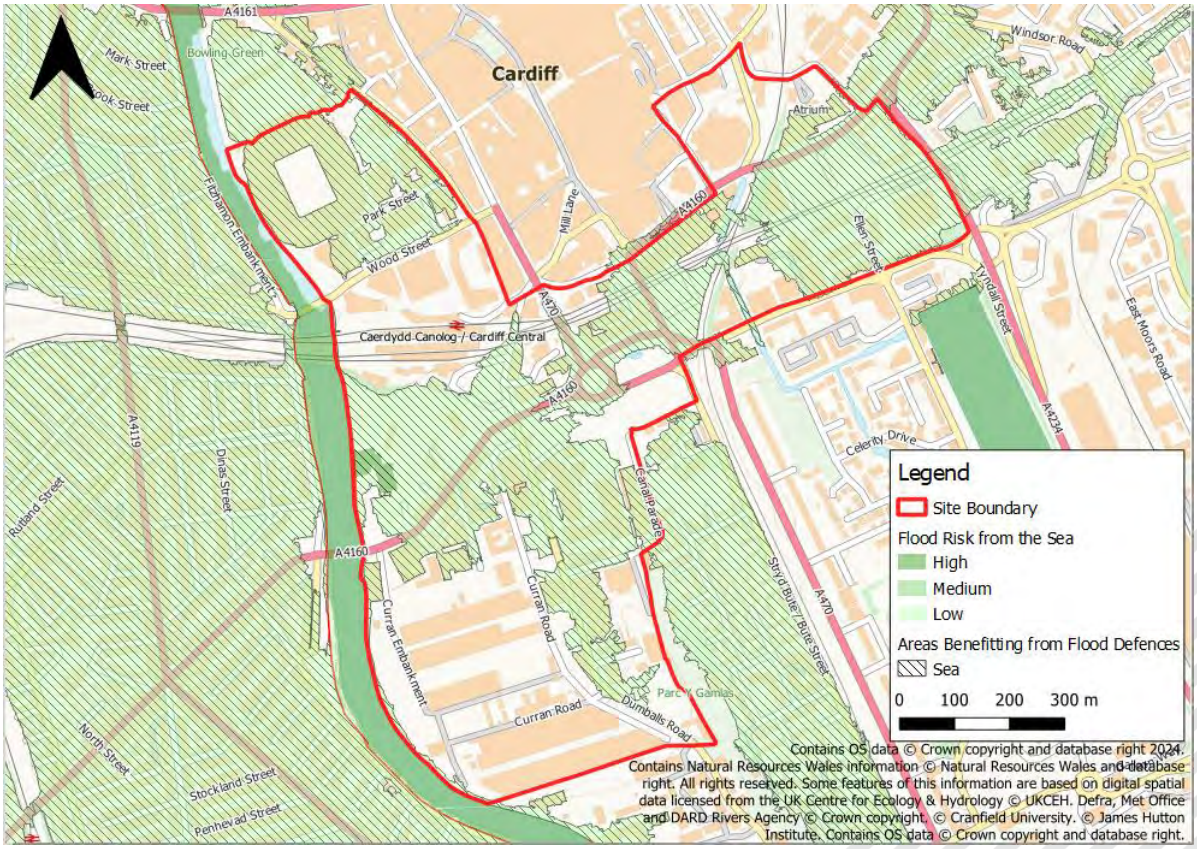

Figure 3-3 FRAW - The Sea

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is predominantly at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-3-4**Error! Reference source not found.**. This means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at these areas of the site.

Across the site are localised areas of surface water flooding which are shown to be between low – high risk, associated with roads and low topographic points. In the northeast of the site, south of the A4160, there is a relatively large area at low risk of surface water flooding. Low risk indicates between a 0.1% AEP and 1% AEP chance of flooding in any given year. Medium risk suggest between a 1% AEP and 3.3% AEP chance of flooding from these sources in any year, with high risk indicating a greater than 3.3% AEP risk of surface water and watercourse flooding.

The areas shown to be at high risk are along St Marys Street and Bute Street, which is likely to be associated with where roads pass under the railway tracks resulting in a localised decrease in ground levels.

The broadscale nature of surface water mapping may result in an overestimation of risk where local urban drainage networks are not included in modelling. Site-specific assessments should be undertaken to further establish the actual risk of surface water flooding across the development site.

It is recommended that surface water should be managed across the proposed candidate site through the use of SuDS techniques, managing surface water as close to the surface as possible, providing water quality, amenity, and biodiversity benefits.

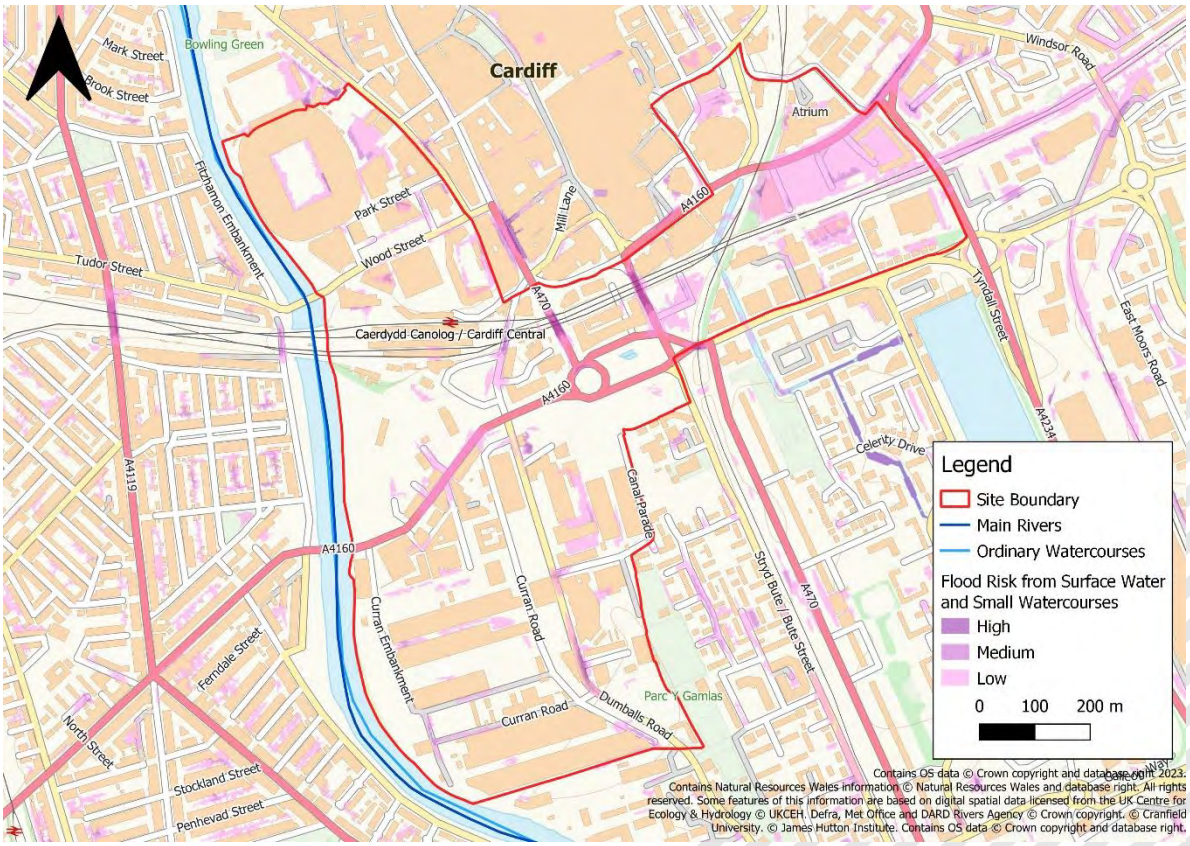

Figure 3-3-4 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

JBA has developed a range of Groundwater Flood Map products nationally. The 5m resolution JBA Groundwater Map has been used within the report. The modelling involves simulating groundwater levels for various return periods (including 1.33% year, 1%, and 0.5% AEP). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map

categorises the head difference (m) into five feature classes based on the 1% AEP model outputs.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, which would represent an extreme scenario. The maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often necessary for groundwater to have nowhere to go without ponding and flooding an area first.

The South East Wales Stage 1 SFCA includes JBA's Groundwater Flood map as part of the assessment and shows the proposed candidate site to have varying levels of risk emergence, as shown in Figure 3-5**Error! Reference source not found.**.

Most of the proposed site has a low risk of groundwater emergence. However, land in the east of the site is shown to have groundwater levels of between 0.025 and 0.5m below ground level, with some areas where groundwater levels are less than 0.025m below the surface. These areas pose a high risk of groundwater emergence.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad-scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding, this may include review of historical flood records, historical borehole logs, consultation with the LLFA and groundwater monitoring. It is likely that a form of groundwater assessment shall be required to inform the suitability of proposed SuDS at the development site.

There are no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the South East Wales Stage 1 SFCA. Furthermore, the Cardiff Local Flood Risk Management Strategy also states that "there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small".

It is therefore concluded that the groundwater flood risk is **low-medium**.

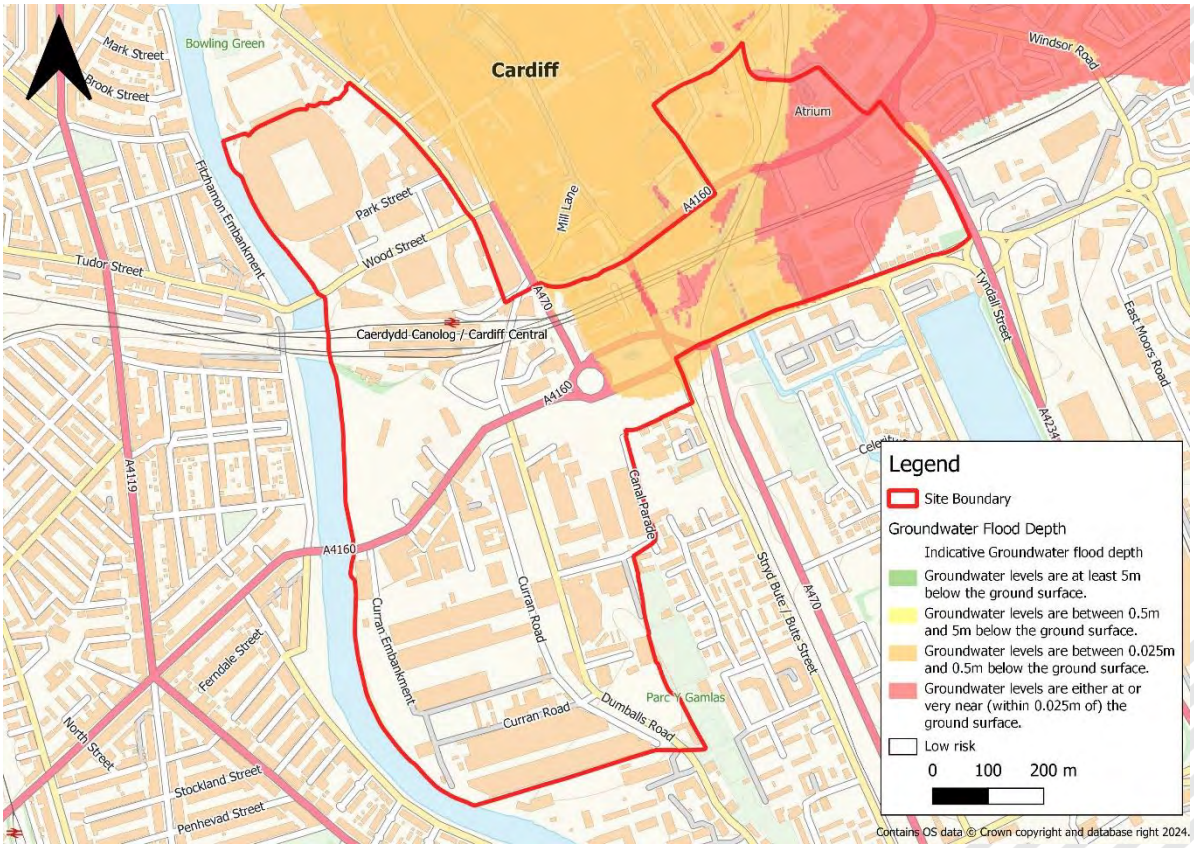

Figure 3-5 Groundwater Emergence Risk Map

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at risk of flooding from reservoir failure, as seen in Figure 3-6**Error! Reference source not found.**.

However, it is worth noting that reservoir flooding is extremely unlikely to occur as all large reservoirs must be inspected and supervised by reservoir panel engineers under the Reservoirs Act 1975.

Section 5.3 of TAN-15 states that "*reservoirs are maintained to very high standards in Wales and therefore the location of homes and businesses in reservoir inundation areas should not raise alarm. This information is presented to ensure open and constructive dialogue between planning authorities and reservoir operators or owners should development plans have implications for the risk categorisation of the reservoir*".

Given that the site is located in central Cardiff, it is unlikely that the risk categorisation of the reservoir would be re-categorised as a result of the proposals. Therefore, the risk of flooding from reservoir failure has been assessed to be **low**.

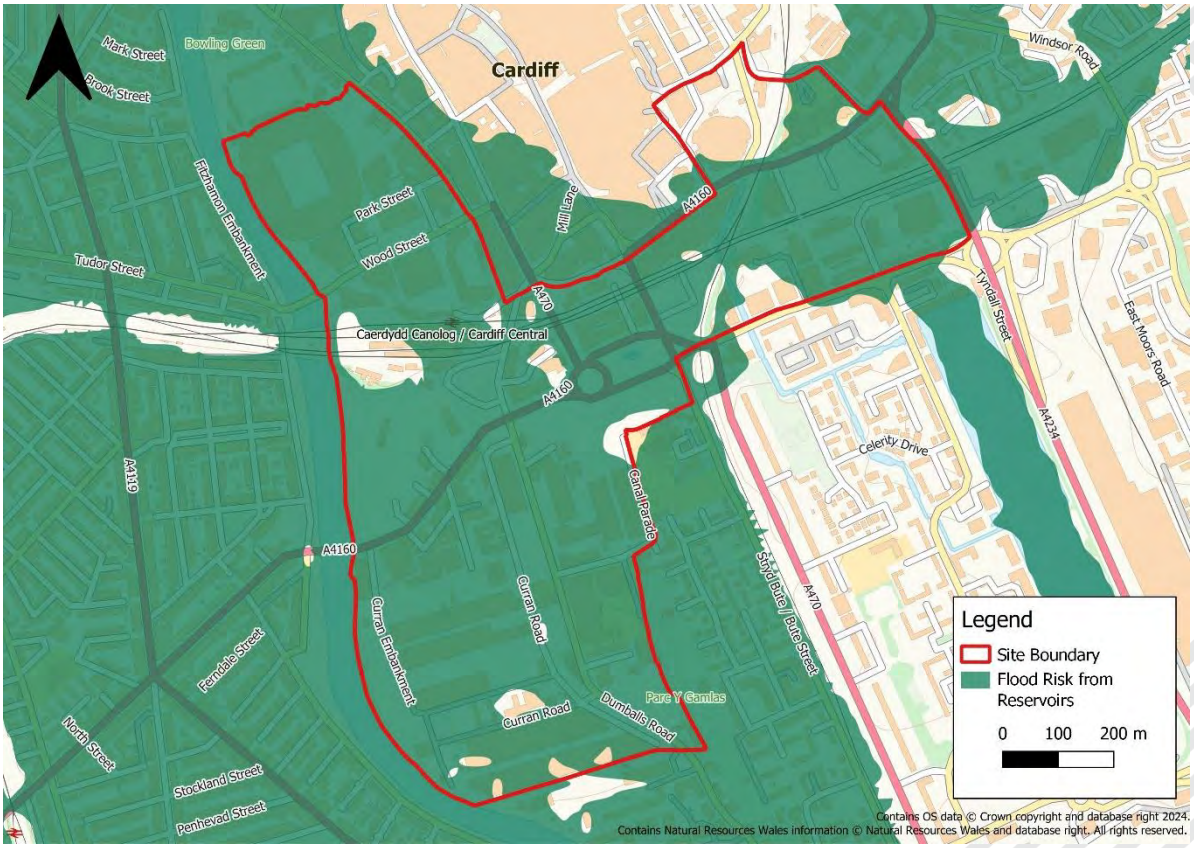

Figure 3-6 FRAW- Reservoirs

3.6 Flood Risk from Sewers

The South-East Wales Level-1 Strategic Flood Consequence Assessment (SFCA) has identified there to be a high number (260) of historic sewer flood incidents within the Butetown and Cathays ward boundaries of Cardiff, in which this candidate site is located. It should be noted that there is no further indication of where these sewer flood incidents occurred.

This area of Central Cardiff is predominately served by a combined sewer. It is likely that all surface water drains to this combined sewer. Combined sewers present a greater flood risk, especially in times of extreme rainfall when the sewers can become overwhelmed. Therefore, it has been assessed that there is a **low - medium** risk of sewer flooding for this site. Furthermore, it is likely, that improvements to existing drainage network and confirmation of capacity within the system will be needed before any development. Further assessment of the sewer flood risk should be undertaken as part of the Flood Consequences Assessment for the site to fully assess the risk posed by sewer flooding.

3.7 Summary of Flood Risk

The primary flood risk to the site is from fluvial and tidal sources. The site is at risk during the 0.1% AEP plus climate change fluvial event with significant flood depths in the areas of the site adjacent to the Millennium Stadium. Whilst tidal flooding is shown to pose a risk, this risk is managed by the presence of the Cardiff Bay Barrage and hence its position within a TAN-15 Defended Zone. The summary of the flood risk from all sources is shown in Table 3-2 below.

Table 3-2 Summary of Flood Risk

Source of Flooding	Risk
Rivers	Medium
Sea	Low
Surface Water and Small Watercourses	Predominantly Very Low, however, there are areas within the site at Medium and High risk
Groundwater	Low-Medium
Reservoir	Low
Sewers	Low-Medium

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it provides an indication as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP Flood Zones[1]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

1 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – Flood Risk from Rivers shows the site is predominantly located in in Flood Zone 2, with some areas in the north of the site located within Flood Zone 3, as shown in Figure 4-1. Areas shown to be within Flood Zones 2 and 3 are also shown as being located in a TAN-15 Defended Zone.

Areas within Flood Zone 2 represent areas with between a 0.1% - 1% AEP chance of flooding from fluvial sources in any given year, including an allowance for climate change. Flood Zone 3 indicates areas with a greater than 1% AEP chance of flooding, including an allowance for climate change. However, areas within a TAN-15 Defended Zone are areas that benefit from Risk Management Authority flood defences with a minimum standard of protection of 1 in 100 years (present day) for rivers.

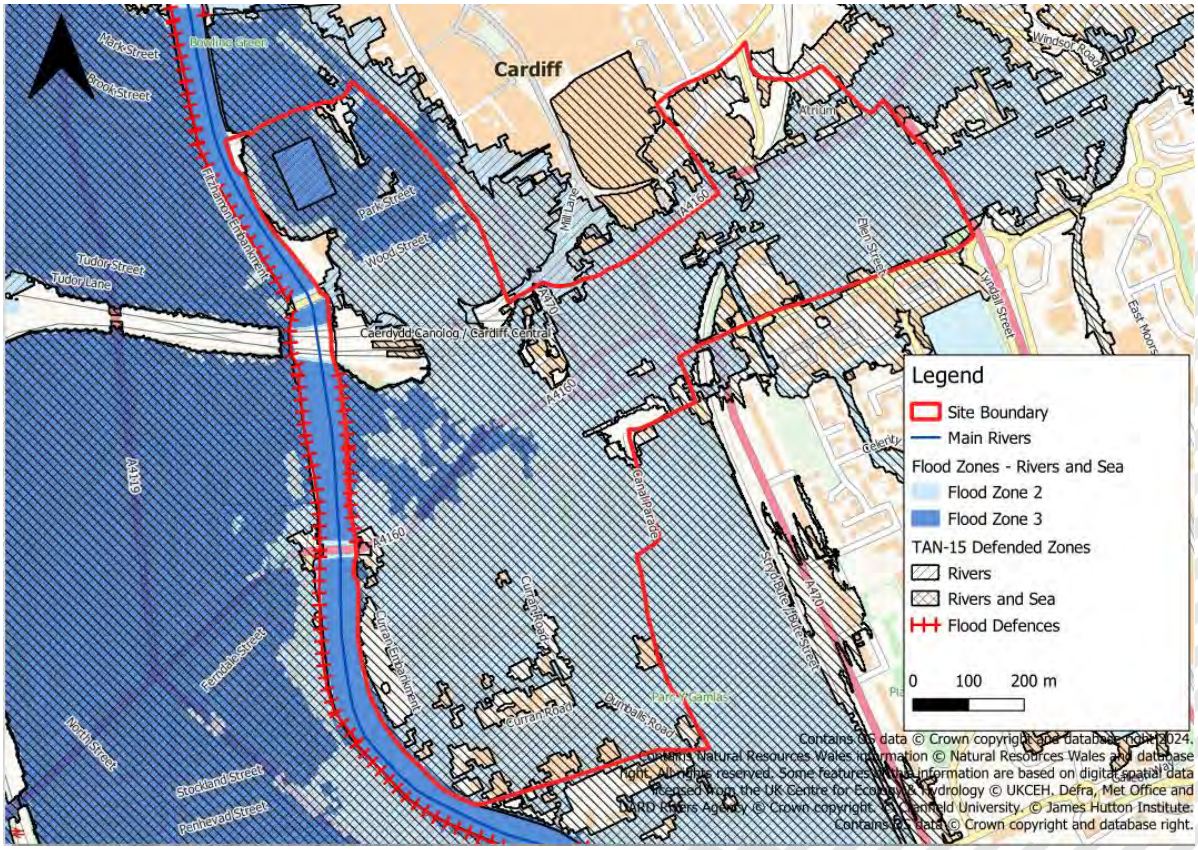

Figure 4-1 Flood Map for Planning- Rivers

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – Flood Risk from the Sea shows the site is located in Flood Zone 3, as shown in Figure 4-2. The site is located in a TAN-15 Defended Zone due to the area being protected from tidal flooding by the Cardiff Bay Barrage. This flood risk management infrastructure provides a 0.5% AEP minimum standard of protection against flooding from the sea.

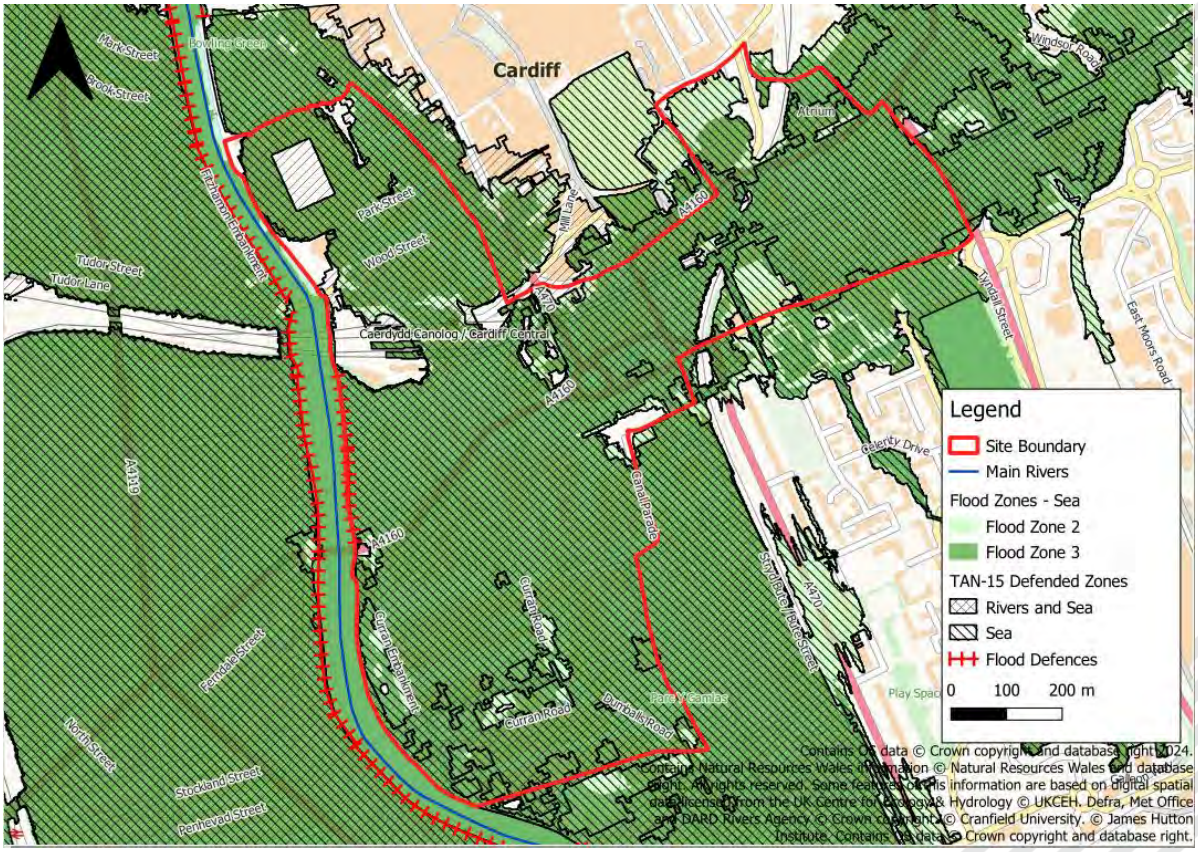

Figure 4-2 Flood Map for Planning- Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominantly located in Flood Zone 1, as shown in Figure 4-3.

Across the site, there are small, localised areas shown to be within Flood Zones 2 and 3, along with a large proportion of land in the northeast. These areas of surface water flooding are likely to be associated with localised topographic depressions. Other notable areas at high risk of surface water flooding are located along St Mary St and Bute St where the road passes under the railway line.

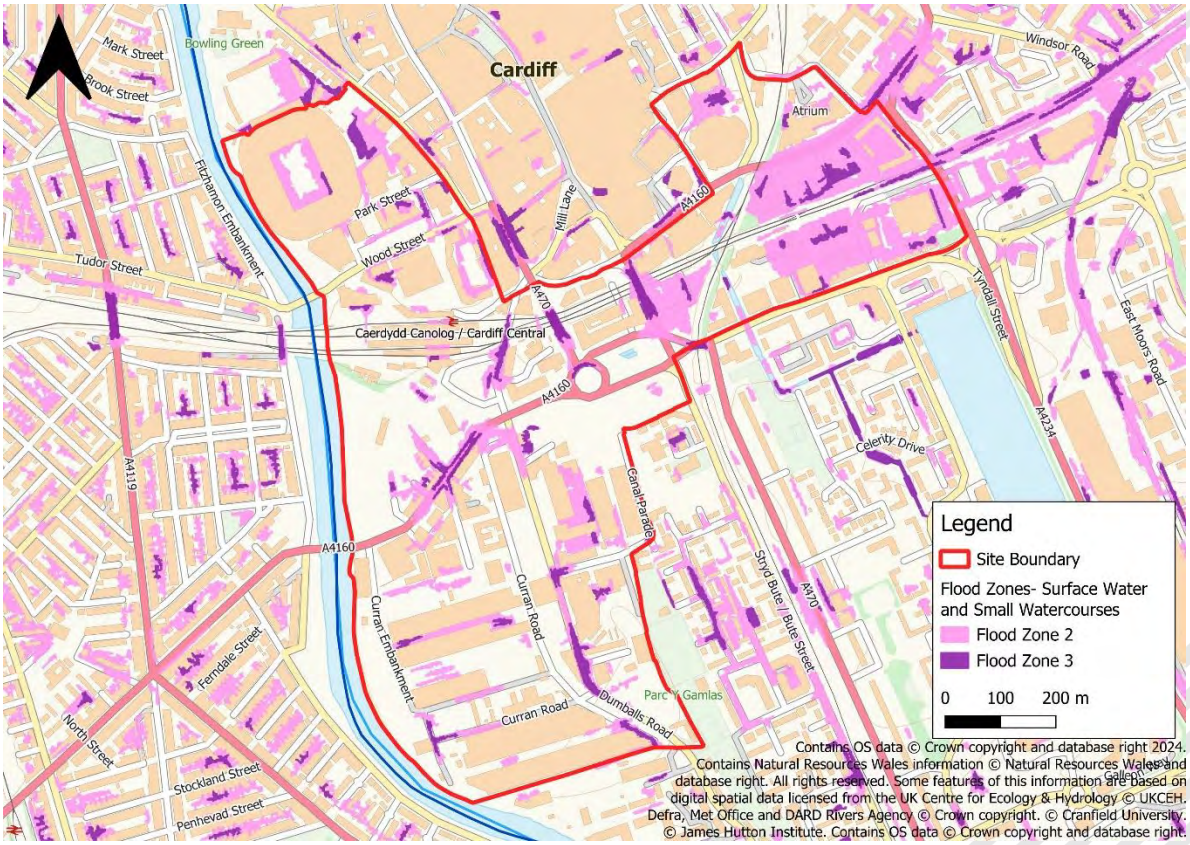

Figure 4-3 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for residential development it is classified as highly vulnerable development.

Table 4-2 Development vulnerability categories[2]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites, caravan parks and camping sites). Schools and childcare establishments, colleges, and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in time of flood.
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

2 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice in relation to four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of redevelopment.

The consultation draft of the new TAN-15 defines Redevelopment as *"development that proposes to replace a building with an existing use (in full or in Part) with a new building."*

Furthermore, TAN-15 states that:

"Proposals for redevelopment, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient than the expectation is that planning permission will not be granted (TAN-15 para 4.5).

Where buildings in flood risk areas are currently in use, there may be circumstances where redevelopment, changes of use or conversion proposals can bring clear benefits to the area and the building. These should be balanced and weighed against the flood risk considerations (TAN-15 para 10.4)."

The current consultation draft of the revised TAN-15 appears to support redevelopment if these changes can further increase the resilience of a building. For the time being and to the best of our knowledge, the proposed site will be classified as a 'redevelopment' for the application of TAN-15 and the Justification Test.

4.4 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The justification requirements for 'Redevelopment' are less onerous than 'new development', and a clear distinction is drawn been the two forms of development.

The requirements of the Justification Test are summarised in Table 4-3.

Table 4-3 Justification Test[3]

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>Development will be justified in the TAN 15 Defended Zones if:</td><td>Development will be justified in Zone 2 if:</td><td>Development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.</td></tr>
</table>

3 TAN-15, Section 10

4.5 Acceptability Criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'Acceptability Criteria'. There are three principal aspects to the Acceptability Criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depend on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[4]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[5]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water-compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

4 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
5 TAN-15, Figure 6

4.6 Summary of Policy Position

The proposed development of the site is for redevelopment purposes to construct residential dwellings. The development is considered to be 'redevelopment' as defined by TAN-15.

The site is located within the TAN-15 Defended Zone. All forms of development are permissible within the TAN-15 Defended Zone.

Additionally, as the site is for 'redevelopment' the Justification Test requirements are less onerous, and requires the scheme to demonstrate resilience to flooding, and satisfy the requirements of the Acceptability Criteria.

The primary sources of flood risk to the site are associated with tidal and fluvial sources. Tidal flood risk is mitigated by the presence of the Cardiff Bay Barrage, to the south of the development site. In relation to tidal flood risk, it is anticipated that the site shall be flood free in all design events.

However, risks associated with fluvial flooding are more significant for the most extreme event, exceeding indicative depths of acceptable flooding during the 0.1% AEP plus climate change event. As 'redevelopment', proposals may be considered more favourably given the site location, and the opportunities to increase the resilience of existing infrastructure in this area. Proposals should aim to avoid an intensification of development or increase in risk across the site. However, a balance should be sought between flood risk considerations and redevelopment bringing clear benefits to regeneration of the area and the proposed developments (as per TAN-15 para 10.4).

In order for the site to be deemed appropriate for residential purposes, mitigation measures are likely to need to be considered and supported by detailed flood modelling, presented in a site specific FCA for any future redevelopment proposals. It shall be for the LPA and NRW to determine if proposals are acceptable.

5 Conclusion

Site Description

- JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Cardiff Central Enterprise Zone (residential use).
- The site is located in the centre of Cardiff. The site comprises a predominantly developed area made up of a mixture of development types including residential and commercial as well as transport infrastructure and sports grounds.

Overview of flood risk

- The primary risk of flooding to the site is from fluvial sources. Detailed flood modelling indicates that during the 0.1% AEP plus climate change event, flood depths in some areas of the site are predicted to reach up to 3.4m, with large areas of the site shown to flood to depths greater than 1.2m.
- The site is at low risk from tidal flooding and shown to benefit from tidal flood defences. This defence against tidal flooding is predicted to be managed and maintained in the future; therefore reducing the risk at the site to low.
- The site is predominately at very low risk of surface water and small watercourse flooding; however, the level of flood risk varies across the site.
- The site is predominantly low risk of flooding from groundwater sources and reservoir flooding. However, in regard to groundwater flooding caution should be taken especially in areas in the east of the site.
- The site is at low-medium risk from sewer flooding, with further investigation recommended as part of future site-specific Flood Consequence Assessments.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to support 'redevelopment'. Redevelopment within any Flood Zone is required to satisfy the Justification Test and Acceptability of Consequences.
- Site specific Flood Consequence Assessments for future redevelopment proposals for areas at no or low risk from flooding may be able to meet the requirements of the Justification Test and Acceptability Criteria.
- Mitigation measures such as ground raising, supported by detailed modelling, will be required for the majority of the site in order for redevelopment proposals to demonstrate they can meet the Acceptability Criteria of TAN-15.
- As 'redevelopment', proposals may be considered more favourably given the site location, and the opportunities to increase the resilience of existing infrastructure in this area.

Conclusion

- Given the known risks to the site, flood risk management should be considered carefully to facilitate future development. In order for the site to be deemed appropriate for residential purposes, mitigation measures shall need to be considered and supported by detailed flood modelling, presented in a site specific FCA for any future redevelopment proposals. It shall be for the LPA and NRW to

determine if proposals are acceptable, striking a balance between flood risk and the clear benefits of regeneration of key areas of the city centre.

Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	George Williams
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc MCIWEM C.WEM
Subject	Image House, East Tyndall Street- Flood Risk Appraisal

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA) for a site considered for allocation in its replacement Local Development Plan; Image House, East Tyndall Street. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site per Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling, where available.

2 Site Description

The proposed development site is located north of East Tyndall Street, Cardiff as shown in Figure 2-1. Bounding the site is a Lidl supermarket to the west, residential development to the north, and an existing industrial unit to the east. Further residential areas are found to the south of East Tyndall Street Currently, the site is for commercial/ employment premises with warehouse areas and office space, in use by photography specialists.

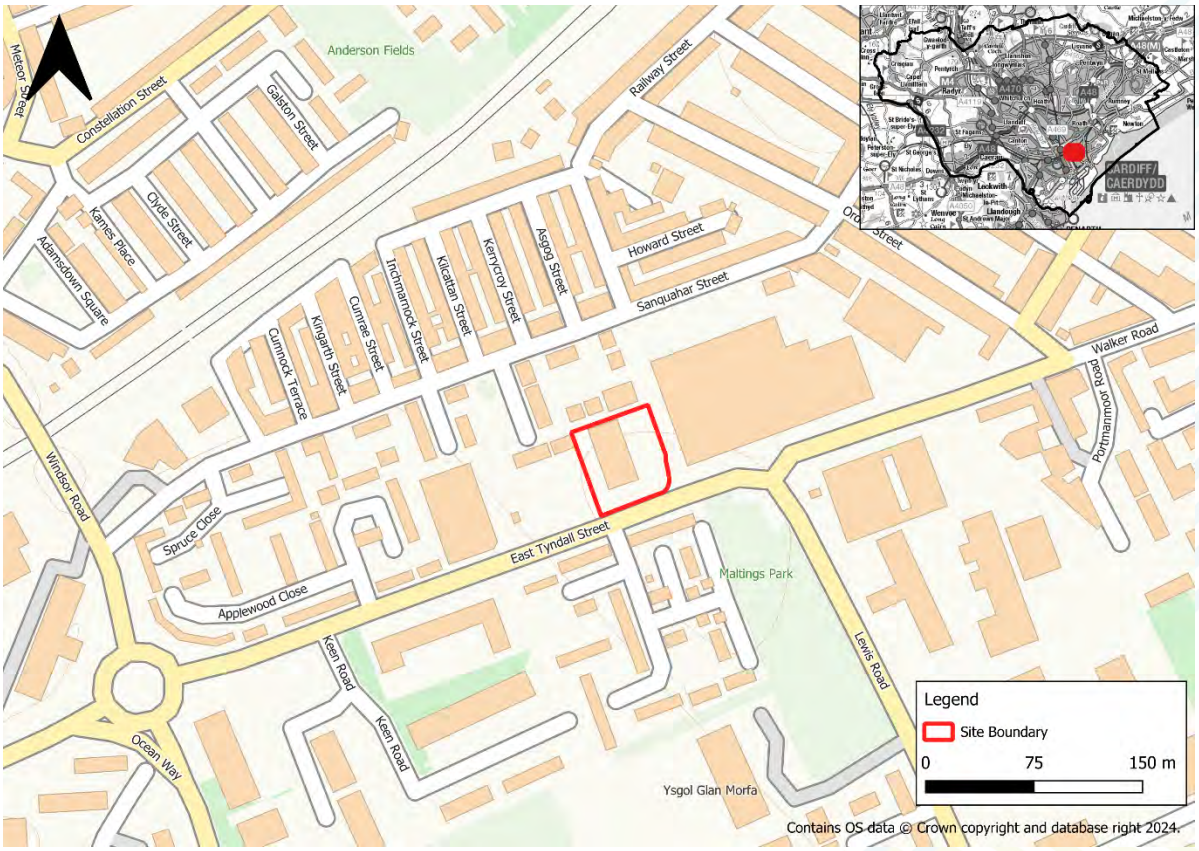

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development at this site is for Residential use and has been outlined as an affordable housing development.

2.2 Watercourses and Flood Defences

No main rivers or ordinary watercourses cross the proposed development site, as shown in Figure 2-2 below. The nearest main river is the River Taff which is located approximately 1.8km to the west of the proposed site. The River Rhymney is located approximately 2km to the west of the site. The site is not located in an area that currently benefits from the presence of flood defences.

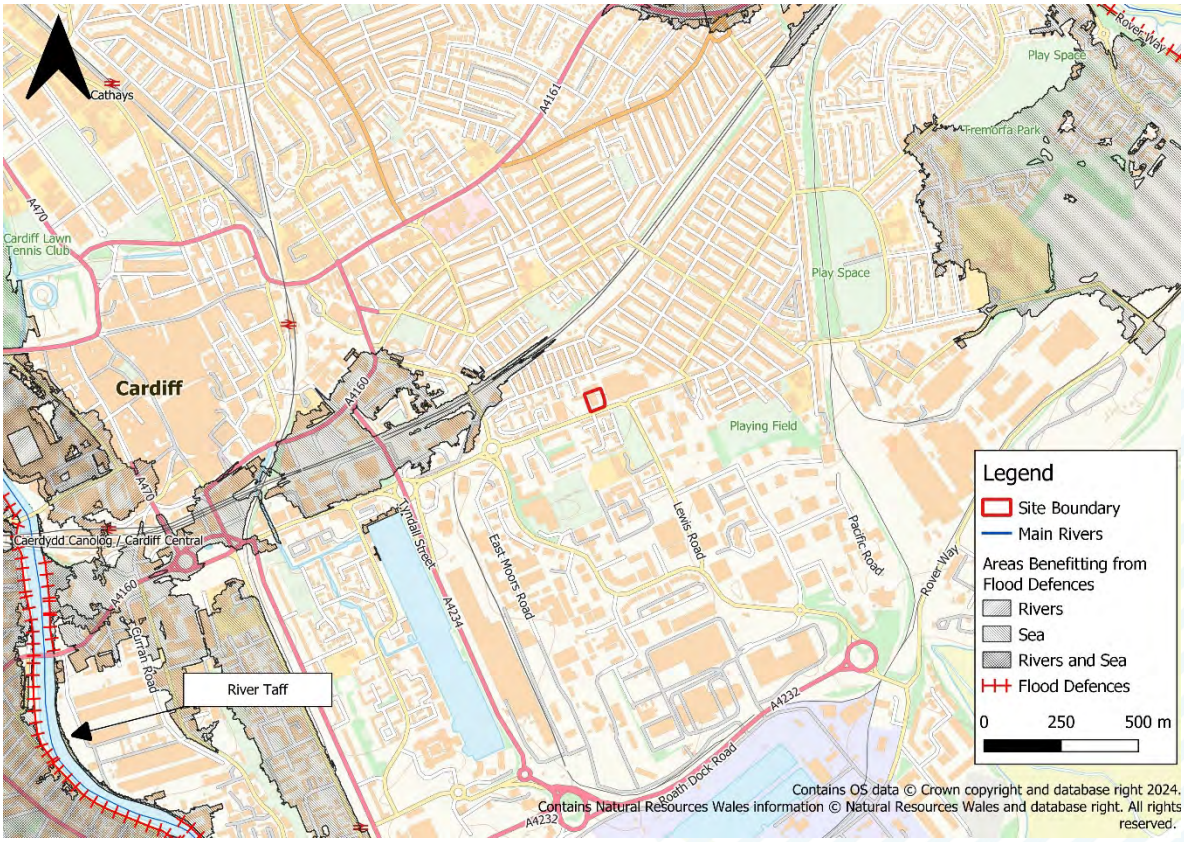

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the proposed development site is relatively flat with levels on site ranging between approximately 8.78mAOD and 9.66mAOD. The highest elevation of 9.66mAOD can be found in the southwest corner of the site on the boundary with East Tyndall Street, and the lowest elevation is found in front of the existing building of Image House.

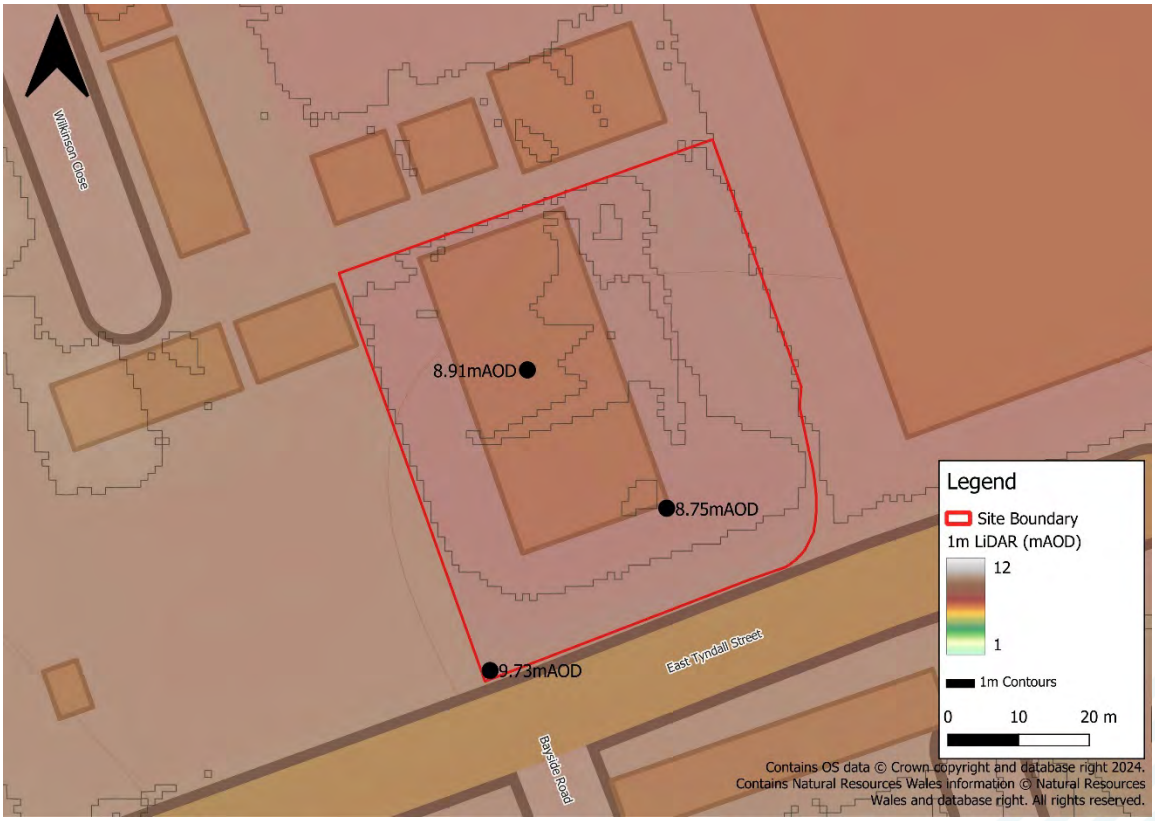

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from Rivers. This means that there is a less than 0.1% (1 in 1000 year) AEP chance of fluvial flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW FRAW mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% (1 in 1000 year) AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

However, FRAW does not take into account the impacts of climate change which should be considered in line with the requirements of TAN-15. Therefore, to fully assess the level of tidal flood risk to the site, detailed modelling has been used to consider the risk further, and is detailed below.

3.2.1 Model Availability

A detailed tidal flood model for Cardiff and the River Rhymney was developed by JBA Consulting in 2020 and updated in 2022. The updated model was used to simulate results for a 100-year lifetime of development, to the year 2122. Furthermore, the model simulated the risk of flooding with and without the Cardiff Coastal Flood Defence Scheme. For this assessment, only the defended scenario with the new defences has been used due to the commencement of construction works for the defences in 2024.

3.2.2 Model Results

Figure 3-1 and Figure 3-2 indicate that the site is predicted to be flood-free in both the 2121 0.5% AEP and 2121 0.1% AEP events.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequence Assessment (FCA).

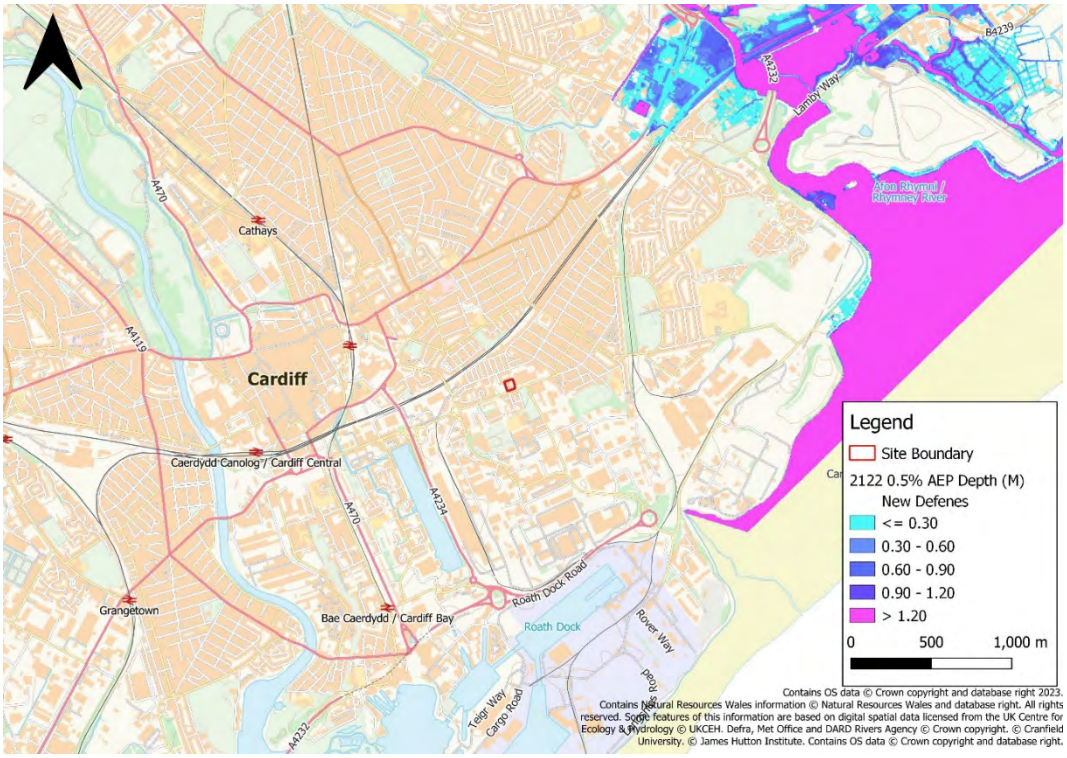

Figure 3-1 2122 0.5% AEP plus Climate Change Event

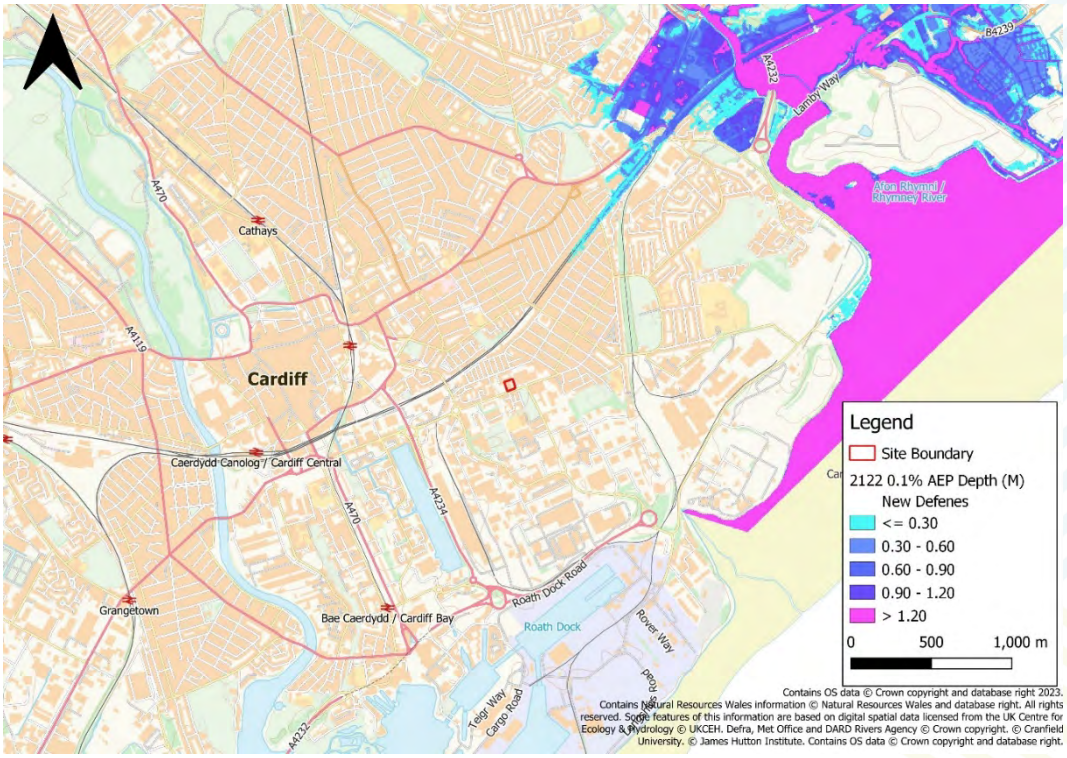

Figure 3-2 2122 0.1% AEP plus Climate Change Event

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is at **very low to low risk** of flooding from surface water and small watercourses, as shown in Figure 3-3. This means that each year, this area has a chance of flooding between 0.1% (1 in 1000 year) and 1% (1 in 100 year).

This area of **low** risk has been associated with a topographic depression within the car park which is lower than the adjacent highway and ground levels at the southern boundary of the site. This results in surface water ponding around the existing Image House building on site.

TAN-15 requires an assessment of surface water flood risk for the lifetime of the development, for the 1% AEP and 0.1% AEP events with an allowance for climate change. The low risk designation of the surface water flood risk on the FRAW mapping product indicates that the site is predicted to be flood free in the 1% AEP event.

NRW have made available for this study data relating to surface water flood risk with an allowance for climate change. Predicted surface water flood depths for the 0.1% AEP plus climate change event are in the region of 300mm.

It is envisaged that the predicted surface water flood risk to the site can be managed through the good site design and application of an adequate surface water drainage strategy that makes use of SuDS features, in line with the statutory standards for SuDS in Wales.

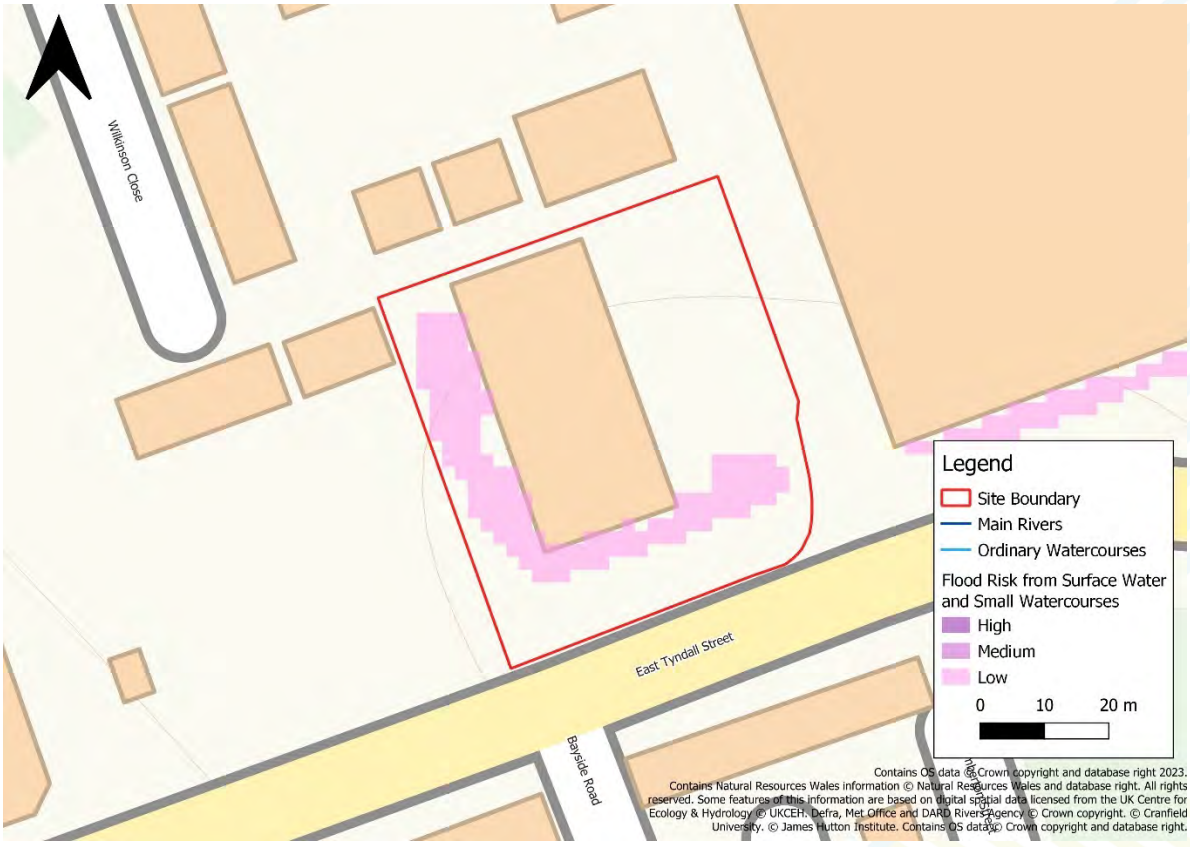

Figure 3-3 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

JBA has developed a range of Groundwater Flood Map products nationally. The 5m resolution JBA Groundwater Map has been used within the report. The modelling involves simulating groundwater levels for various return periods (including 1.33% year, 1%, and 0.5% AEP). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 1% AEP model outputs.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, which would represent an extreme scenario. The maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often necessary for groundwater to have nowhere to go without ponding and flooding an area first.

The South East Wales Stage 1 SFCA includes JBA's Groundwater Flood map as part of the assessment and shows the proposed site to have varying levels of risk of emergence, as seen in Figure 3-4.

Across the majority of the proposed candidate site, there is a high risk of groundwater emergence with groundwater modelled to be either at or very close (within 0.025m) of the surface.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad-scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding, this may include review of historical flood records, historical borehole logs, consultation with the LLFA and groundwater monitoring. It is likely that a form of groundwater assessment shall be required to inform the suitability of proposed SuDS a the development site.

There are no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the South East Wales Stage 1-SFCA. Furthermore, the Cardiff Local Flood Risk Management Strategy[1] also states that "there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small".

Therefore, it has been assessed that the risk of groundwater flooding at this site is **medium to high**.

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx

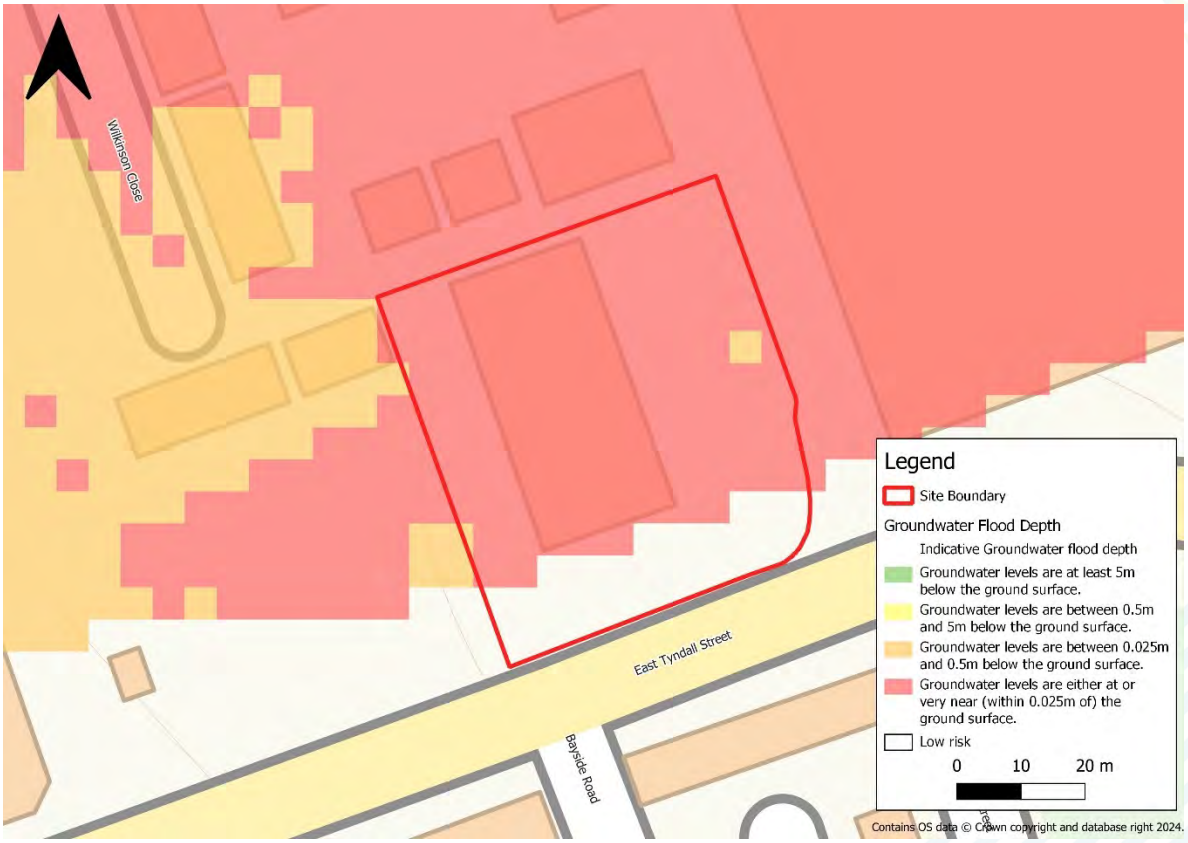

Figure 3-4 Groundwater Emergence Risk Map

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at risk of flooding from reservoir failure, as seen in Figure 3-5. Areas at risk are focused on the central areas of the site, including most of the footprint of the existing building.

However, it is worth noting that reservoir flooding is extremely unlikely to occur as all large reservoirs must be inspected and supervised by reservoir panel engineers under the Reservoirs Act 1975.

Section 5.3 of TAN-15 states that "*reservoirs are maintained to very high standards in Wales and therefore the location of homes and businesses in reservoir inundation areas should not raise alarm. This information is presented to ensure open and constructive dialogue between planning authorities and reservoir operators or owners should development plans have implications for the risk categorisation of the reservoir*".

Given the sites location in central Cardiff, it is unlikely that the risk categorisation of the reservoir would be re-categorised as a result of the proposals.

Therefore, the risk of flooding from reservoir failure has been assessed to be **low**.

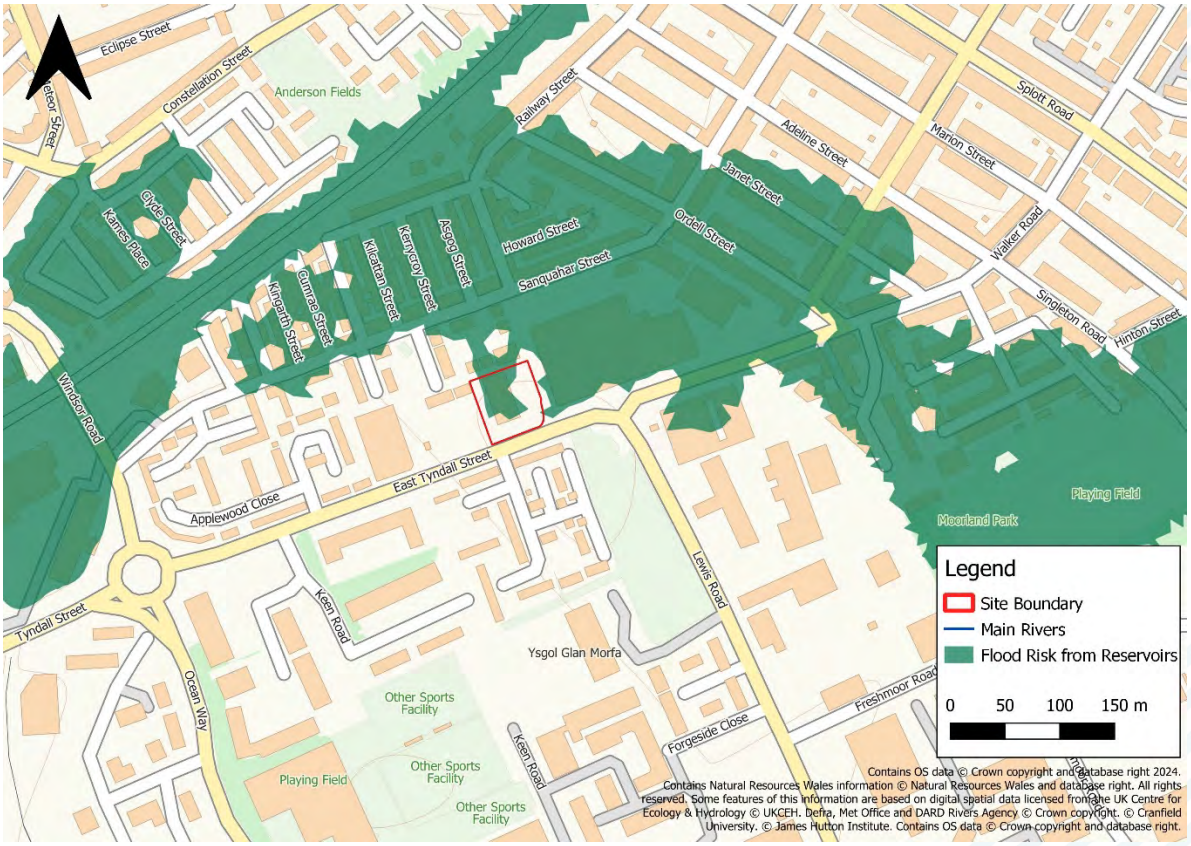

Figure 3-5 FMfP Flood Risk from Reservoirs

3.6 Flood Risk from Sewers

The South-East Wales Level-1 Strategic Flood Consequence Assessment (SFCA) has identified there to be a high number (175) of historic sewer flood incidents within the Splott electoral ward in which this candidate site is located. The current location of the existing sewers is unknown and further assessment of sewer flood risk would need to be undertaken as part of the Flood Consequences Assessment for this site to fully assess the risk posed by sewer flooding. With there being a high number of historic flood events and the current location of the existing sewers not known, the risk posed by sewer flooding is currently assessed to be **medium**.

3.7 Summary of Flood Risk

The primary source of flood risk to the site is surface water associated with ponding against the existing building where ground levels are lower than the adjacent highway and southern boundary of the site. This risk is low and is likely to be viably managed through good on-site design and an adequate surface water drainage strategy serving the site.

The site is located within an area benefitting from flood defences in the form of the Cardiff Bay Barrage and the new Cardiff Coastal Defence scheme, on which construction started in 2024. The site is predicted to be flood free from tidal sources in all design events.

The risk from all sources of flooding has been summarised in Table 3-1.

Source of Flooding	Risk
River	Very Low
Sea	Very low
Surface Water and Small Watercourse	Low
Groundwater	Medium to High
Reservoir	Low
Sewer	Medium

Table 3-1 Summary of Flood Risk

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published in January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – flood risk from rivers shows the site is in Flood Zone 1. No figure has been provided Flood Zone 1 is depicted as a transparent layer on the FMfP.

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – flood risk from the sea shows the site is in Flood Zones 2 and 3, with the entire footprint of the current building within Flood Zone 3, as shown in Figure 4-1 below. Flood Zone 2 represents areas with 0.1% to 0.5% (1 in 1000 to 1 in 200) chance of flooding from the sea in a given year, including the effects of climate change. Whereas Flood Zone 3 represents areas with more than 0.5% (1 in 200) chance of flooding from the sea in a given year, including the effects of climate change.

However, the site is within a TAN-15 Defended Zone for sea, meaning it is protected up to the 0.5% AEP event, (including climate change and a freeboard if the defences were constructed after 2016).

Whilst the current TAN-15 Defended Zone shall not reflect the climate change uplift and freeboard as the defences were not constructed post-2016, it is envisaged that the TAN-15 Defended Zone designation shall be retained and shall reflect these allowances post-construction of the Cardiff Coastal Defence Scheme.

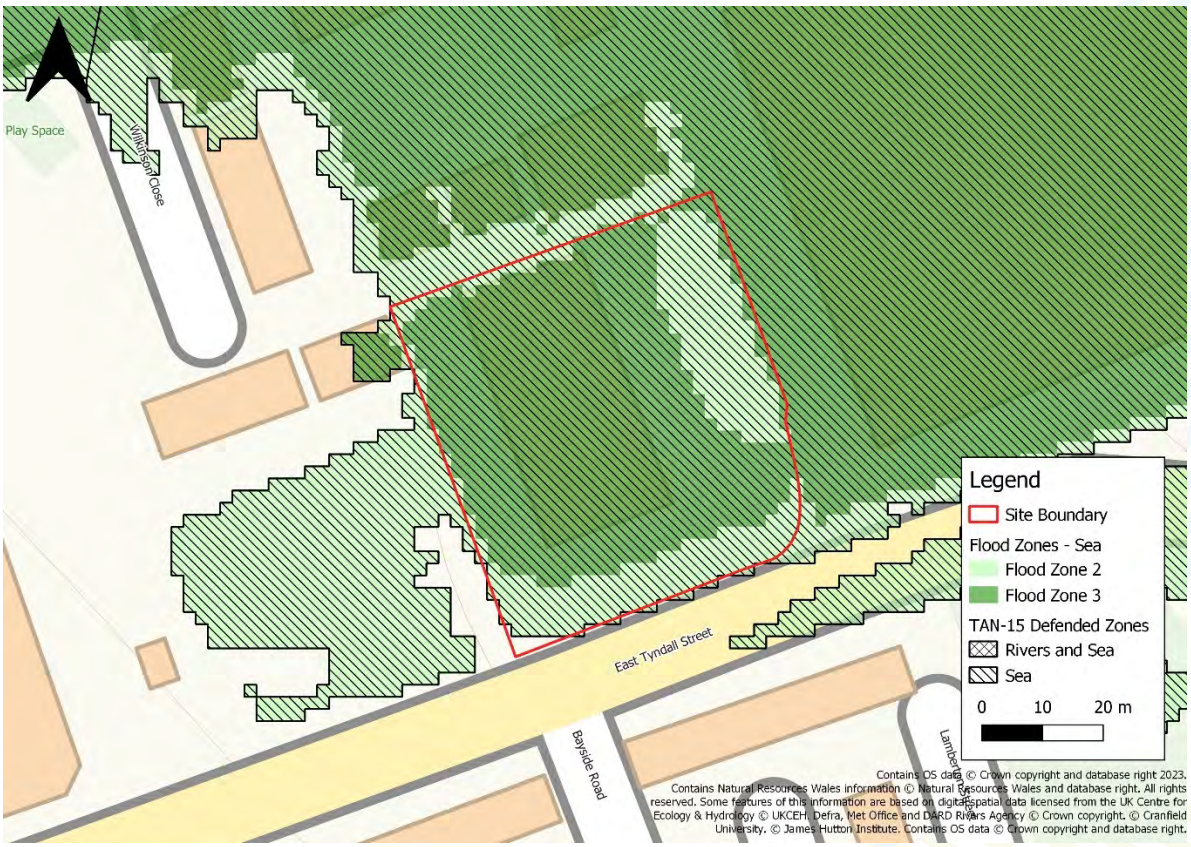

Figure 4-1 FMfP- Flood Risk from the Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominantly located in Flood Zone 1 for Surface Water and Small Watercourses, as shown in Figure 4-2.

However, the site is also partially located within Flood Zone 2 and Flood Zone 3 of the FMfP. Flood Zone 2 represents areas with a 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. Whereas Flood Zone 3 represents areas with more than 1% (1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change.

Areas in Flood Zone 2 are located immediately to the east and south of the current building (Image House) located on the site. Areas in Flood Zone 3 are located in the car park directly to the south of the existing building.

TAN-15 suggests that a Flood Consequences Assessment shall be required for any site located within the surface water flood zones. However, it is likely that surface water flood risk shall be managed through an adequate surface water drainage strategy and this shall be sufficient to meet the requirements of the SuDS Approval Body (SAB).

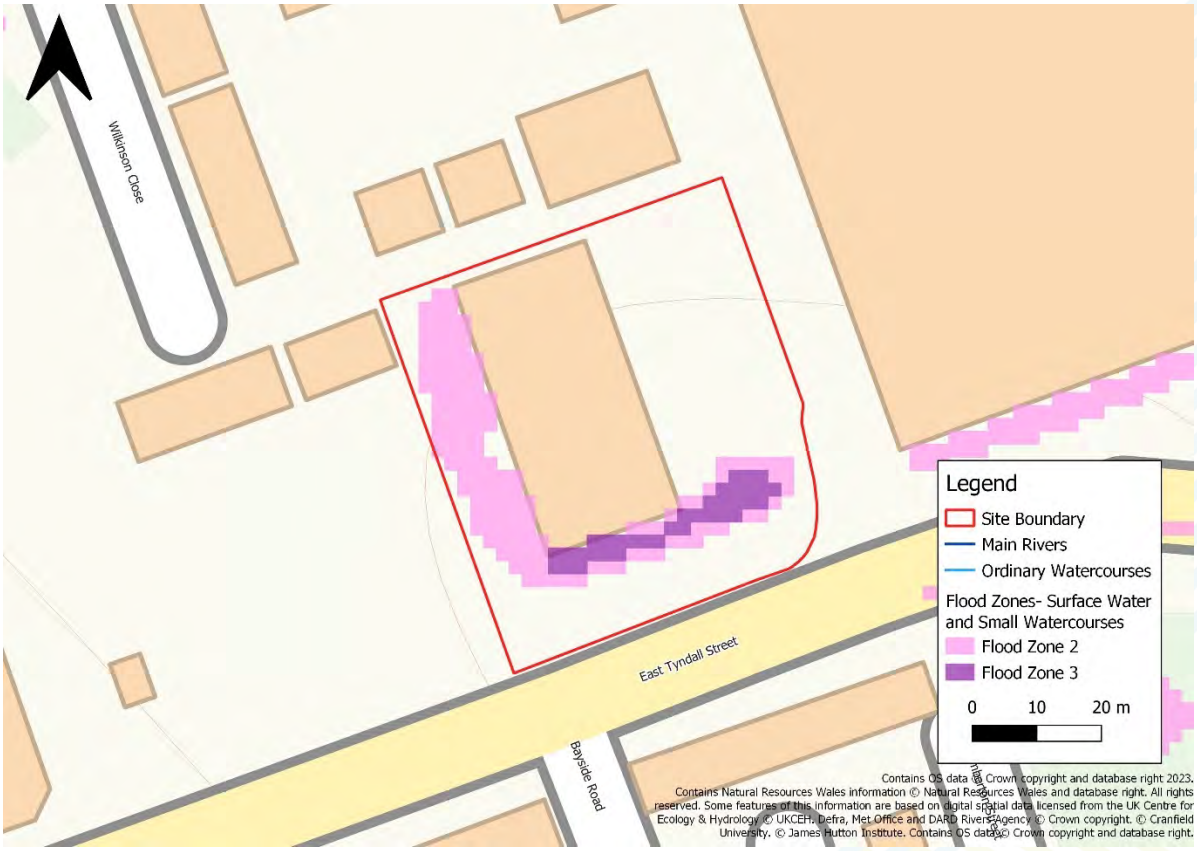

Figure 4-2 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for residential development it is classified as a highly vulnerable development.

Table 4-2 Development vulnerability categories[3]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood.
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of **Redevelopment**.

The TAN-15 states that: *The **redevelopment** of existing buildings in flood risk areas can present decision-makers with difficult decisions. There may be circumstances where the planning authority may be sympathetic to changes of use or conversion proposals which bring clear benefits to the area and the building.*

Furthermore, TAN-15 states that:

*Proposals for **redevelopment**, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient then the expectation is that planning permission will not be granted (TAN-15 para 4.5).*

For the time being and to the best of our knowledge, the proposed site will be classified as a '**redevelopment**' for the purposes of TAN-15 and the application of the Justification Test.

4.4 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The justification requirements for 'redevelopment' are less onerous than 'new development', and a clear distinction is drawn been the two forms of development.

The requirements of the Justification Test are summarised in Table 4-3 and the proposed development has been assessed against the requirements of the Justification Test with the results summarised in Section 4.6.

Table 4-3 Justification Test[4]

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>The development will be justified in the TAN 15 Defended Zones if:</td><td>The development will be justified in Zone 2 if:</td><td>The development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or[5]</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable by the criteria contained in section 11 of TAN-15.</td></tr>
</table>

4 TAN-15, Section 10

[5] This has not been included within the current draft of TAN-15 however it is our understanding that this section should include this.

4.5 Acceptability Criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'acceptability criteria'. There are three principal aspects to the acceptability criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depend on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[6]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[7]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water-compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

Note: The extreme flood event is defined as the 0.1% AEP flood event

6 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
7 TAN-15, Figure 6

4.6 Summary of Policy Position

The proposed development of the site is for redevelopment purposes to construct residential dwellings, likely in the form of affordable housing. The development is considered to be 'redevelopment' as defined by TAN-15.

The site is located within the TAN-15 Defended Zone. All forms of development are permissible within the TAN-15 Defended Zone.

Additionally, as the site is 'redevelopment' the Justification Test requirements are less onerous with a requirements for a development that is resilient to flooding or that the potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable.

The primary source of flood risk to the site is surface water associated with ponding against the existing building where ground levels are lower than the adjacent highway and southern boundary of the site. This risk is low and is likely to be viably managed through good on-site design and an adequate surface water drainage strategy serving the site.

A review of detailed model availability demonstrates that the site is predicted to be flood free from both the 2122 0.5% AEP and 2122 0.1% AEP tidal flood events.

We therefore conclude that the proposed development is permissible in its proposed location on the grounds of flood risk.

5 Conclusion

Site Description

- Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Image House East Tyndall Street for residential use.
- Currently the site is used for commercial/ employment use with warehouse areas and office space in use by photography specialists.
- The site is located to the north of East Tyndall Street and is predominantly flat in topography.

Overview of flood risk

- The site is considered to be at risk from tidal sources. However detailed modelling shows that the site is to be flood-free during both the 2122 0.5% AEP event and the 2122 0.1% AEP event, and is currently located within a TAN-15 Defended Zone. Furthermore, the site is expected to remain in TAN-15 Defended once the new Cardiff Coastal flood defences are constructed and operational;
- The Site was at low risk from surface water and small watercourse flooding. This is anticipated to be managed through good site design and an adequate surface water drainage strategy.
- The site is at very low risk of fluvial flooding, and low risk from flooding from reservoir failure. The site has a medium to high risk of flooding from sewers, and there is a medium to high risk of groundwater emergence.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to support 'redevelopment' over new 'development'. Furthermore, the site is within a TAN-15 Defended Zone, which will likely be seen as favourable.
- Redevelopment within any flood zones is required to satisfy the Justification Test and acceptability criteria.
- The Site meets the requirements of the Justification Test.
- The site meets the requirements of the acceptability criteria as it is predicted to be flood-free for both the 0.5% and 0.1% AEP tidal events . Surface water is anticipated to be managed through good site design and an adequate surface water drainage strategy

Conclusion

- It is concluded that on the grounds of flood risk, development proposals do comply with the aims and objectives of TAN-15 and Planning Policy Wales.

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Porth Teigr and Alexandra Head. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site per Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development, flooding, and coastal erosion and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located at Porth Teigr and Alexandra Head, Cardiff as shown in Figure 2-1. The site comprises brownfield land and commercial buildings, as well as a park and leisure areas. The site is surrounded by artificial docks and basins with public open space and the Cardiff Bay barrage to the south.

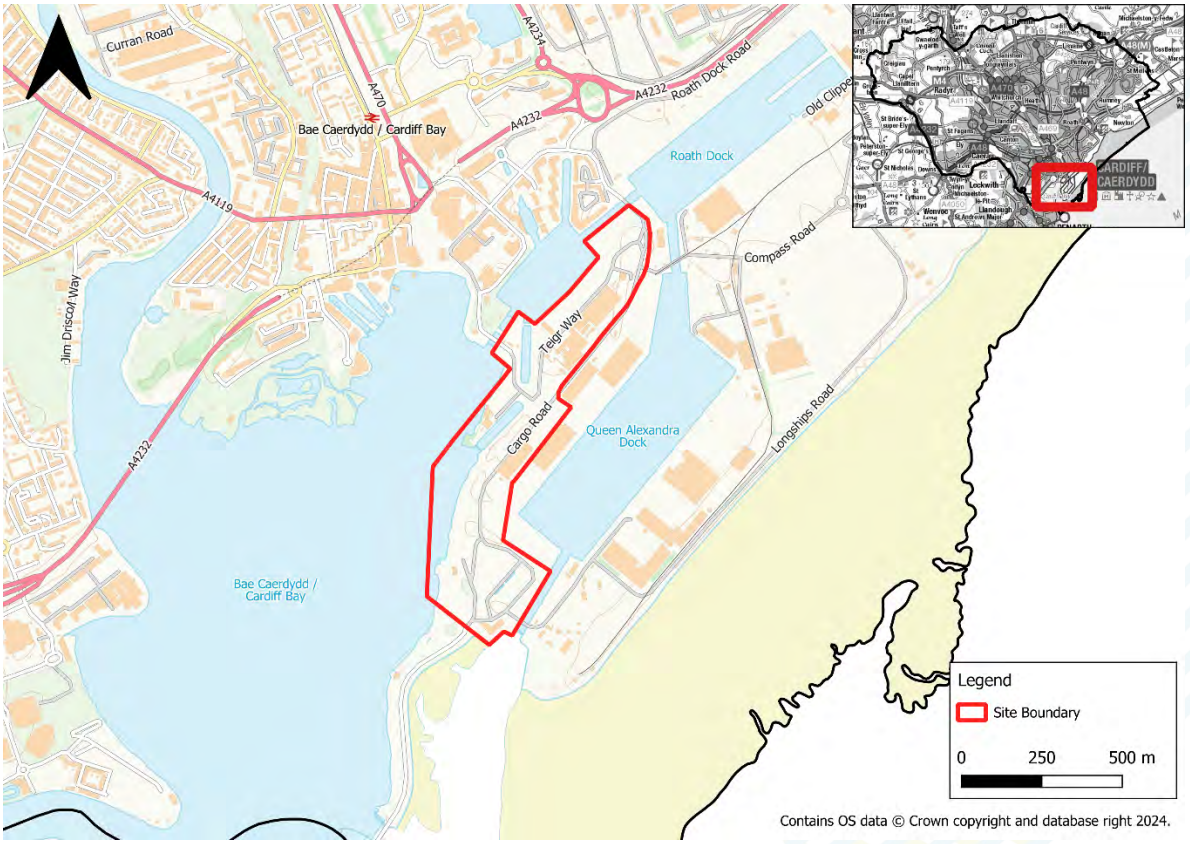

Figure 2-1 Site Location

2.1 Development Proposals

Development proposals at this site are for Mixed-Use Development comprising retail, food and drink, business, hotel, residential, assembly and leisure, car parking and transport infrastructure.

2.2 Watercourses and Flood Defences

Located within the historic dock area of Cardiff, the site is predominantly surrounded by artificial waterbodies, as shown in Figure 2-2. To the north-east is Roath Dock and to the south is the Queen Alexandra Dock. Roath Basin is immediately west of the proposed development site. Further west is Cardiff Bay. The docks are interconnected via channels, and a number of small dock basins.

Roath Basin and Roath Dock are fed by the dock feeder watercourse, flowing from the north. The levels within the Roath Basin, Roath Dock and Queen Alexandra Dock waterbodies are managed by Associated British Ports (ABP) through lock gates situated at the entrance to Roath Basin and Queen Alexandra Dock. These are located on the seaward side of the barrage and are therefore independent to water level changes as a result of the Cardiff Bay barrage.

The water levels within Cardiff Bay are managed by the Cardiff Bay Barrage which provides substantial tidal flood risk protection to Cardiff. The barrage has a standard of protection greater than the 0.1% AEP plus climate change event.

The nearest main river near the proposed development site is the River Taff, located approximately 1.5km to the southwest of the site. The River Taff is a designated NRW Main River, flowing into a southerly direction through Cardiff and into Cardiff Bay. Cardiff Bay also receives flows from the River Ely, which flows through the west of Cardiff.

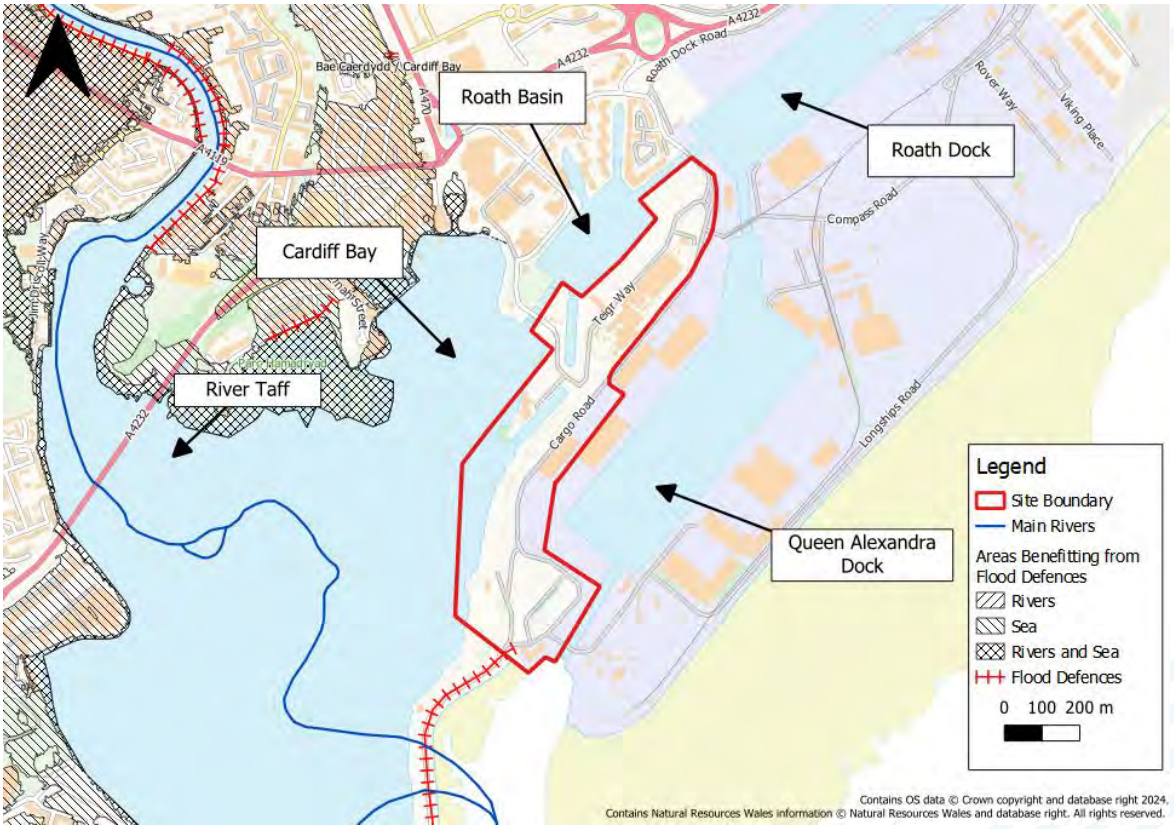

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the site is predominantly flat, between 9.0-10.3mAOD with some localised areas shown to be at a higher level of up to 12.58mAOD.

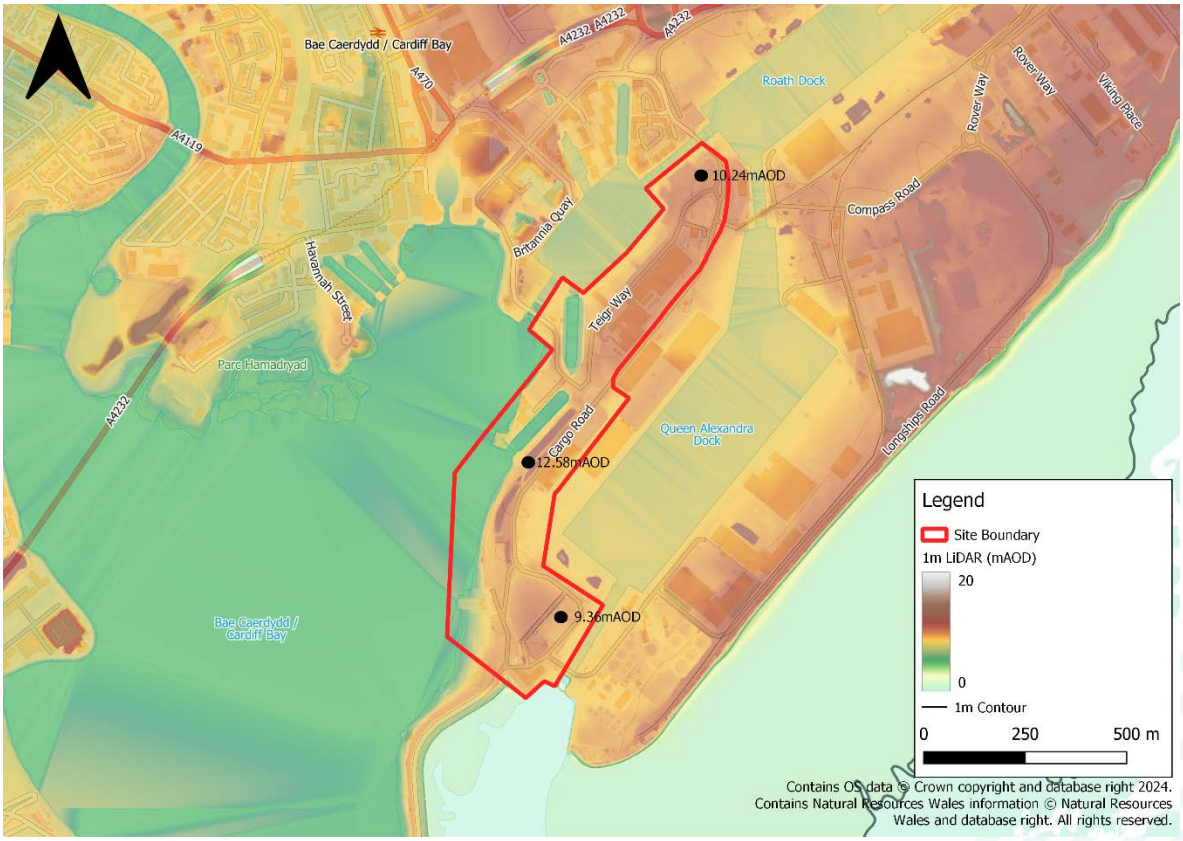

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

NRW's Flood Risk Assessment Wales (FRAW) Flood Risk from Rivers shows that the entire site is at **very low risk of flooding from rivers**. This means there is a less than 0.1% AEP chance of river flooding in any given year. It should be noted that the FRAW maps do not include an uplift for climate change which will need to be considered to fully assess the flood risk at the site for its lifetime.

3.1.1 Model Availability

The original Natural Resources Wales's (NRW's) Cardiff VDM hydraulic model was developed by Mott MacDonald in 2013. The original Mott MacDonald model is referred to as version v2.2. Subsequently, the model was further updated by Mott MacDonald in 2016 to extend the model domain so that new climate change allowances (adopted into Flood Consequence Assessments (FCA) in December 2016) did not exceed the existing model extents. This version of the model is referred to as v2.3.

In 2019, JBA received the Cardiff VDM models (v2.2 and v2.3) from NRW and updated the River Ely hydrology using the Flood Estimation Handbook (FEH) Statistical method as QMED was based on local data. For flows above the 1% AEP event, the ratio from ReFH2 was applied. Additionally, 13 new cross-sections covering approximately 750 m of the River Ely downstream of the A48 road bridge were added to the model based on survey data collected in 2019. This model was reviewed and accepted by NRW as part of the Lansdowne Hospital Development FCA (Planning Application REF:21/02054/MJR) in 2020.

This model version was subsequently updated in 2022 by JBA to support development aspirations at Ferry Road, Cardiff. Model updates included updates to the MHWS tidal boundary to represent 2022 and 2122, updates to the TUFLOW and flood modeller software versions, and minor updates to topographic representations of specific development sites, including inclusion of the 2019 as-built survey of the Paper Mill development to improve the representation of the development site. This version of the model has subsequently supported several other successful FCAs across Cardiff.

As such the JBA flood modelling of Cardiff represents the best available information to support this assessment.

3.1.2 Model Results

Figure 3-1 and Figure 3-2 demonstrate that the land-based extent of the redline boundary of the proposed candidate site is not predicted to flood during either the 1% (1 in 100 year) AEP plus climate change event or the 0.1% (1 in 1000 year) AEP event. Flood water in these events is confined to the waterbodies surrounding the site. Therefore, the flood risk from rivers is assessed to be **very low**.

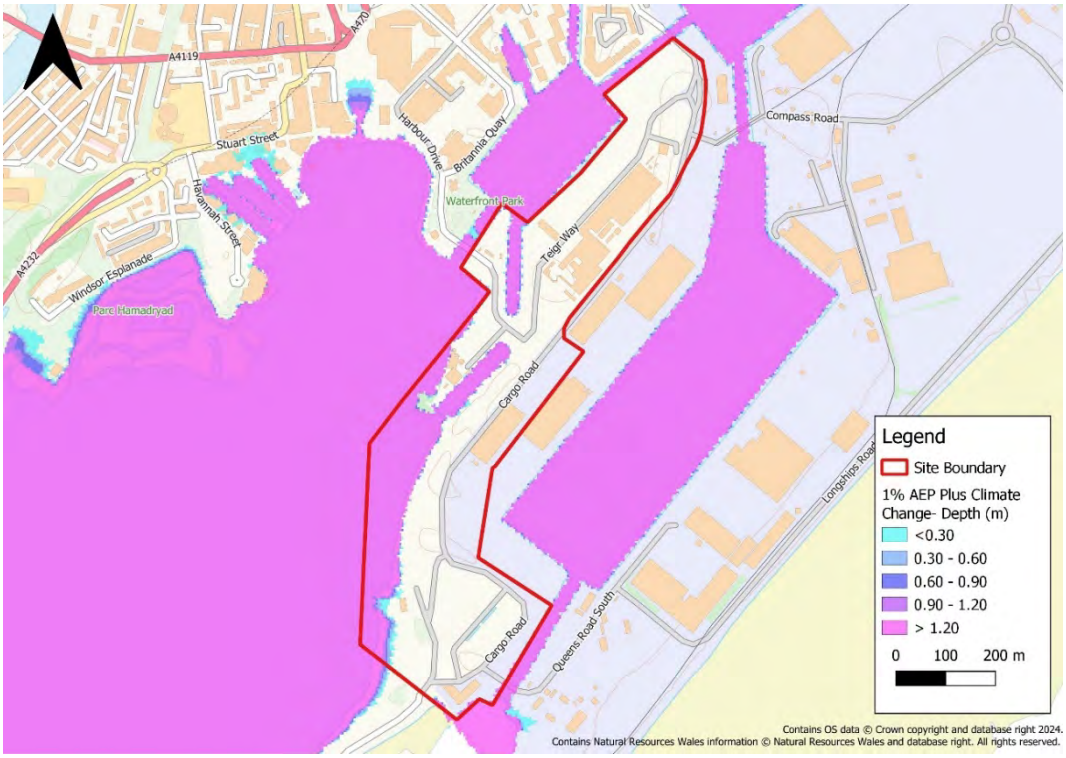

Figure 3-1 1% AEP plus Climate Change Event: Flood Depths

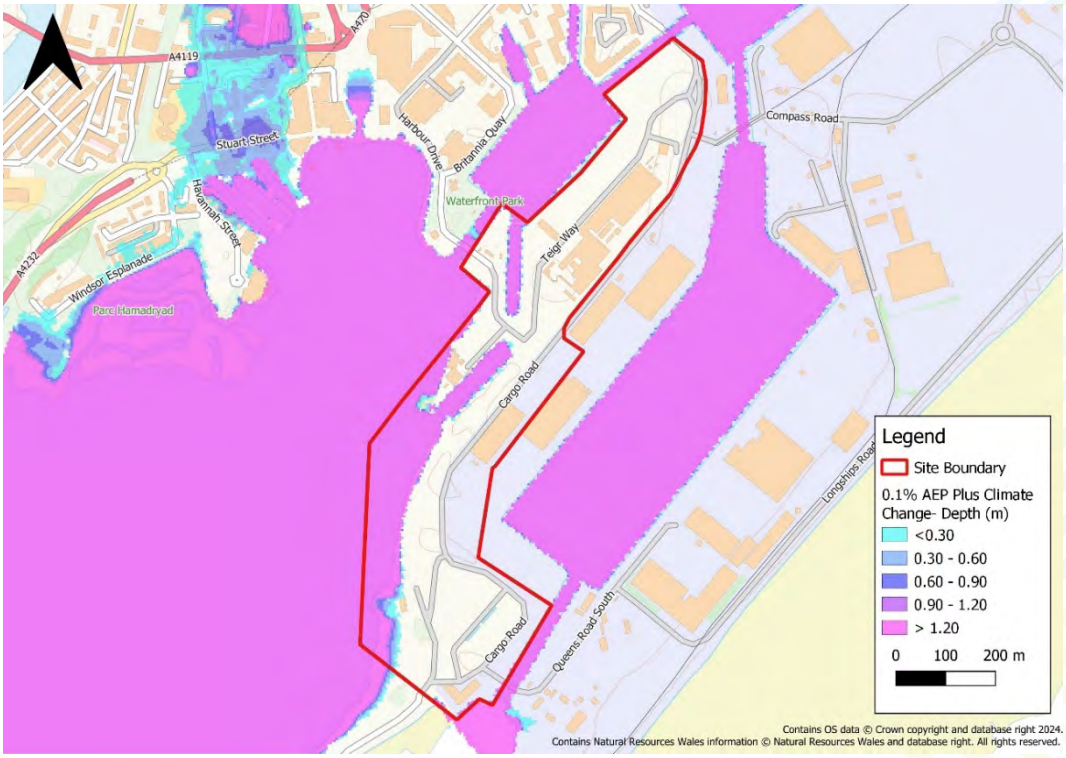

Figure 3-2 0.1% AEP + CC Event: Flood Depths

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site as shown in Figure 3-3. It is worth noting that the FRAW maps do not include an uplift for climate change which will need to be considered to fully assess the flood risk at the site for its lifetime.

As noted in Section 2.2, the water levels within Cardiff Bay are managed through the Cardiff Bay Barrage. The Cardiff Bay Barrage provides substantial tidal protection to Cardiff with a standard of protection greater than the 0.1% AEP plus climate change event. As such no further assessment is considered necessary from this waterbody.

However, the water levels in Roath Dock, Roath Basin and Queen Alexandra Dock are managed through lock gates controlled by ABP. Due to the tidal nature of the area, there is limited modelling which shows the risk of flooding from the sea. Consequently, to better understand the risk of tidal flooding to the site from this source, and the potential implications of climate change, further assessment using extreme sea level estimates has been undertaken below.

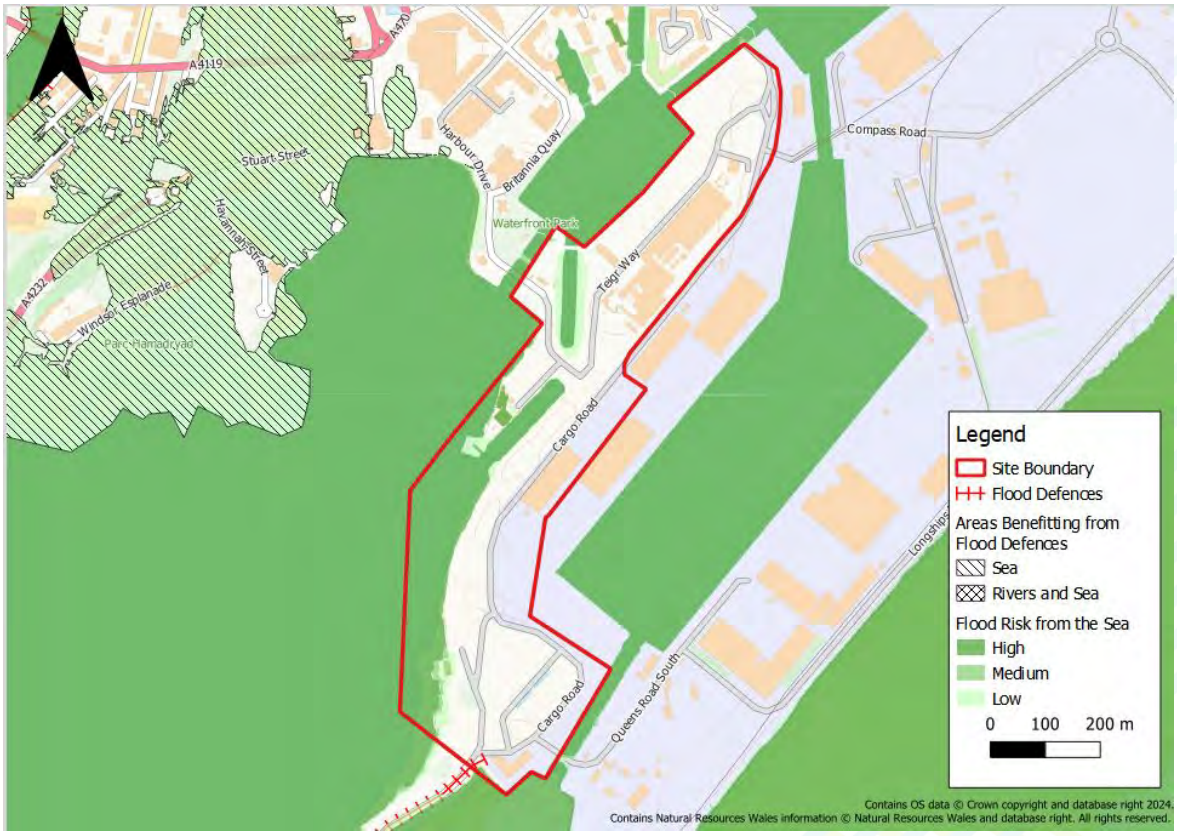

Figure 3-3 FRAW-Flood Risk from the Sea

3.2.1 Extreme Sea Level Estimates

Extreme sea level estimates have been taken from the Environment Agency Coastal Flood Boundary Conditions for UK Mainlands and Islands; Design Sea Levels (ref. SC060064). Extreme sea level predictions are provided at node locations at approximately 2km spacing along the coastline. Extreme sea levels have been used to indicate levels from the Queen Alexandra Dock, which is managed by the ABP via a lock gate, which could be overtopped during an extreme flood event.

For this assessment, the closest extreme sea level node is Node 412 located to the west of the coastline, approximately 3.5km from the site. The extreme sea level estimates for this node are shown in Table 3-1.

Table 3-1 Extreme Sea Level Estimates (present day)

Event	Predicted sea level (mAOD)
0.5% AEP (1 in 200)	7.79
0.1% AEP (1 in 1000)	8.16

For all coastal locations, future sea level rise is a major consideration and should be applied to the extreme sea level estimates. The Welsh Government Guidance on Climate Change Allowances for Planning Purposes**Error! Bookmark not defined.** suggests that a lifetime of 100 years should be assumed for residential developments and for other developments it is considered to be 75 years. As such, extreme sea level estimates have been uplifted to include sea level rise to 2099 to represent 75 year lifetime of development, and 2124 to represent a 100-year lifetime of development.

The UKCP18 User Interface[1] has been used per Welsh Government Guidance on Climate Change Allowances for Planning Purposes (September 2021)[2] to provide climate change uplifts. The cumulative increase in sea level has been calculated between 2017 and 2023 to uplift extreme sea-level estimates to the present day, and then furthermore to 2099 and 2124. The climate change uplifts applied to the extreme sea level estimates are shown in Table 3-2. Using the extreme sea level estimates and climate change uplifts, predicted tidal still water levels are provided in Table 3-3.

Table 3-2 Cumulative Sea Level Rise

Period	Cumulative sea level rise (m increase)
2017-2024	0.03
2017-2124	1.08

1 UK Climate Projections User Interface. https://ukclimateprojections-ui.metoffice.gov.uk/ui/home.

2 Welsh Government. Flood Consequences Assessment: Climate Change Allowances (Sept 2021) https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf.

Table 3-3 Predicted tidal flood levels

Event (AEP)	2024 Still Water Level (mAOD)	2099 Still Water Level (mAOD)	2124 Still Water Level (mAOD)
0.5%	6.10	8.55	8.87
0.1%	6.28	8.91	9.24

When considering the lifetime of development of 75 years (the 2099 event) the predicted flood level is lower than ground level across the development site in all design events.

During the 2124 epoch (for a 100 year lifetime of development), land-based areas within the Red Line Boundary are predicted to remain flood-free during the 0.5% AEP. During the 2124 0.1% AEP event, a flood level of 9.24mAOD may result in flooding to the land-based areas of the site. With site levels ranging from 9.0-10.3mAOD, the maximum flood depths expected at the site would be 240mm in the most extreme design event. This is well within the 600mm of tolerable conditions allowed under the guidance of TAN-15 for residential properties assessed under this epoch.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is predominantly at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-6. This means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site. There are two areas of risk within the site, one is located centrally north of the site and is associated with the Roath Basin and the other is located in the far northeast to the west of Cargo Road. Both areas represent a 'low' risk which means that each year, this area has a chance of flooding between 0.1% (1 in 1000 year) and 1% (1 in 100 year).

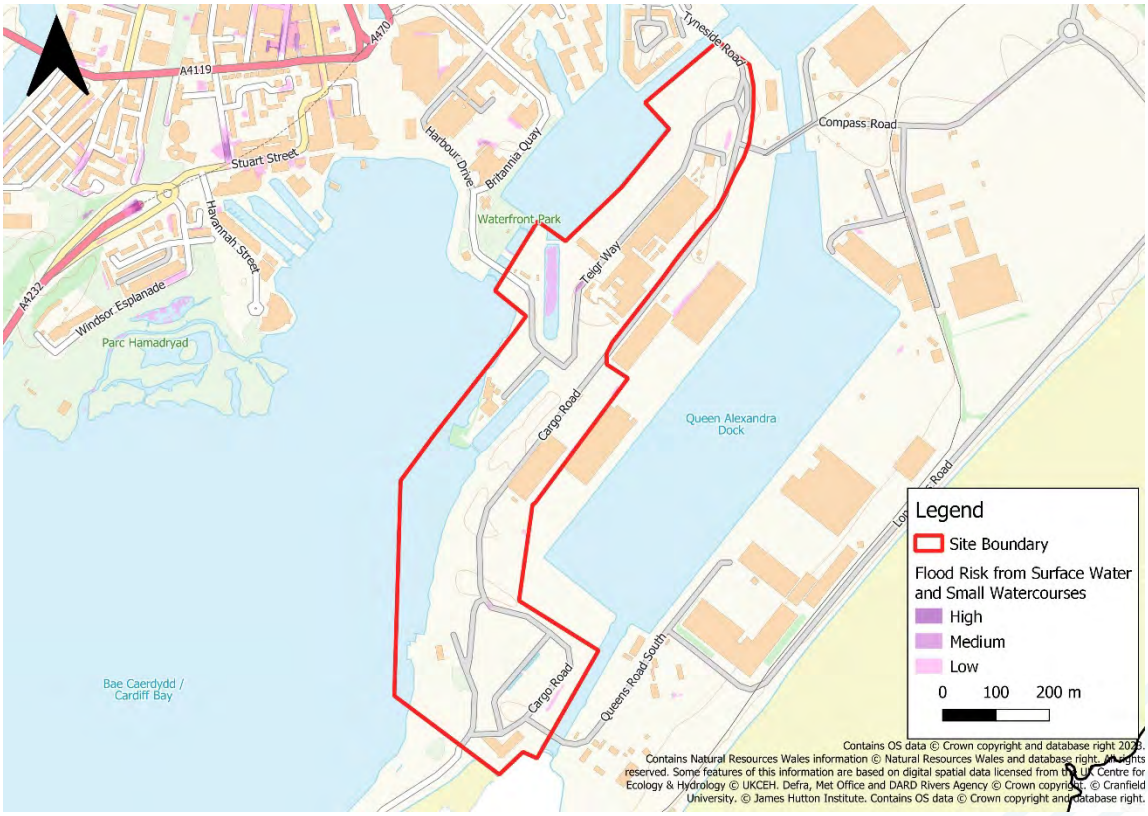

Figure 3-4 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The South East Wales Stage 1 SFCA includes JBAs Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area of 'low' risk from groundwater emergence meaning that groundwater flooding would be unlikely at the site. There have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Stage 1 SFCA. Furthermore, the Cardiff Local Flood Risk Management Strategy[3] also states that 'there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small.'

Therefore, it's been assessed that the risk from groundwater flooding is **Very low**.

[3] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is partially at risk of flooding from reservoir failure, as seen in Figure 3-5 below. The areas at risk are those close to the existing waterways and dock features on the site. However, it is worth noting that reservoir flooding is extremely unlikely to occur as all large reservoirs must be inspected and supervised by reservoir panel engineers under the Reservoirs Act 1975.

Section 5.3 of TAN-15 states that "*reservoirs are maintained to very high standards in Wales and therefore the location of homes and businesses in reservoir inundation areas should not raise alarm. This information is presented to ensure open and constructive dialogue between planning authorities and reservoir operators or owners should development plans have implications for the risk categorisation of the reservoir*".

Given the sites location in central Cardiff, it is unlikely that the risk categorisation of the reservoir would be re-categorised as a result of the proposals.

Therefore, the risk of flooding from reservoir failure has been assessed to be **low**.

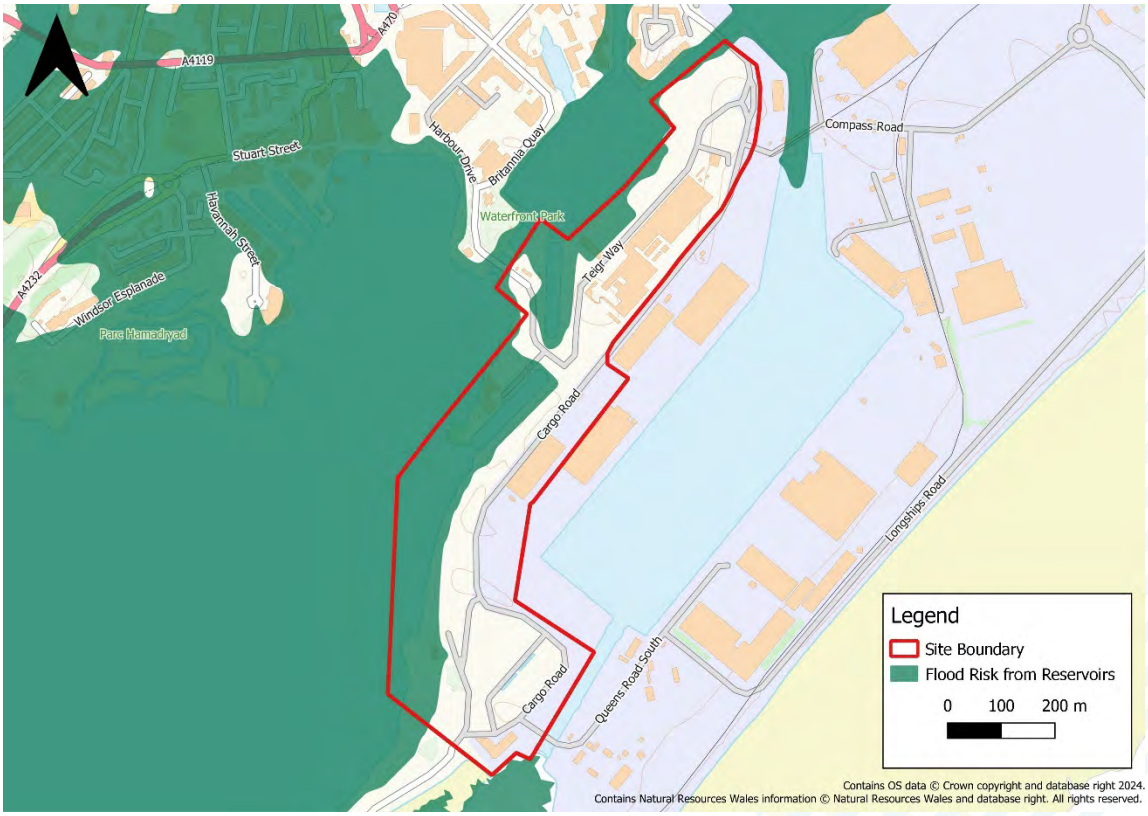

Figure 3-5 FRAW - Reservoir

3.6 Flood Risk from Sewers

The South East Wales Stage 1 SFCA indicates that Dŵr Cymru Welsh Water (DCWW) has identified 95 incidents of sewer flooding within the Butetown ward, in which this proposed candidate site is located. The site is a mixture of greenfield and brownfield development. It is assumed that there will be existing foul sewers connecting the area

to the wider DCWW system, with surface water likely to drain into the existing docks via a mixture of public and private sewers. This would need to be assessed further prior to any construction at the site. Therefore, it is concluded that there is a **low to medium risk** of sewer flooding.

3.7 Summary of Flood Risk

Table 3-4 below provides an overview of the flood risk at the site from all sources.

The main flood risk source to the site is tidal flooding. Small areas of the site are shown to be at risk during the 0.5% AEP plus climate change and 0.1% AEP plus climate change flood events, with significant depths predicted in some of these areas. Areas of the greatest depths are associated with existing dock infrastructure with the majority of the site is predicted to be flood-free.

Table 3-4 Summary of Flood Risk

Source of Flooding	Risk
River	Very Low
Sea	Low-Medium
Surface Water and Small Watercourses	Predominantly Very low with two isolated areas of Low
Groundwater	Very Low
Reservoir	Low
Sewers	Low to medium

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it provides an indication as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests.

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[4]

Zone	Flooding from Rivers	Flooding from the Sea	Flooding from Surface Water and Small Watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

4 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – Flood Risk from Rivers shows the site is predominantly located in Flood Zone 1, as shown in Figure 4-1. Areas of Flood Zones 2 and 3 are confined to the artificial waterbodies within the site. Flood Zone 2 represents areas with a 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers in a given year, including the effects of climate change. Whereas Flood Zone 3 represents areas with more than 1% (1 in 100) chance of flooding from rivers in a given year, including the effects of climate change.

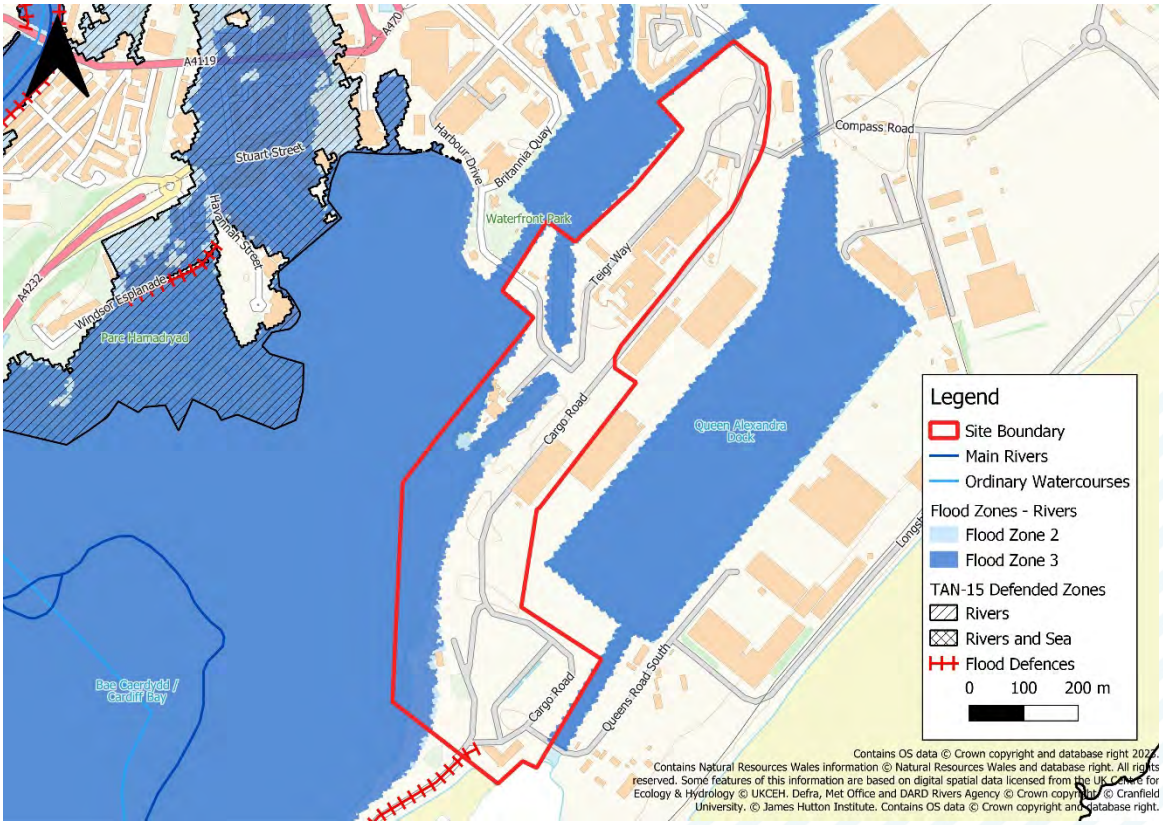

Figure 4-1 Flood Map for Planning – Flood Risk from Rivers

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – Flood Risk from the Sea shows the site is predominantly located in Flood Zone 1. Part of the site is located in Flood Zones 2 and 3 as seen in Figure 4-2. Flood Zone 2 represents areas with 0.1% to 0.5% (1 in 1000 to 1 in 200) chance of flooding from the sea in a given year, including the effects of climate change. Whereas Flood Zone 3 represents Areas with more than 0.5% (1 in 200) chance of flooding from the sea in a given year, including the effects of climate change.

These areas are mainly focused on the existing waterbodies e.g the Roath Basin in the north and the areas closest to Cardiff Bay. However, an area of Flood Zone 3 extends from Queen Alexandra Basin in the south to Cargo Road with an area in Flood Zone 2 extending further north. An area of Flood Zone 2 in the northeast extends to Teigr Way.

It is unclear why part of the site is not located within the TAN-15 Defended Zone given the wide ranging protection from the Cardiff Bay Barrage, detailed in Section 3.2.

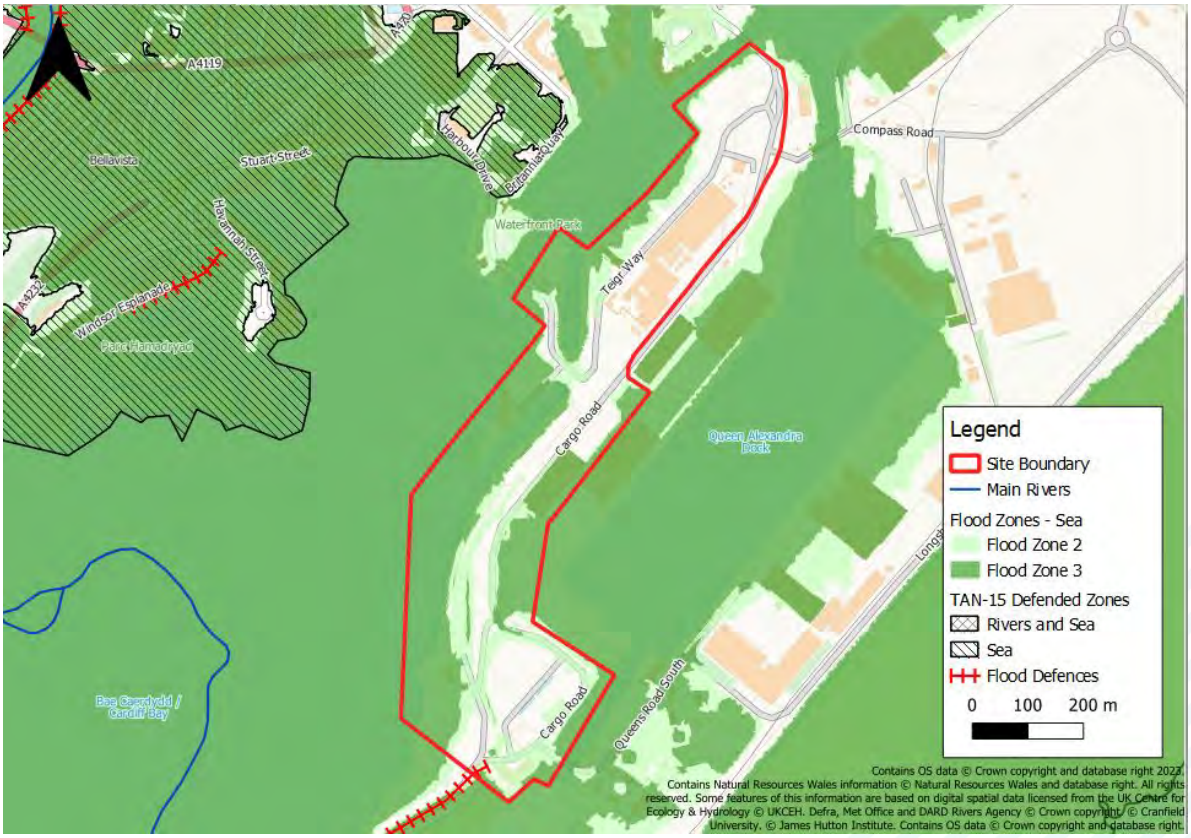

Figure 4-2 Flood Map for Planning- Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominantly located in Flood Zone 1, as shown in Figure 4-3.

Two small areas are located in Flood Zone 2. However, one of these areas is associated with the waterbody north of Porth Teigr Way. The second isolated area is associated with ponding of surface water in a localised topographic depression. Flood Zone 2 represents areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year including the effects of climate change.

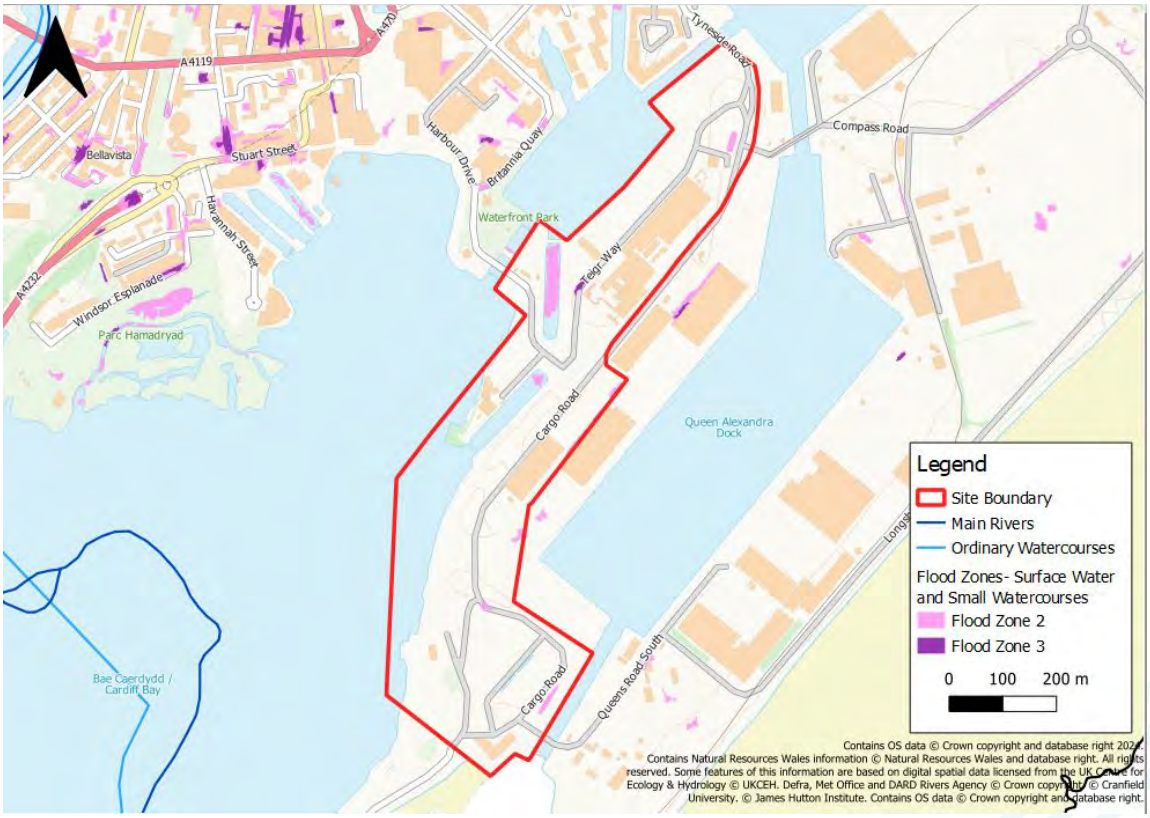

Figure 4-3 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under the new TAN-15, the development of the site can take a more sequential approach to the Highly vulnerable and Less Vulnerable aspects of the Development. This is especially relevant for sites like this where just one vulnerability classification is not appropriate. This new flexible approach will allow for better use of the site and encourage more thoughtful design from initiation. The three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below.

As the proposed use for the site is proposed to include residential developments parts of the development will be classified as 'highly vulnerable'. Additionally, other aspects of the proposed developments at this site will be considered as 'Less Vulnerable' i.e. business use and commercial proposals.

Table 4-2 Development vulnerability categories[5]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood
Less vulnerable development	**General industrial, employment, commercial and retail development**. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

5 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of 'Redevelopment'.

TAN-15 defines Redevelopment as: "development that proposes to replace a building with an existing use (in full or in Part) with a new building".

Furthermore, TAN-15 states that:

Proposals for redevelopment, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient then the expectation is that planning permission will not be granted (TAN-15 para 4.5).

Where buildings in flood risk areas are currently in use, there may be circumstances where redevelopment, changes of use or conversion proposals can bring clear benefits to the area and the building. These should be balanced and weighed against the flood risk considerations (TAN-15 para 10.4).

The current consultation draft of the revised TAN-15 appears to support redevelopment where these changes can further increase the resilience of a building. For the time being and to the best of our knowledge, the proposed site will be classified as 'redevelopment' for the TAN-15 and the application of the Justification Test.

4.4 Lifetime of Development

As this site is proposed for 'Mixed-use' the lifetime of the development may vary between the proposals and this could impact how the Justification Test is applied.

The lifetime of development for residential aspects of the development will be 100 years meaning that the design events up to 2124 should applied.

Whereas the lifetime of development for non-residential aspects of the development will have a lifetime of 75 years and design event up to 2099 should be applied when assessing the justification of the development.

4.5 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The justification requirements for 'Redevelopment' are less onerous than 'new development', and a clear distinction is drawn been the two forms of development.

The requirements of the Justification Test are summarised Table 4-3.

Table 4-3 Justification Test[6]

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>The development will be justified in the TAN 15 Defended Zones if:</td><td>The development will be justified in Zone 2 if:</td><td>The development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable by the criteria contained in section 11 of TAN-15.</td></tr>
</table>

6 TAN-15, Section 10

4.6 Acceptability Criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'Acceptability criteria'. There are three principal aspects to the Acceptability criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depend on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[7]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[8]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water-compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

7 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
8 TAN-15, Figure 6

4.7 Summary of Policy Position

Development proposals at this site are for Mixed-Use Development comprising retail, food and drink, business, hotel, residential, assembly and leisure, car parking and transport infrastructure. The development is considered to be 'redevelopment' as defined by TAN-15.

The majority of the site is located within Flood Zone 1. However, some areas of the site are located within Flood Zones 2 and 3 of the FMfP – flood risk from sea. Given the varying levels of flood risk across the site, a sequential approach to development is advised. As discussed in section 3.2.1 extreme sea levels indicate that the site is expected to remain flood-free during all design events except the tidal 2124 0.1% AEP event. In this event, maximum flood depths are expected to reach 0.24m at the lowest areas of the site. It is advisable to located residential development outside of areas of flood risk. However, predicted flood depths within the extreme event are well within the tolerable limits as defined by TAN-15.

Based on our assessment the proposed development is likely to be justified should a sequential approach to development be followed.

Where required, resilience measures can be incorporated into the design of new buildings to ensure resilience for the lifetime of the development.

We, therefore, conclude that on the grounds of flood risk, this development is permissible subject to thoughtful sequential planning of the development.

5 Conclusion

Site Description

- The proposed development site is located at Porth Teigr and Alexandra Head, within the Cardiff Bay areas of Cardiff. The site comprises brownfield land and commercial buildings as well as a park and leisure areas. The site is surrounded by artificial docks and basins with green land and the Cardiff Bay barrage to the south.
- The proposed development at this site is for mixed-use comprising retail, food and drink, business, hotel, residential, assembly and leisure, car parking and transport infrastructure.

Overview of flood risk

- The primary risk of flooding to the site is from tidal flooding sources;
- Extreme Sea Level Estimates were assessed and found the site to remain flood-free in both the 0.5% and 0.1% AEP event for the year 2099. During 2124 the site was only expected to flood to shallow depths during the extreme 0.1% AEP event.
- Maximum flood depths for the land-based areas of the site were shown to be 2400mm. Well within the maximum tolerable conditions.
- The site is at very low risk of flooding from fluvial, surface water and reservoir flooding and a low risk of groundwater and sewer flooding sources;
- The site is at medium to low risk of flooding from sewers.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to support redevelopment if these changes are able to further increase the resilience of a site.
- Redevelopment within any Flood Zone is required to satisfy the Justification Test and Acceptability of Consequences.
- The site can meet the requirements of the acceptability criteria if developed sequentially. Furthermore, only the 100-year lifetime of development has been assessed within this assessment with some aspects only having a lifetime of development of 75 years. Areas of the site that do not satisfy the acceptability criteria may be raised so that the acceptability criteria is satisfied and the Justification Test passed. Further detail would be required as to the layout of a future development before a robust determination could be made.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals are likely to comply with the aims and objectives of TAN-15 and Planning Policy Wales.

Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	Libby Raines BSc and George Williams BSc MSc
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc C.WEM MCIWEM
Subject	Wholesale Fruit Market, Bessemer Road - Flood Risk Appraisal

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Wholesale Fruit Market, Bessemer Road. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is 4.59 hectares and located at Bessemer Road, Cardiff, as displayed in Figure 2-1. The site has been previously developed and includes the existing Bessemer Road Wholesale Fruit Market. The site is bordered by Bessemer Road to the west, and Hadfield Road to the south. To the north and east, the site is bounded by a mix of residential properties and commercial units.

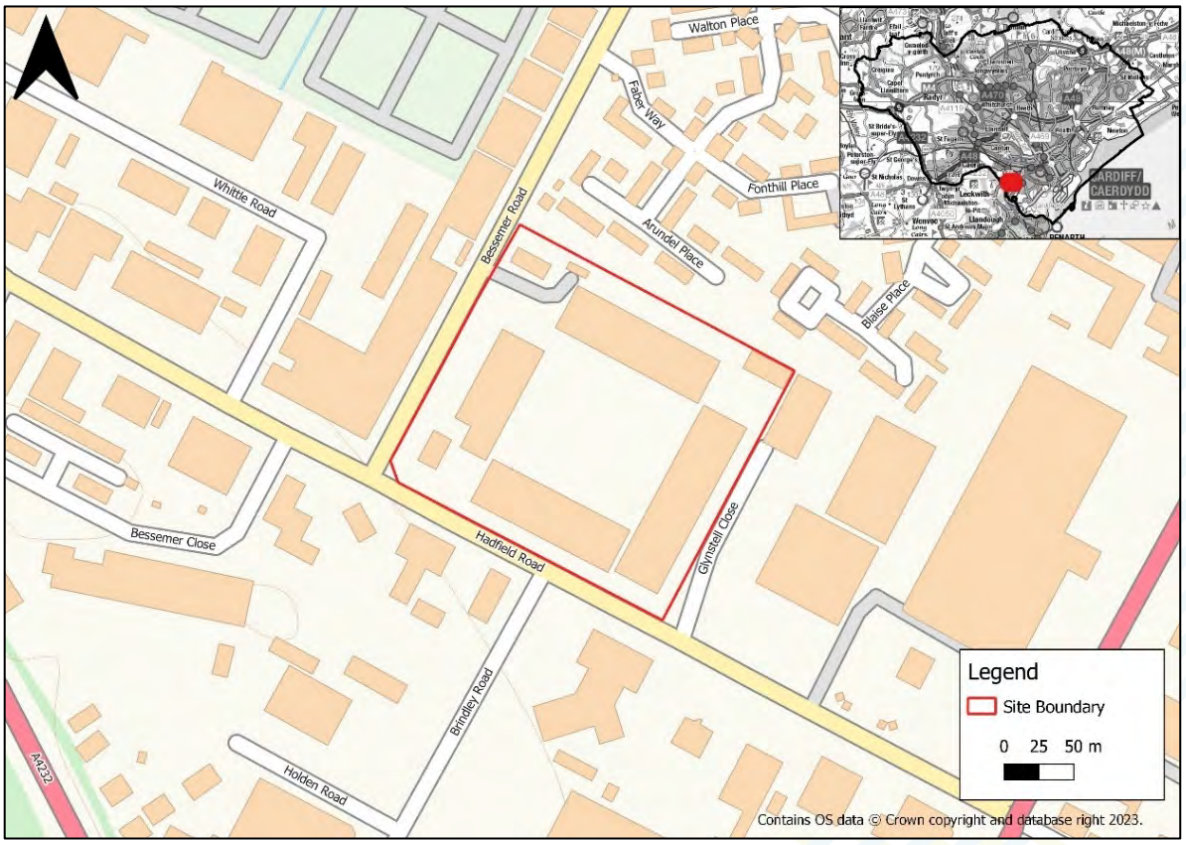

Figure 2-1 Site location.

2.1 Development proposals

The proposed development at this site is for residential use.

2.2 Watercourses and Flood Defences

The nearest NRW main river in close proximity to the proposed development site is the River Ely, located approximately 425m west of the site, as displayed in Figure 2-2. The River Taff is 1km east of the site, as displayed in Figure 2-3. There are no other mapped watercourses in close proximity to the site.

There are no raised defences in close proximity to the site. However, the entire site is an area benefitting from flood defences against the sea. The site benefits from the presence of the Cardiff Bay Barrage, defending against tidal flooding.

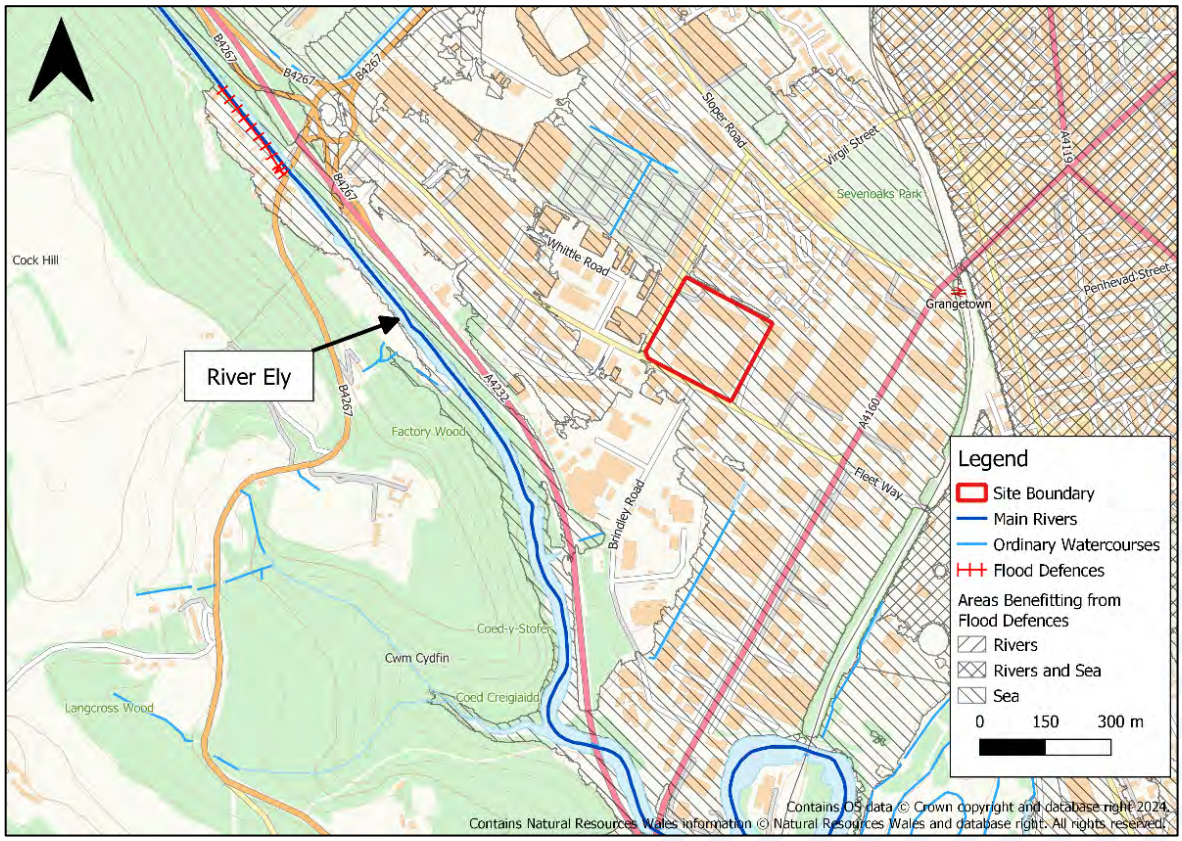

Figure 2-2 Main Rivers and Ordinary Watercourses in close proximity to the site.

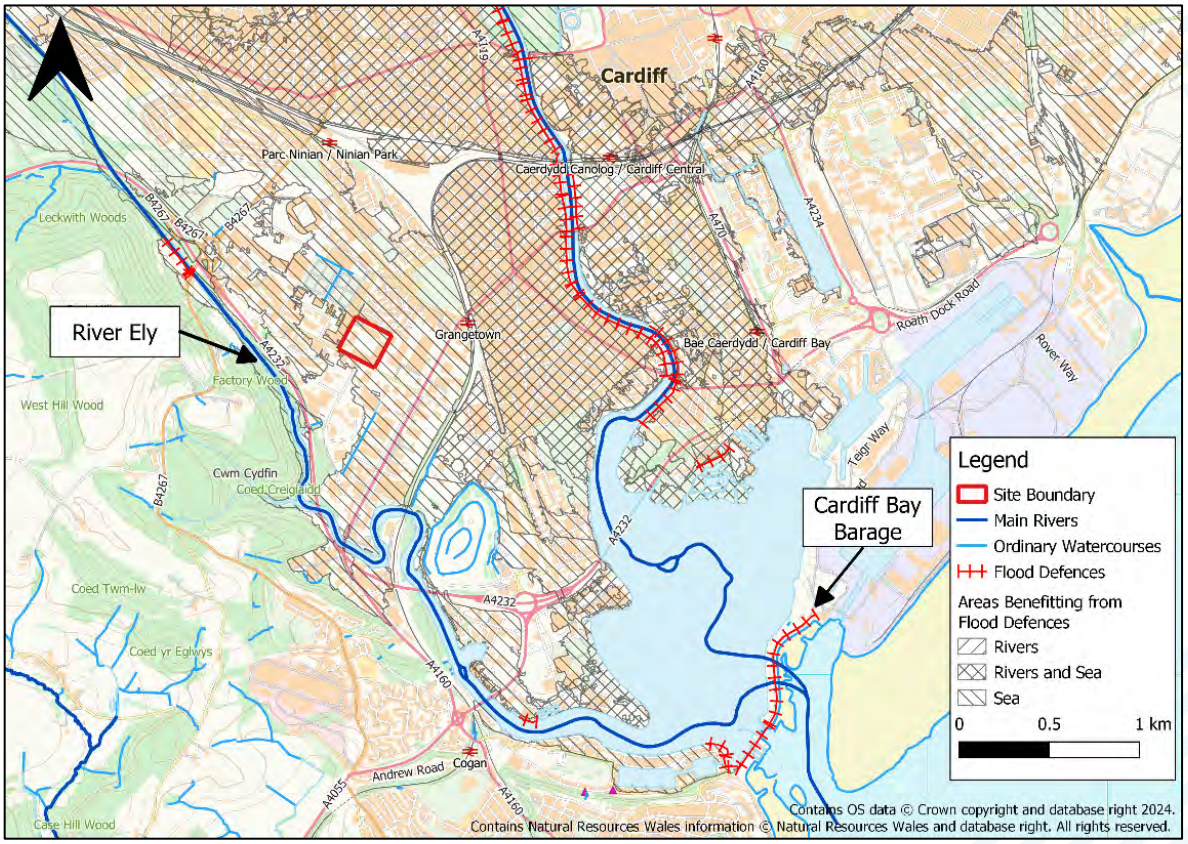

Figure 2-3 Main Rivers and ordinary watercourses in the wider vicinity of the site.

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-4. Please note that as there are existing buildings within the site, LiDAR data may not be representative of the actual site topography.

The LiDAR data indicates that the site is predominantly flat, with site elevations ranging between 7.57 and 9.53mAOD. There are some isolated minor topographic depressions located in the northern and south-western corner of the site. In the wider vicinity of the site, the land slopes from north-west to south-east, at a reasonably flat gradient of under 1%.

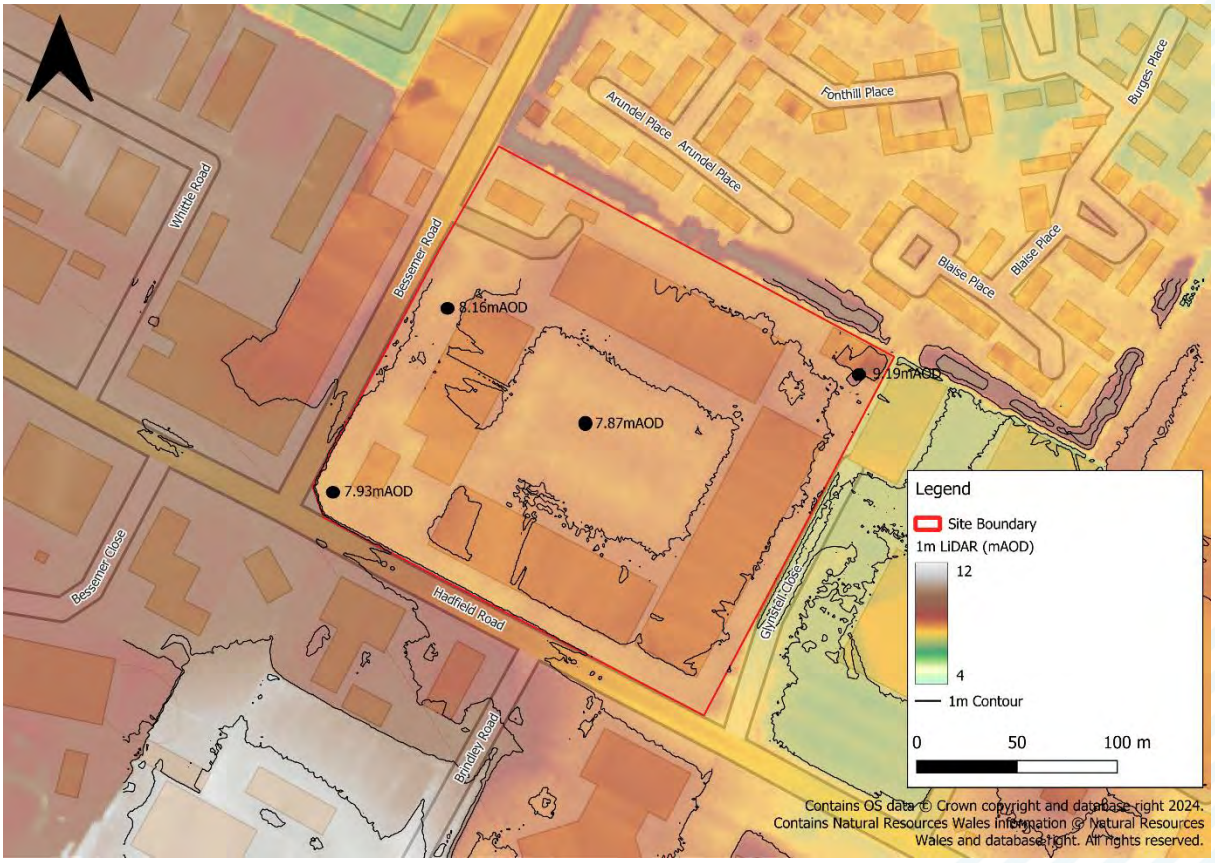

Figure 2-4 1m LiDAR Topography.

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

Detailed flood modelling has been used to assess the risk of fluvial flooding to the site from the River Ely. This has been detailed further below.

3.1.1 Model availability

The original Natural Resources Wales's (NRW's) Cardiff VDM hydraulic model was developed by Mott MacDonald in 2013. The original Motts model is referred to as version v2.2. Subsequently, the model was further updated by Mott MacDonald in 2016 to extend the model domain so that new climate change allowances (adopted into Flood Consequence Assessments (FCA) in December 2016) did not exceed the existing model extents. This version of the model is referred to as v2.3.

In 2019, JBA received the Cardiff VDM models (v2.2 and v2.3) from NRW and updated the River Ely hydrology using the Flood Estimation Handbook (FEH) Statistical method as QMED was based on local data. For flows above the 1% AEP event the ratio from ReFH2 was applied. Additionally, 13 new cross sections covering approximately 750 m of the River Ely downstream of the A48 road bridge were added to the model based on survey data collected in 2019. This model was reviewed and accepted by NRW as part of the Lansdowne Hospital Development FCA in 2020 (Cardiff Council planning reference: 21/02054/MJR) and has subsequently supported several other successful FCA's across Cardiff. As such, the JBA flood modelling of Cardiff is considered to represent best available information to support this assessment.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequence Assessment (FCA).

3.1.2 1% AEP plus climate change event

Figure 3-1 shows that the site is not predicted to flood during the 1% AEP plus climate change event. During this event, floodwater is largely confined within the banks of the River Ely.

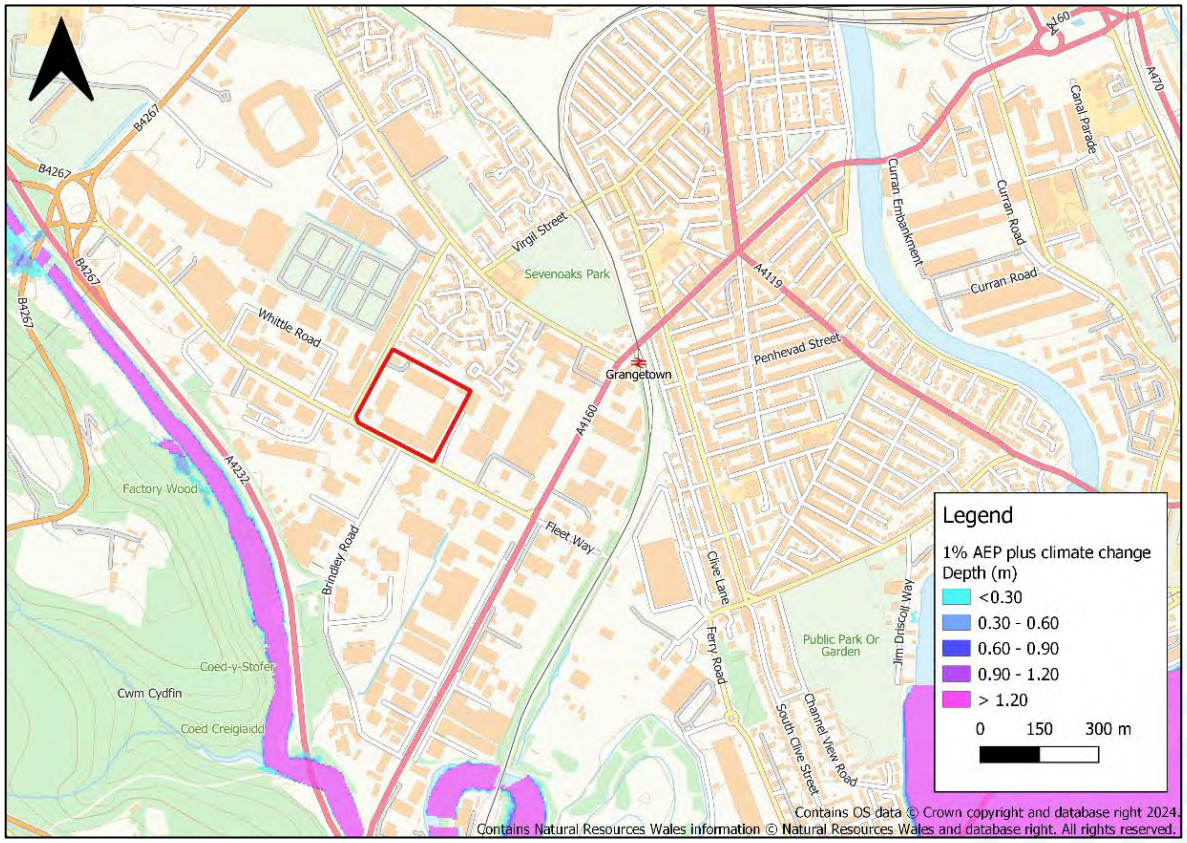

Figure 3-1 1% AEP plus climate change event: flood depths

3.1.3 0.1% AEP plus climate change event

The entire site floods during the 0.1% AEP plus climate change event, as displayed in Figure 3-2. The source of this flooding is the breach of flood defences on the River Taff, with the River Ely – to the west of the site – largely remaining in bank. The flood depths, velocities and flood level at the site are summarised in Table 3-1 below.

Flood depths within the site are between 0.11m and 0.98m, although generally range between 0.30 and 0.60m. Maximum flood depths are located to the north-west of the site, adjacent to Bessemer Road, where some of the lowest site elevations within the site are located.

Table 3-1 0.1% AEP plus climate change event flood: flood model results summary

Flood Event	Flood Depths (m)	Maximum Flood Level (mAOD)	Flood Velocities (m/s)
0.1% AEP event	0.11-0.98	8.48	0.02-0.89

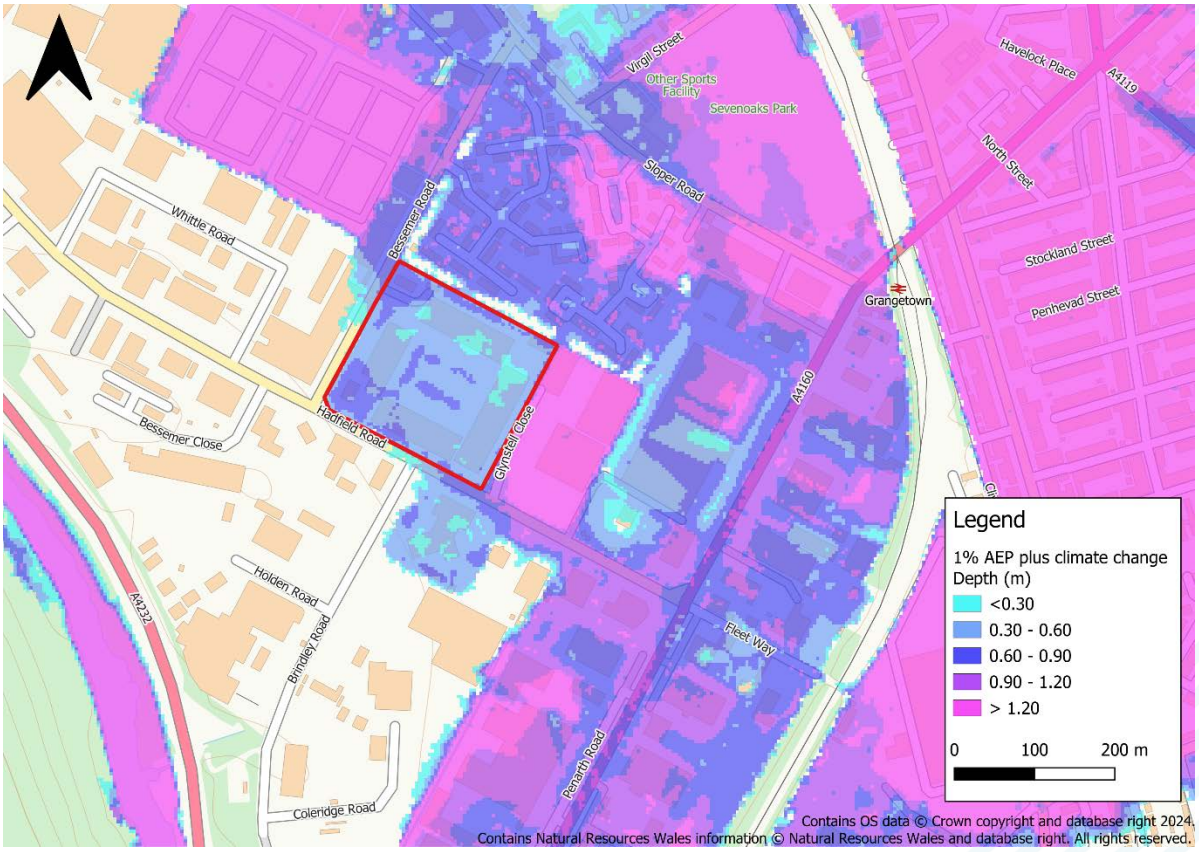

Figure 3-2 0.1% AEP plus climate change event: flood depths

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at **low risk of flooding** from the sea, as displayed in Figure 3-3. This means that there is between a 0.5% and 0.1% AEP chance of tidal flooding at the site. However, as discussed in Section 3.1.2, the site is located in a Defended Zone benefitting from the presence of the Cardiff Bay Barrage, which is understood to provide robust protection from flooding from the sea now and in the future.

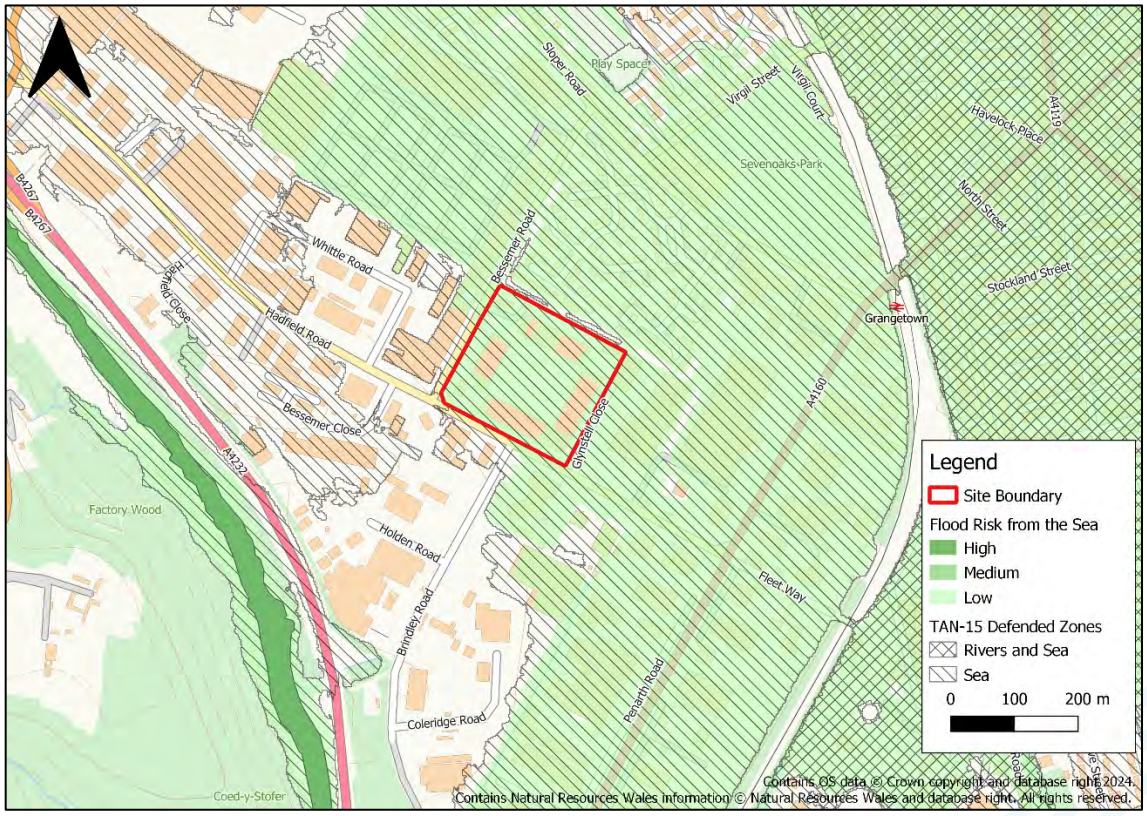

Figure 3-3 Flood Risk Assessment Wales – flood risk from the sea.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the majority of the site is at a very **low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-4. Very low risk means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site.

There are some isolated areas distributed across the site which are at a **medium risk of flooding**. Medium risk of flooding means there is between 0.1% and 1% AEP chance of flooding from surface water and small watercourses. The areas of the site at a high and medium risk of flooding are concentrated within isolated existing topographic depressions to the north and south-west of the site.

As this surface water flood risk is relatively minor, this surface water flood risk within the site can likely be managed through surface water drainage and sustainable drainage systems (SuDS) within the site.

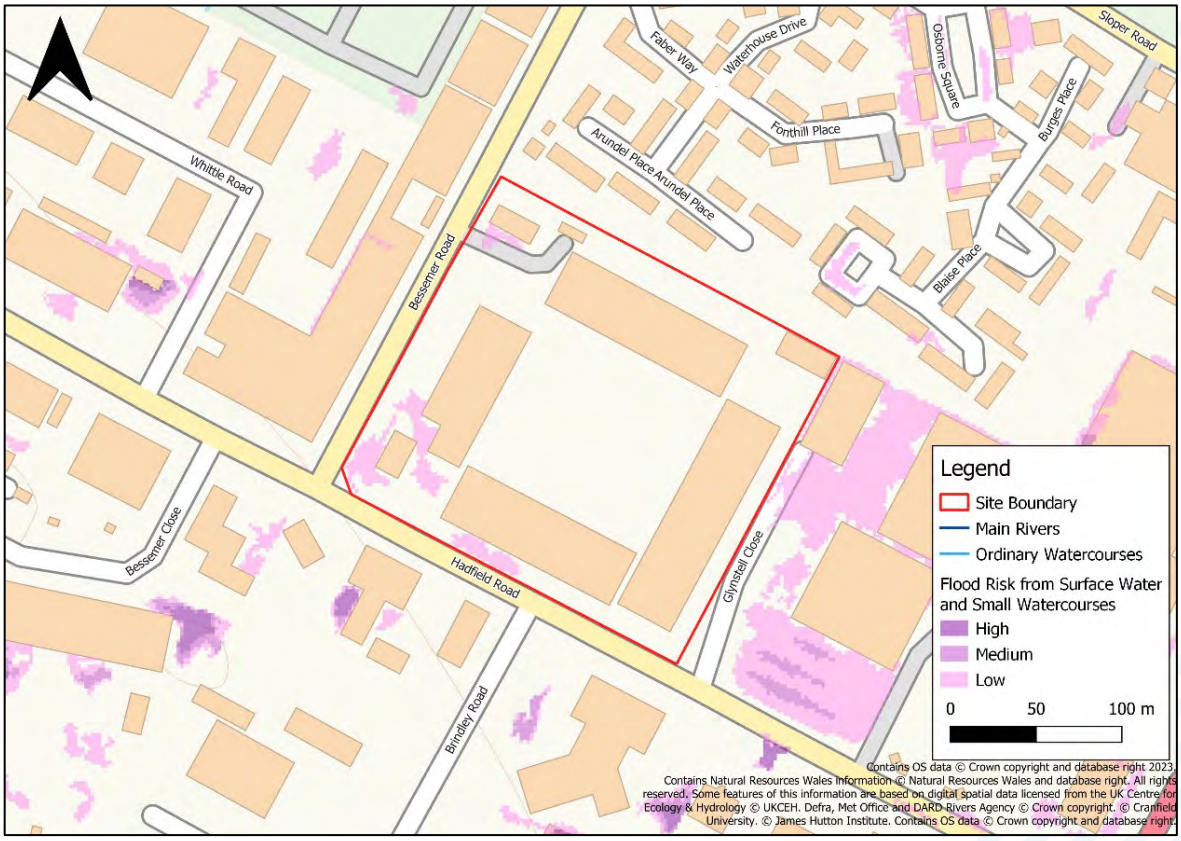

Figure 3-4 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months, and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

JBA has developed a range of Groundwater Flood Map products nationally. The 5m resolution JBA Groundwater Map has been used within the report. The modelling involves simulating groundwater levels for various return periods (including 1.33% year, 1%, and 0.5% AEP). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 1% AEP model outputs.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, which would represent an extreme scenario. The maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often

necessary for groundwater to have nowhere to go without ponding and flooding an area first.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad-scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding, this may include review of historical flood records, historical borehole logs, consultation with the LLFA and groundwater monitoring.

According to the JBA groundwater flood mapping, the site is at a low risk of ground water flooding. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

The Cardiff Local Flood Risk Management Strategy[1] also states that 'there is little documented evidence of groundwater flooding in [Cardiff] and therefore the risk of flooding from this source is considered to be small.'

Therefore, it is concluded there is a **low risk** of flooding to the site from groundwater.

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at risk of flooding from reservoir flooding (from the Pontsticill (Taf Fechan) located approximately 40km to the north of the site), as displayed in Figure 3-5.

However, it is worth noting that reservoir flooding is extremely unlikely to occur as all large reservoirs must be inspected and supervised by reservoir panel engineers under the Reservoirs Act 1975.

Section 5.3 of TAN-15 states that "*reservoirs are maintained to very high standards in Wales and therefore the location of homes and businesses in reservoir inundation areas should not raise alarm. This information is presented to ensure open and constructive dialogue between planning authorities and reservoir operators or owners should development plans have implications for the risk categorisation of the reservoir*".

Given that the site is located in central Cardiff, it is unlikely that the risk categorisation of the reservoir would be re-categorised as a result of the proposals. Therefore, the risk of flooding from reservoir failure has been assessed to be **low**.

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx>

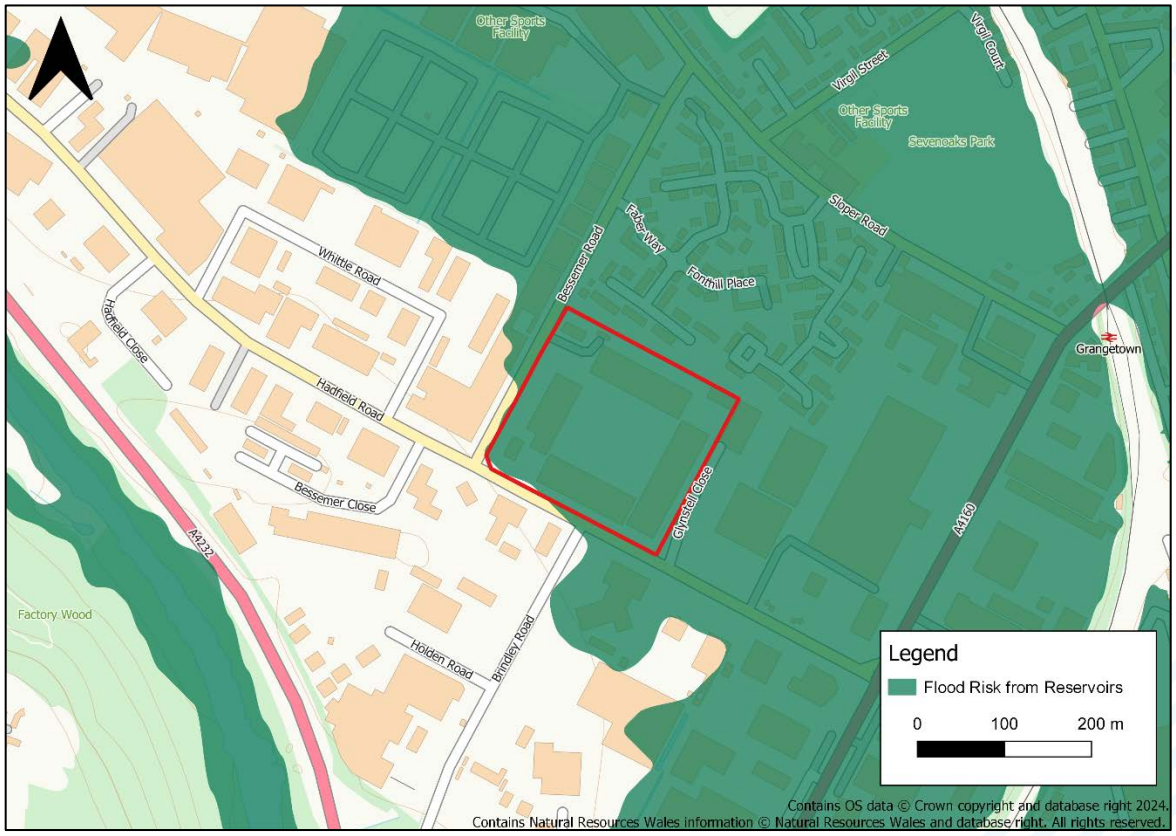

Figure 3-5 Flood Risk Assessment Wales (FRAW) Flood Risk from Reservoirs mapping.

3.6 Flood Risk from Sewers

The South-East Wales Level-1 Strategic Flood Consequence Assessment (SFCA) has identified there to be a low number (3) of historic sewer flood incidents within the Grangetown electoral ward. The current location of existing sewers is unknown and further assessment of sewer flood risk would need to be undertaken as part of the Flood Consequence assessment for this site to fully assess the risk posed by sewer flooding at the site. With the current location of the existing sewers not known, the risk posed by sewer flooding is currently assessed to be **low**.

3.7 Summary of Flood Risk

Table 3-2 below summarises the flood risk to the site.

Table 3-2: Summary of Flood Risk to the site.

Source of Flooding	Description
Flood Risk from Rivers	The site is at risk of flooding during the 0.1% AEP plus climate change flood event. Therefore, the site is at a **medium risk** of river flooding.
Flood Risk from the Sea	Low Risk
Surface Water and Small Watercourses	Very Low - Low
Groundwater	Low Risk
Reservoirs	Very Low Risk
Sewers	Very Low Risk

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it provides an indication as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development, and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – flood risk from rivers shows the site is located in Flood Zone 2, as indicated in Figure 4-1. The FMfP rivers layer at this site is informed by the detailed flood model discussed in Section 4.1.

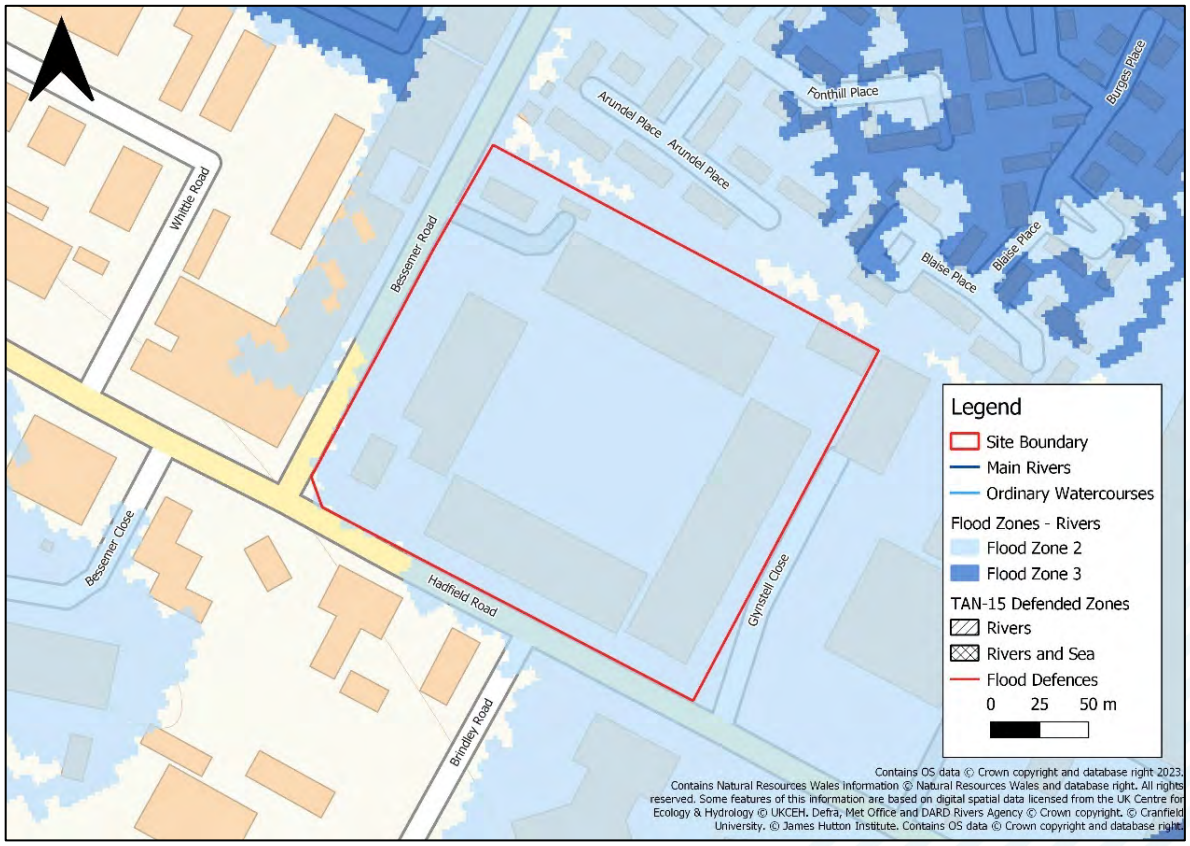

Figure 4-1 Flood Map for Planning- Rivers

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – flood risk from the sea shows the site is located in Flood Zone 3, as displayed in Figure 4-2.

The proposed site is also entirely located in a TAN-15 defended zone for flooding from the sea. The site is protected from tidal flooding by the presence of the Cardiff Bay Barrage, which is understood to provide 0.5% AEP minimum standard of protection from flooding from the sea.

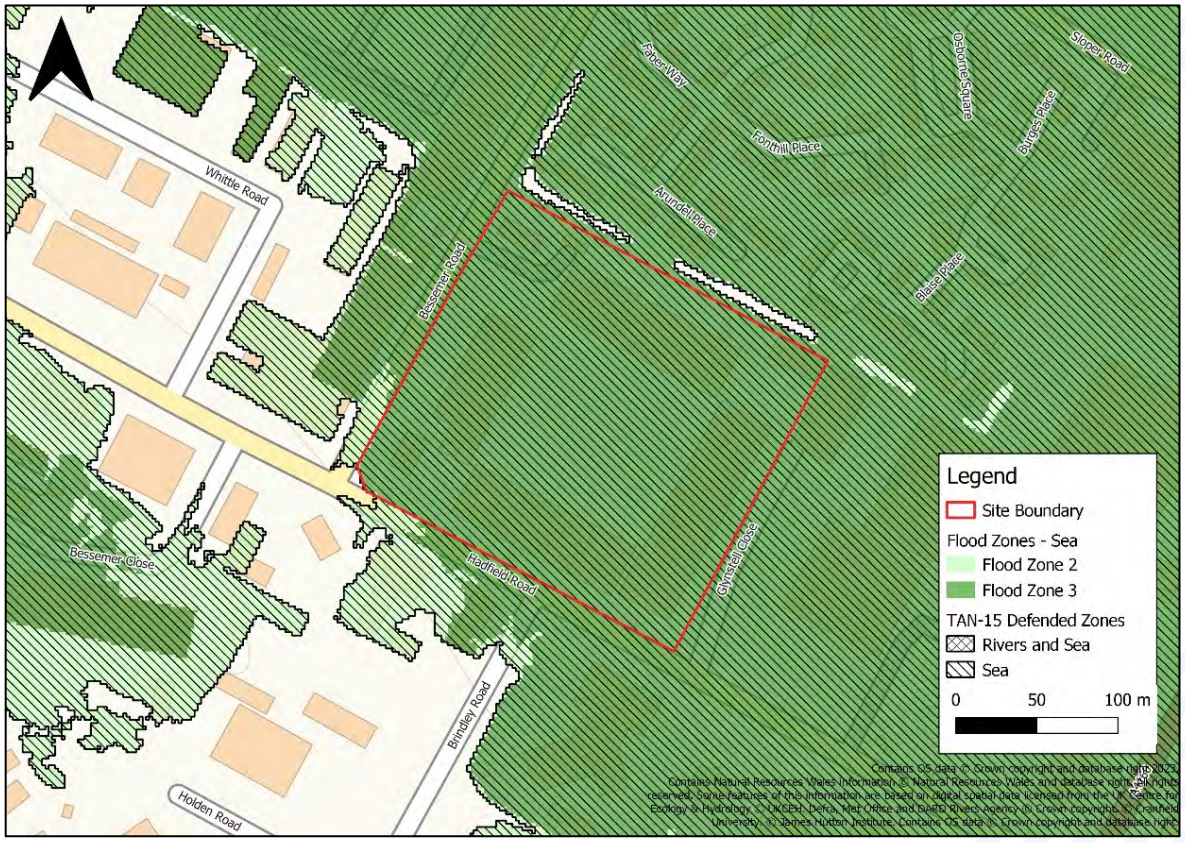

Figure 4-2 Flood Map for Planning, flood risk from the Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominately at low risk from surface water and small watercourse flooding.

As displayed in Figure 4-3, the majority of the site is located in Flood Zone 1. There are isolated areas in the northern and south-western corners of the site which located within Flood Zones 2 and 3. The location of this surface water ponding corresponds with the locations of existing minor topographic depressions within the site, as identified in Section 2.3.

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses does not take into account local drainage systems, so the risk to the site from surface water is likely over-represented. As this surface water flood risk is relatively minor, this surface water flood risk within the site can likely be managed through surface water drainage and sustainable drainage systems (SuDS) within the site.

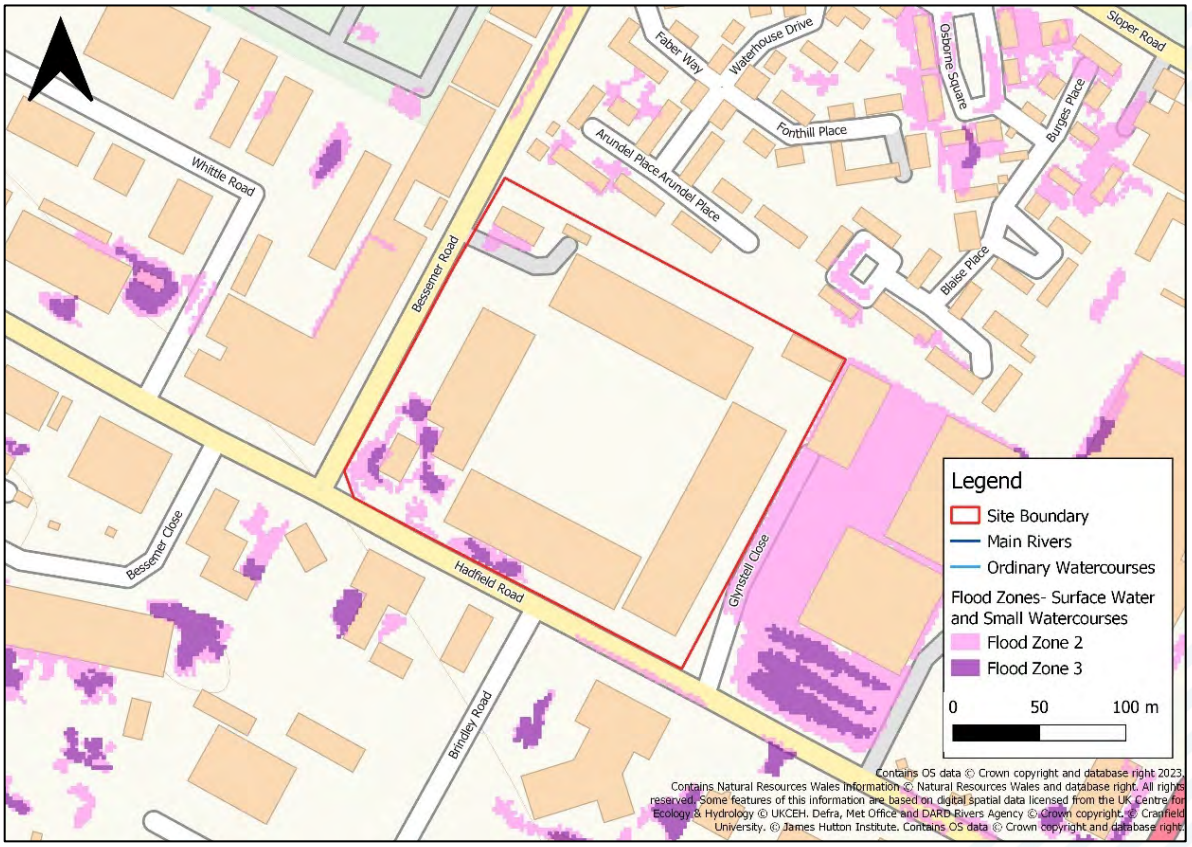

Figure 4-3 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for residential development it is classified as highly vulnerable development.

Table 4-2 Development vulnerability categories[3]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites.

3 TAN-15, Figure 2

	Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

4.3 New development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice in relation to four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood risk areas.

Of most relevant to this appraisal is the definition of re-development.

The TAN-15 defines re-development as: *"Replacing an existing in-use building(s) (fully or partly) with a new building(s)."*

Furthermore, TAN-15 states that:

Proposals for redevelopment, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient then the expectation is that planning permission will not be granted (TAN-15 para 4.5).

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new development for the purposes of this guidance. New

developments increase exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

Where buildings in flood risk areas are currently in use, there may be circumstances where redevelopment, changes of use or conversion proposals can bring clear benefits to the area and the building. These should be balanced and weighed against the flood risk considerations (TAN-15 para 10.4).

The current consultation draft of the revised TAN-15 appears to support changes of use if these changes are able to further increase the resilience of a building. For the time being and to the best of our knowledge, the proposed site will be classified as 're-development' for the purposes of the TAN-15 and the application of the Justification Test.

4.4 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The justification requirements for 'redevelopment' are less onerous than 'new development', and a clear distinction is drawn been the two forms of development.

The requirements of the Justification Test are summarised in Table 4-3.

Table 4-3 Justification Test[4]

Zone 1	TAN-15 Defended Zones	Zone 2 (rivers and sea)	Zone 3 (rivers and sea)	Redevelopment, change of use and conversions in any Flood Zone
All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.	Development will be justified in the TAN 15 Defended Zones if:	Development will be justified in Zone 2 if:	Development will be justified in Zone 3 if:	Redevelopment will be justified in any Flood Zone if:
	Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration	It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental	There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the	The scheme results in a development that is resilient to flooding

4 TAN-15, Section 10

	scheme **or**[5]	objectives; **and**	impacts of climate change; **and**	
		Its location meets the definition of previously developed land; **and**	Its location meets the definition of previously developed land; **and**	
	The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.			

4.5 Acceptability criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'acceptability criteria'. There are three principal aspects to the acceptability criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable, depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depending on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[6]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

[5] This has not been included within the current draft of TAN-15 however it is our understanding that this section should include this.

6 Technical Advice Note 15: Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5

Table 4-5 Tolerable conditions in extreme flood event[7]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

Note: The extreme flood event is defined as the 0.1% AEP flood event

4.6 Summary of Policy Position

The site has been previously developed, with existing buildings across the site. Development proposals for the site are for new highly vulnerable (residential) development. Therefore, as confirmed by Cardiff Council in April 2024, the Justification Test for a 'Redevelopment' should be used.

Based on NRW's FMfP the site is located within a TAN-15 Defended Zone for flood risk from the sea. Furthermore, the site is located within Flood Zone 2 of Flood Risk from Rivers. All types of development are permissible within the TAN-15 Defended Zone, subject to the application of the Justification Test.

Sites within the TAN-15 Defended Zone pass the Justification Test where there is either a Community Adaptation and Resilience Plan in place or, it has been demonstrated that the consequences of flooding have been considered and found to be acceptable

Detailed modelling demonstrated that flood depths within the site are between 0.11 and 0.98m, although generally range between 0.30 and 0.60m. Maximum flood depths are located to the northwest of the site, adjacent to Bessemer Road. Flood depths exceeding 600mm will not be tolerable under TAN-15 guidance. However, if the site was designed sequentially or ground levels or Finished Floor Levels were raised to ensure that flood levels do not exceed 600m.

It is therefore considered that the site is likely to pass the requirements of the Justification Test and acceptability criteria if mitigation were to occur to prevent current maximum flood depths modelled for current site levels. If no mitigation was to occur the proposed development would not be permissible under the guidance of TAN-15 as maximum flood levels during the 0.1% AEP event exceed 600mm. Any future planning application for the site should be accompanied by a site specific FCA demonstrating mitigation measures for managing flood risk across the site, in line with the requirements of TAN-15.

7 TAN-15, Figure 6

5 Conclusion

Site Description

- JBA Consulting have been commissioned to prepare a Flood Risk Appraisal in support of a site Cardiff Council wish to develop at the Wholesale Fruit Market on Bessemer Road for residential use.
- The site is currently a fruit market and there are existing buildings within the site boundary.
- The site is located in the western Cardiff. It is predominantly flat in topography, and is located 425m east of the River Ely, and 1km west of the River Taff.

Overview of flood risk

- The main flood risk source to the site is river flooding. During the 0.1% AEP plus climate change flood event, flood defences on the River Taff overtop, with significant depths predicted to the north of the site during this event. Therefore, the site is at a **medium risk** of river flooding.
- Whilst the site is shown to be at risk from tidal flooding, it is assumed that this risk is managed by the presence of the Cardiff Bay Barrage and hence its position within an 'Area Benefitting' from flood defences. Therefore, the site is at a **low risk** of tidal flooding.
- The majority of the site is at a **low risk** of flooding from surface water and small watercourses, although there are some isolated areas across the site at a medium to high risk. As this flood risk is relatively minor, this flood risk within the site can likely be managed through surface water drainage and sustainable drainage systems (SuDS) within the site.
- The site is at **low or very low risk** of flooding from reservoirs, sewers and groundwater sources.

Consultation draft of new TAN-15

- The site has been previously developed with existing buildings within the site boundary. Development proposals for the site are for new highly vulnerable (residential) development. Therefore, the Justification Test for a 're-development' should be used.
- The site is subject to the Justification Test for re-development. To pass the Justification Test, the site needs to meet the acceptability criteria.
- Although the site satisfies the first requirement of the acceptability criteria (flood free during the 1% AEP plus climate change flood), the site does not satisfy the second requirement (tolerable conditions during the extreme flood event) as flood depths in some parts of the site are greater than 0.6m during the 0.1% AEP plus climate change event. The proposed development is unlikely to pass the acceptability criteria, and therefore Justification Test, without suitable avoidance and mitigation measures.
- Demonstrating safe access and egress to this site using the pre-existing site entrance is likely to be challenging. However, alternative site access and egress routes can be considered, which would be flood free during the 0.1% AEP plus climate change flood.

Conclusion

- It is concluded that on the ground of flood risk without suitable avoidance and mitigation measures, development proposals do not comply with the aims and objectives of TAN-15 and Planning Policy Wales.
- A site-specific Flood Consequences Assessment (FCA) should be undertaken. This should demonstrate how the chosen avoidance and mitigation measures for the site satisfies the requirements of the acceptability criteria, and therefore Justification Test, as stated in TAN-15 and as part of the aims and objectives of Planning Policy Wales (PPW).

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Velindre Cancer Centre. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site per Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located at the current Velindre Cancer Centre, Whitchurch, Cardiff as shown in Figure 2-1. The site comprises the existing Velindre Cancer Centre and is approximately 4.0ha in area. The centre currently provides specialist cancer services to approximately 1.5 million people in South-East Wales.

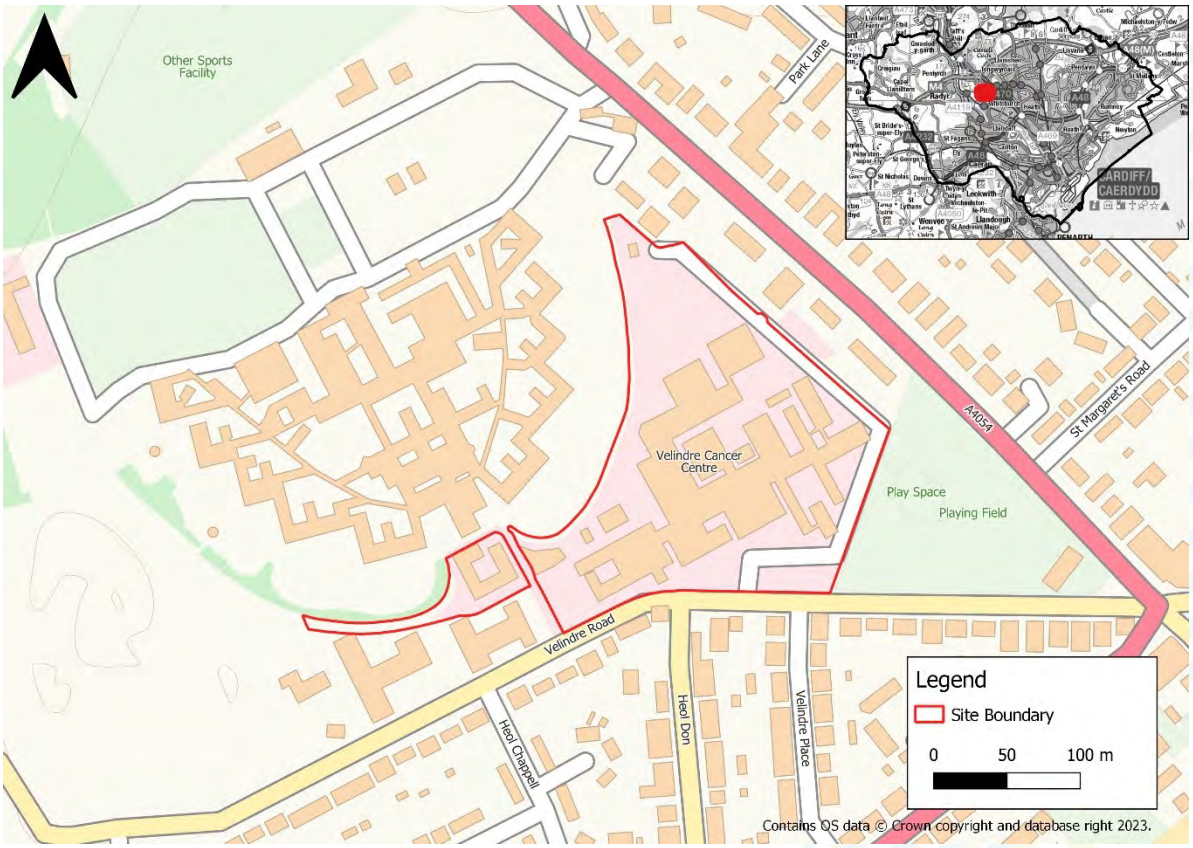

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development at this site is for residential and ancillary mixed-use.

2.2 Watercourses and Flood Defences

The main watercourse near the proposed development site is the River Taff, located approximately 350m to the west of the site, as shown in Figure 2-2. The River Taff is a designated NRW Main River. The proposed development site does not benefit from the presence of flood defences along the River Taff.

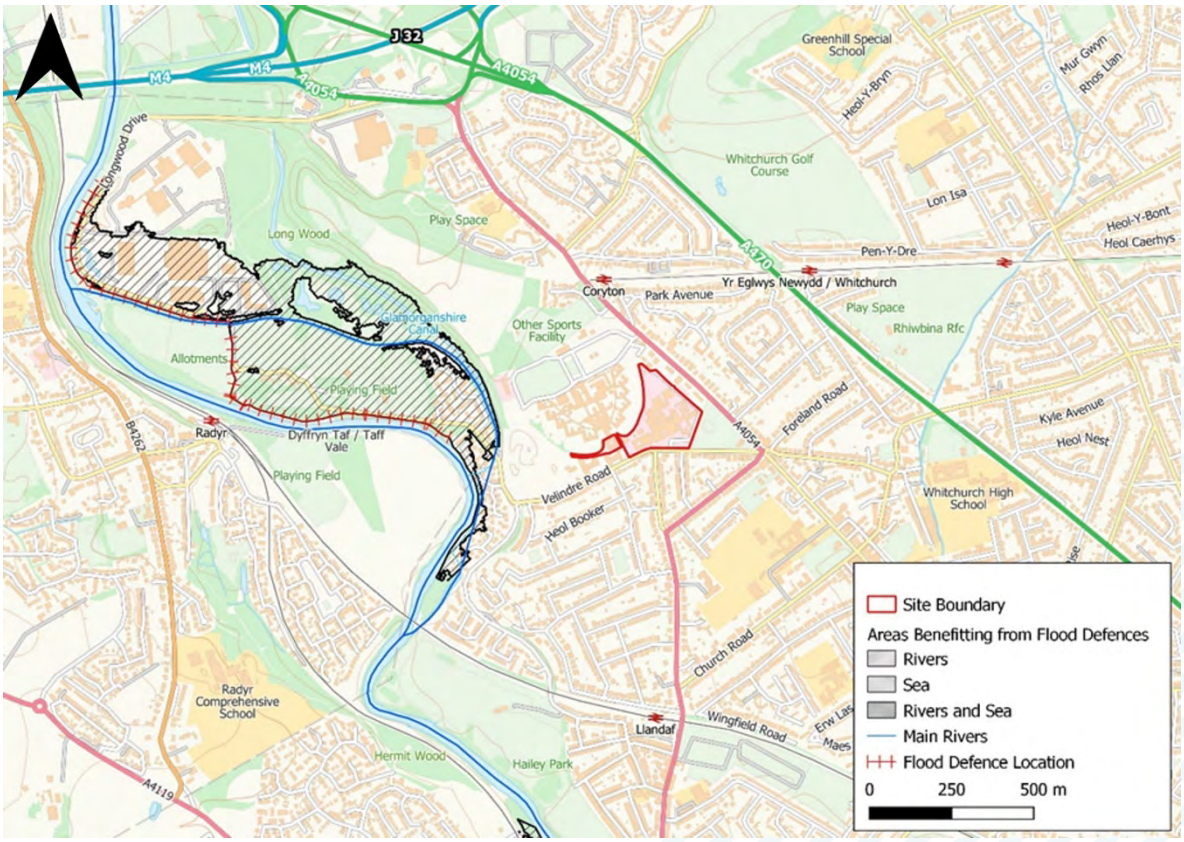

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the site falls in a general north-to-south direction with the highest elevations being found in the north-east of the site and the lowest in the south. The highest elevation is approximately 48.23mAOD at the northern boundary of the site, and the lowest is approximately 35.33mAOD at the southern boundary of the site.

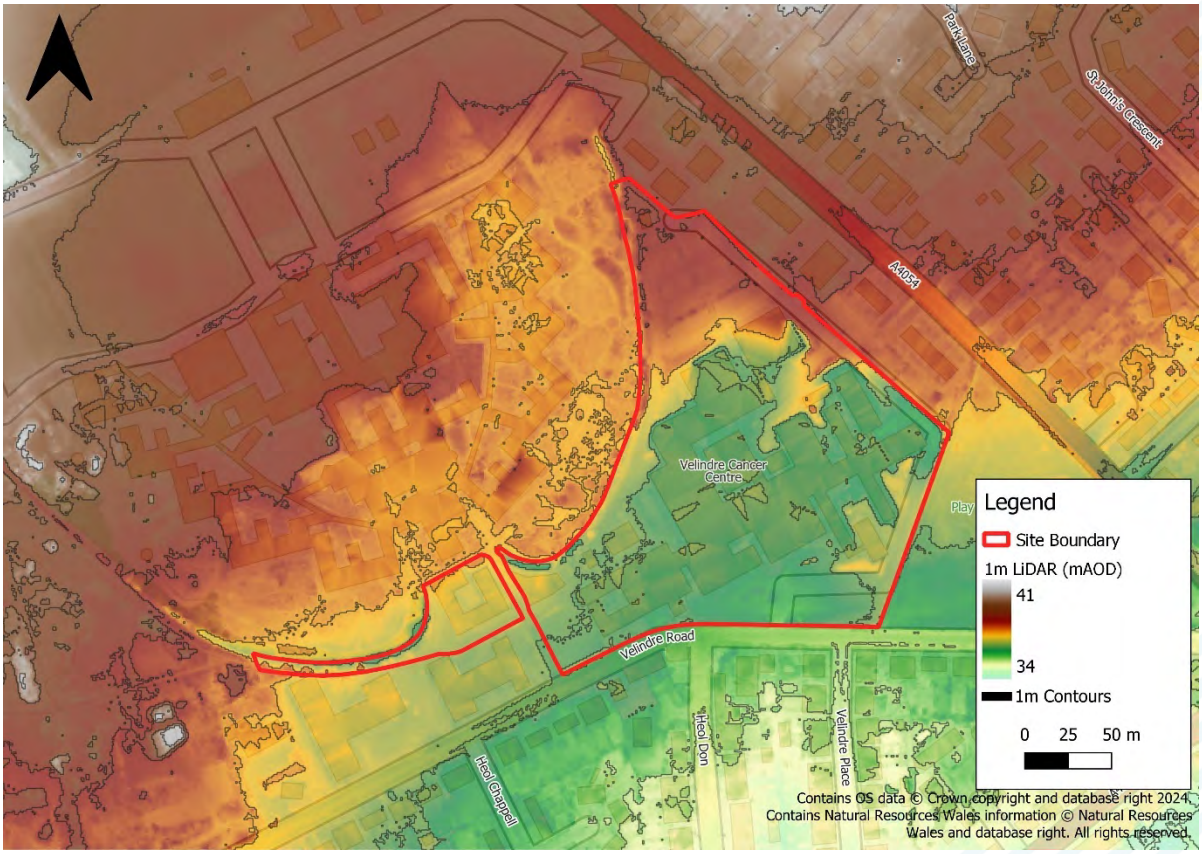

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from fluvial sources. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site has areas of **medium and low** surface water risk across the site as shown in Figure 3-1 below.

The small, isolated area of medium risk is located centrally to the north of the main building that forms the Cancer Centre.

Areas of low risk of surface water flooding are located centrally and in the western extents of the site. Furthermore, an area of low risk extends from the north boundary, following the RLB of the site towards the western boundary. This flow path should be considered and retained in any redevelopment proposals. The areas of surface water flood risk are likely to be associated with ponding due to topographic depressions on the site. Any future development will include SuDS which, if designed properly would mitigate this risk.

The surface water risk is likely to be overestimated with surface water shown to be 'built up' against building. This is due to the representation of the terrain in the model, furthermore, a drainage feature that will reduce this risk is not included in the model. Therefore, in reality, the risk is likely to be lower than shown.

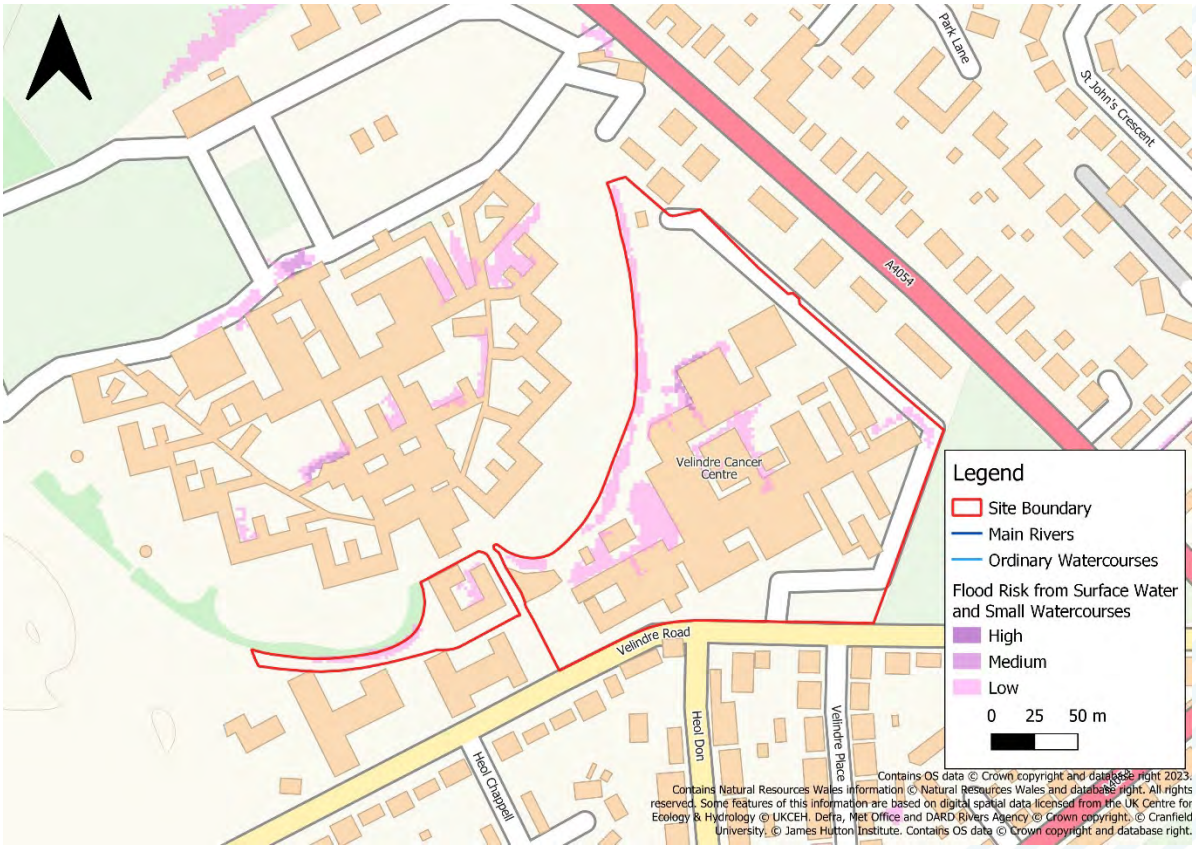

Figure 3-1 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The bedrock geology of Cardiff is predominantly comprised of Mudstone. Mudstone tends to have low porosity and permeability. However, this is dependent upon grain size percentages and level of compaction. As a result, upward percolation of groundwater and subsequent flooding should be considered.

The South East Wales Stage 1 SFCA includes JBAs Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area of 'low' risk from groundwater emergence.

Furthermore, there have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Stage1-SFCA. It has therefore been assessed that the risk from groundwater flooding is **low**.

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir failure. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South-East Wales Stage 1 SFCA has identified a high number (59) of historic sewer flood incidents within the Whitchurch and Tongwynlais wards. The current location of existing sewers is unknown across the proposed development site.

To inform development plans, it is recommended that further investigation into existing site infrastructure is undertaken to establish the presence of any public sewers crossing the site, along with existing site infrastructure.

Should any proposed development propose to utilise any existing sewers across the site, this should be supported by evidence and assessment that the receiving network has sufficient capacity, and to determine the risk of flooding from sewers across the site.

It has therefore been assessed that the flood risk from sewer flooding is **low to medium.**

3.7 Summary of Flood Risk

The main flood risk source to the site is surface water flooding. However, surface water flood risk can be managed through the design of an adequate drainage system that includes theuse of SuDS.Flood risk from other sources are shown in Table 3-1 below:

Table 3-1 Summary of Flood Risk

Source of Flooding	Risk
Rivers	Very Low
Sea	Very Low
Surface Water and Small Watercourses	Predominantly Very Low risk. Isolated areas of Medium risk.
Groundwater	Low
Reservoir Failure	Very Low
Sewer	Low to Medium

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. **Table 4-1** summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[1]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

[1] Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers and the Sea

The Flood Map for Planning – flood risk from rivers and the sea shows the site is located in Flood Zone 1, as shown in Figure 4-1.

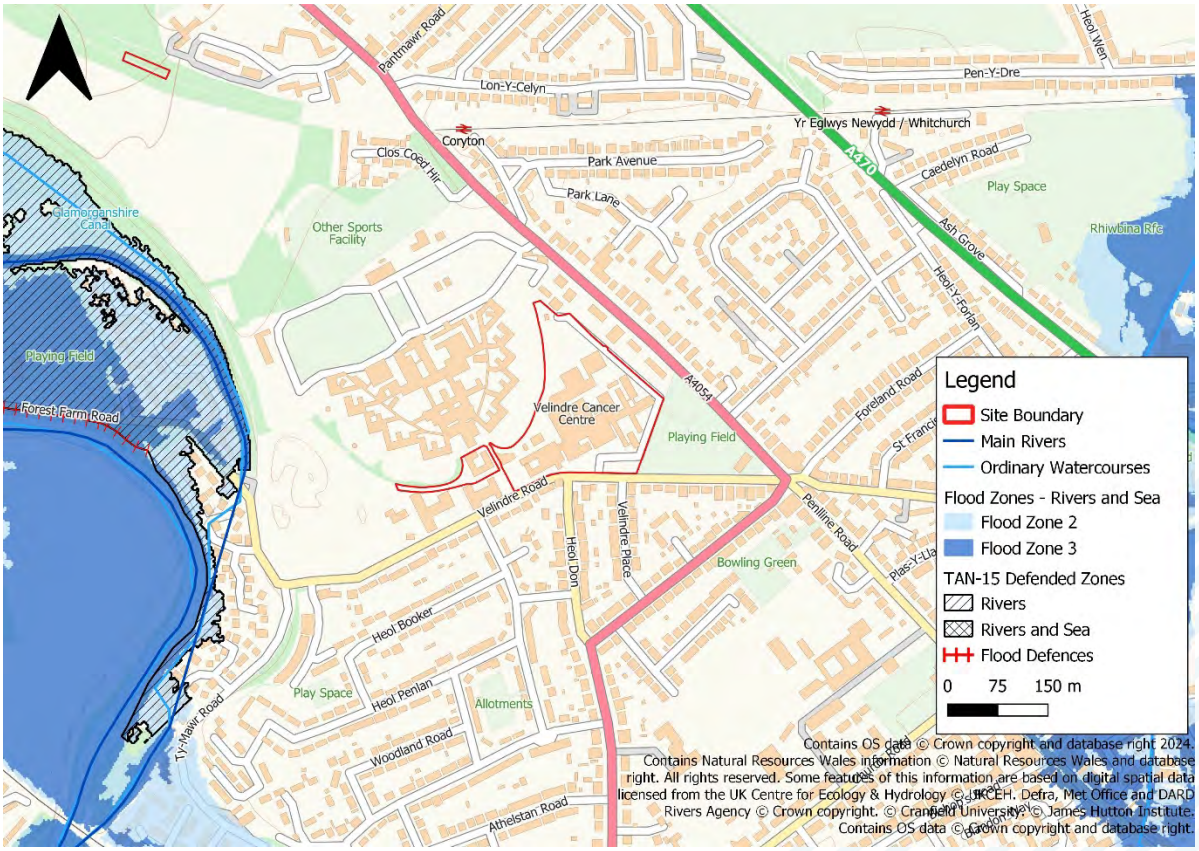

Figure 4-1 FMfP - River and the Sea

4.1.2 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominantly located in Flood Zone 1, as shown in Figure 4-2.

However, isolated areas of Flood Zone 3 and Flood Zone 2 are also shown towards the centre of the site.

As per Section 3.3, the FMfP likely provides an overestimation of the surface water flood risk at this site.

However, the FMfP includes for the allowance of climate change whilst the FRAW map does not. The FMfP suggests a surface water flow path along the northern boundary of the development site. This flow path should be considered and retained in any redevelopment proposals.

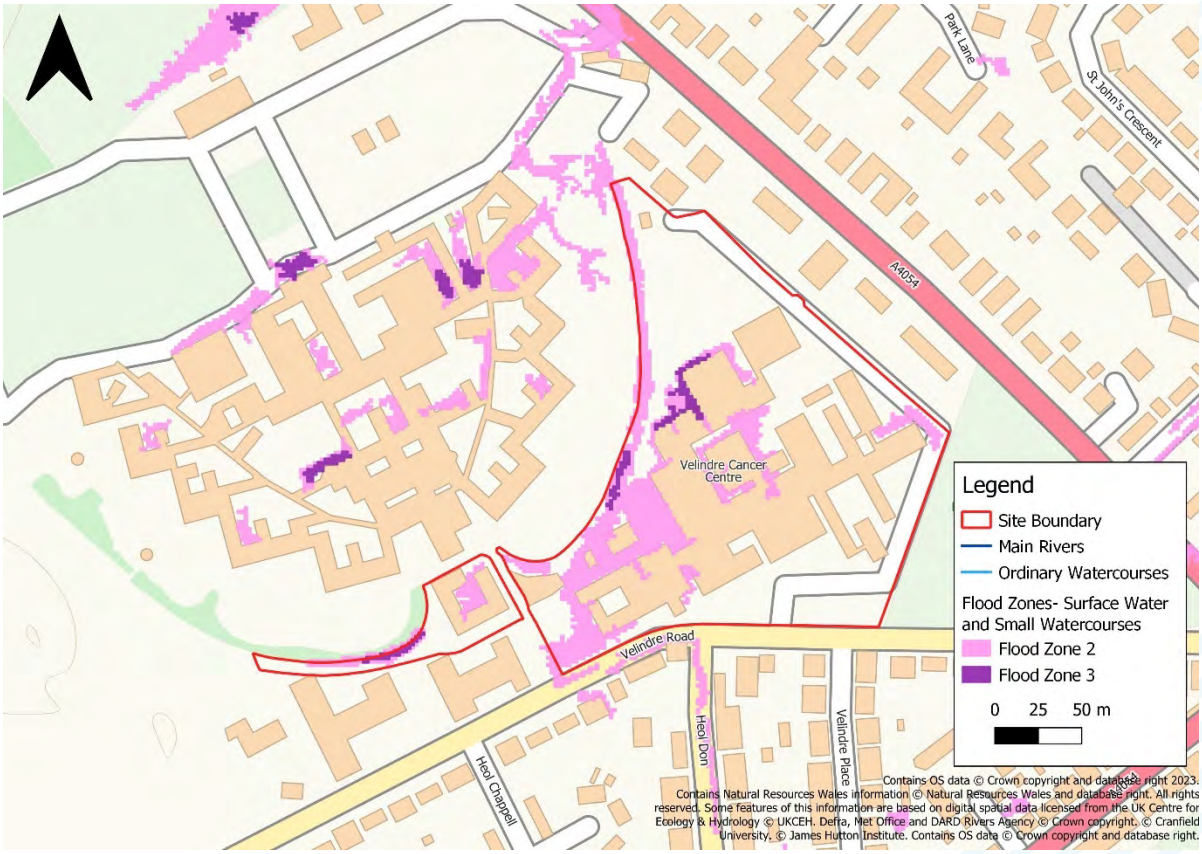

Figure 4-2 FMfP - Flood Risk from Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2. below. As the proposed use for the site is for residential development it is classified as a highly vulnerable development.

Table 4-2 Development Vulnerability categories

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire

	stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are **New Development, Redevelopment, Change of use or conversions, and Extensions**. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

TAN-15 defines Redevelopment as: "development that proposes to replace a building with an existing use (in full or in Part) with a new building".

The proposed development site is brownfield, comprising the existing Velindre Cancer Centre providing specialist cancer services. Consequently, any proposals for the site shall be classed as 'redevelopment'.

Furthermore, TAN-15 states that:

Proposals for redevelopment, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient then the expectation is that planning permission will not be granted (TAN-15 para 4.5).

Where buildings in flood risk areas are currently in use, there may be circumstances where redevelopment, changes of use or conversion proposals can bring clear benefits to the area and the building. These should be balanced and weighed against the flood risk considerations (TAN-15 para 10.4).

The current consultation draft of the revised TAN-15 appears to support redevelopment opportunities if these changes can further increase the resilience of a building. For the time being and to the best of our knowledge, the proposed site will likely be classified as a 'redevelopment' for the purposes of the TAN-15 and the application of the Justification Test.

4.4 Justification Test and Acceptability Criteria

TAN-15 sets out the requirement for an FCA based on the sites location within the flood zones identified within the Flood Map for Planning. A Flood Consequences Assessment is only required as a consequence of a site being located within Flood Zones 2 and 3.

As per Section 4.1, the proposed development is located within Flood Zone 1 of the FMfP –Rivers and Sea.

Tan-15 states that within Zone 1, all types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

Consequently, no FCA is required as a result of tidal or fluvial flood risk, and the site does not need to be considered against the Justification Test or Acceptability Criteria.

However, as the site is located within Flood Zones 2 and 3 of the Flood Map for Planning Surface water and small watercourses, a Flood Consequences Assessment shall be required as a result of the risk from this source. The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. Therefore the FCA will be likely to be simple due to the risk. However, the FCA should include details on how the surface water risk will be managed including the use of SuDS with existing flow paths on site retained.

Surface water and ordinary watercourse flood risk management are the responsibility of the Lead Local Flood Authority which may have site-specific requirements for surface water management across the proposed development site.

The FCA should develop a full appreciation of:

- The risk and consequences of flooding on the development; and
- The risk and consequences of the development of flood risk elsewhere

5 Conclusion

Site Description

- JBA Consulting has been commissioned to prepare a Flood Risk Appraisal in support of a candidate site for the Cardiff Council for the replacement LDP. The site is located at the Velindre Cancer Centre and proposed for a residential development. The site falls in a general north-to-south direction.

Overview of flood risk

- The primary risk of flooding to the site is from surface water. Mapping suggests that this is primarily as a result of ponding around existing site infrastructure, which is unlikely to be accurately represented within the broadscale modelling used to inform the flood map.
- It is likely that surface water flood risk can be mitigated appropriate surface water management techniques, such as incorporating SuDS techniques and delivering a robust surface water management strategy. Existing surface water flow paths should be retained and managed.
- The site is at very low risk of flooding from fluvial, tidal, and reservoir and groundwater sources.
- The site is at low to medium risk of flooding from sewers, with further investigation into the risk being required when developing the site.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to support changes of use and redevelopment if these changes can further increase the resilience of a building.
- The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. However, it's been suggested that a site-specific FCA is undertaken to demonstrate how surface water flood risk is managed. This will be done via the use of SuDS with existing flow routes retained.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales.
- A site-specific Flood Consequence Assessment must demonstrate that surface water flood risk can be managed appropriately without increasing flood risk on or off site.

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its Replacement Local Development Plan; Proposed Gypsy and Traveller Site at Pengam Green. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site by Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located to the north of Rover Way on Pengam Green. To the west of the site is The Willows High School, to the south and east Pengam Green, including the former RAF Pengam Moors airfield. To the north the site is bounded by residential properties, as shown in Figure 2-1. The site currently comprises the greenfield scrubland of Pengam Moors.

Figure 2-1 Site location

2.1 Development Proposals

The proposed development is for a Gypsy and Traveller site to provide additional pitches within Cardiff.

2.2 Watercourses and Flood Defences

The site is located near the Rhymney River, as seen in Figure 2-2 below. The Rhymney River outfalls into the Severn Estuary, passing through the Cardiff Mudflats approximately 500m to the east of the proposed site at its closest point.

The proposed candidate site is within an area benefitting from defences, as shown in Figure 2-2. Flood defences are present along the banks of the River Rhymney and the Severn Estuary. Along the Severn Estuary, defences comprise the remnants of rock armour, whilst along the River Rhymney defences are revetments, a sheet-pile wall, earth embankment, and a section of severely eroded block stone defences along the western bank. These flood defences have a standard of protection of 75 to 150 years. Tidal and fluvial erosion of these defences and the associated coastline has taken place to the extent that extensive sections of defences have either been completely lost or are in very poor condition and are at significant risk of failure in the near future.

Planning permission (planning reference-21/02138/MJR) was granted in September 2021 for the Cardiff Coastal Flood Defence scheme. This scheme will provide improved flood defences along the banks of the River Rhymney and the Severn Estuary. The coastal defences comprise four main sections and will enhance the standard of protection across this area to increase resilience to climate change. Construction of these flood defences commenced in 2024.

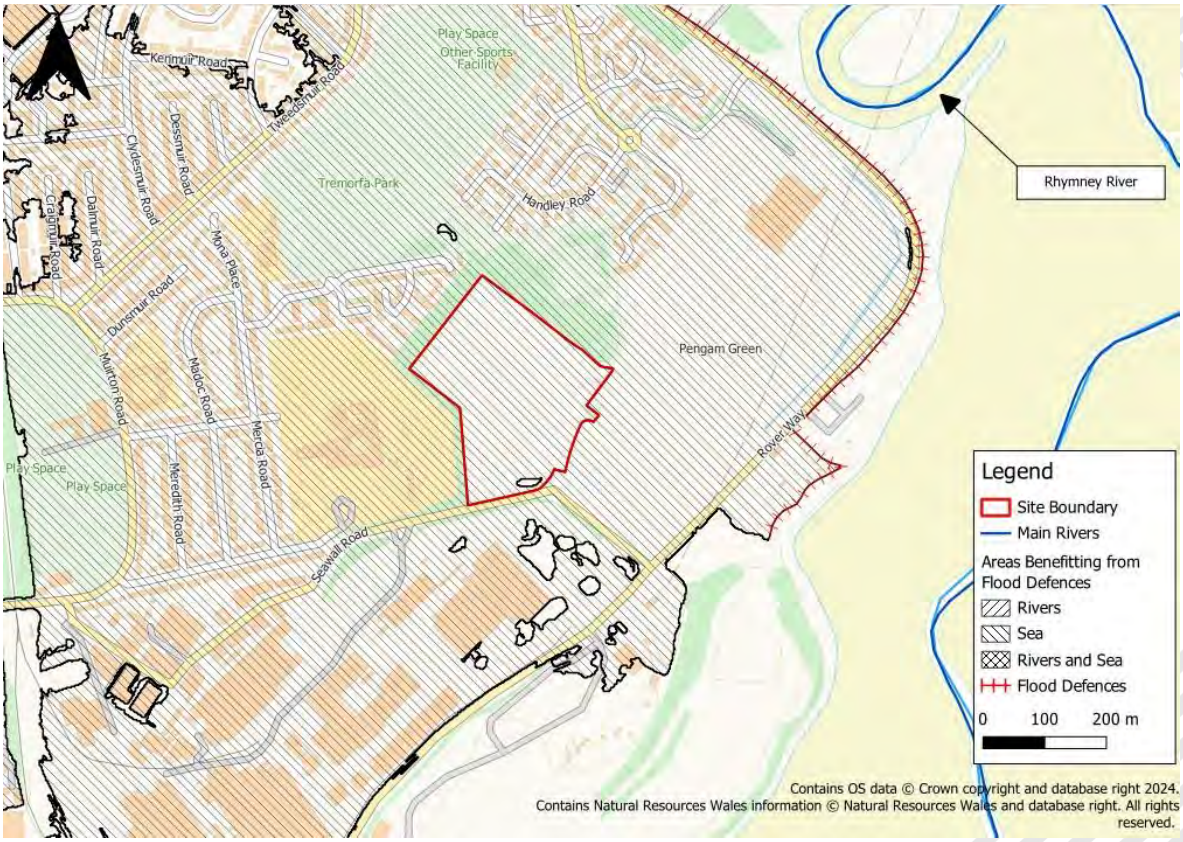

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the site is relatively flat with no overall direction of fall.

The LiDAR data shows a range in the topography between approximately 9.80mAOD and 6.5mAOD. The highest point on the site is found on the site's southern boundary. The lowest point is located towards the north of the site.

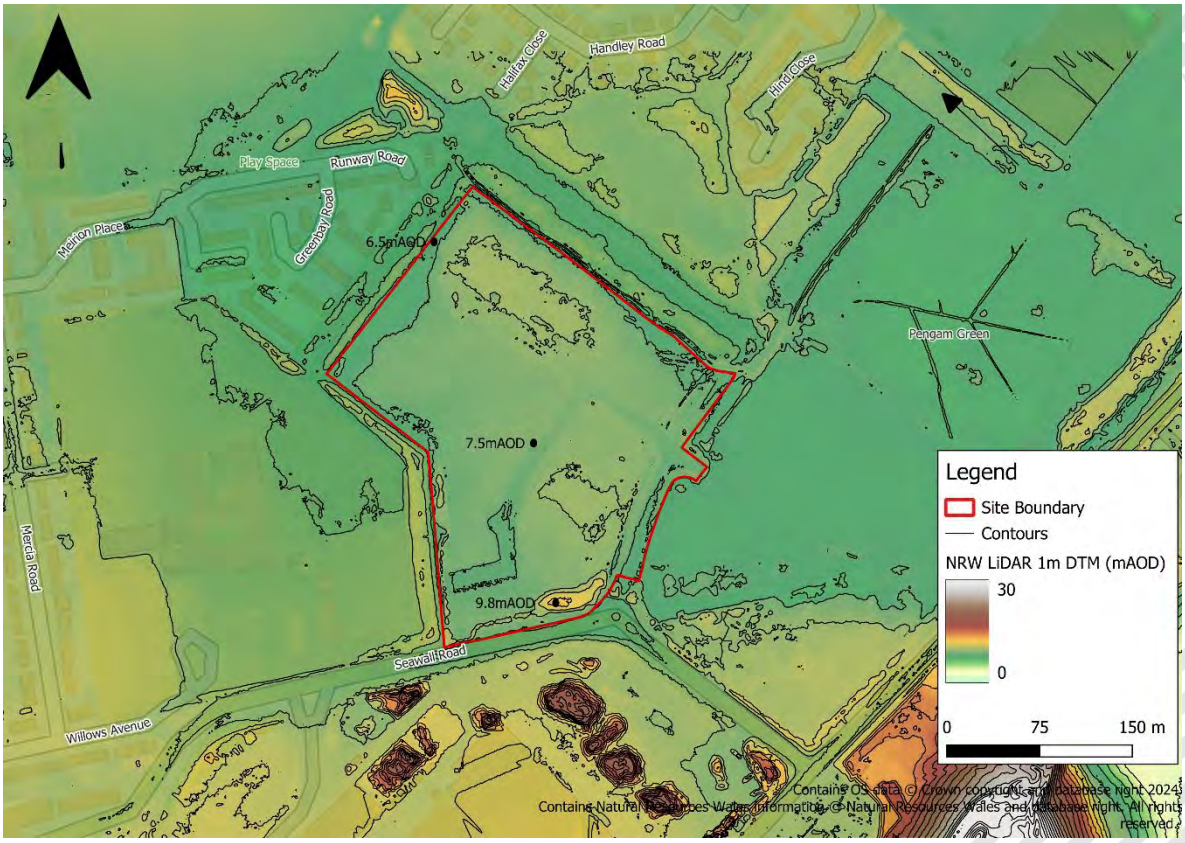

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources of flooding.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from Rivers. This means that there is a less than 0.1% AEP chance of fluvial flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at **low risk** of flooding from the sea, as shown in Figure 3-1. Low risk means that each year, this area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 200 (0.5%). Furthermore, the entire site is within an area 'Benefiting' from Flood Defences, with protection up to the 1 in 200 event (0.5% AEP).

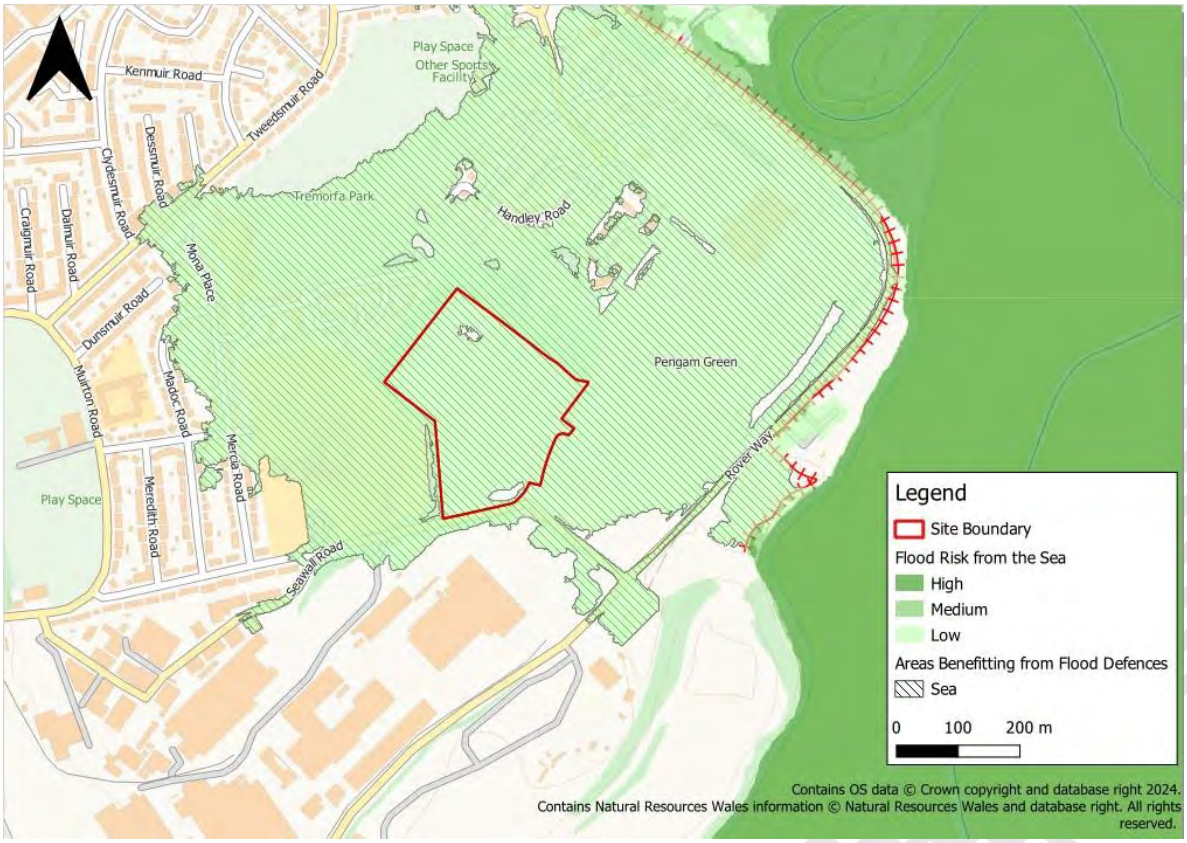

Figure 3-1 FRAW- Flood Risk from the Sea

3.2.1 Model Availability

A detailed tidal flood model for Cardiff and the River Rhymney was developed by JBA Consulting in 2020 and updated in 2022. The updated model was used to simulate results for a 100-year lifetime of development, to the year 2122. Furthermore, the model simulated the risk of flooding both with and without the Cardiff Coastal Flood Defence Scheme. For this assessment, only the defended scenario with the upgraded defences has been used due to the planned commencement of the scheme in 2024.

As this site is proposed for residential use, the lifetime of development will be assumed to be 100 years.

3.2.2 Model Results

Figure **3-2** and Figure **3-3** demonstrate that the proposed candidate site is predicted to be flood-free in both the 2122 0.5% AEP and the 2122 0.1% AEP events.

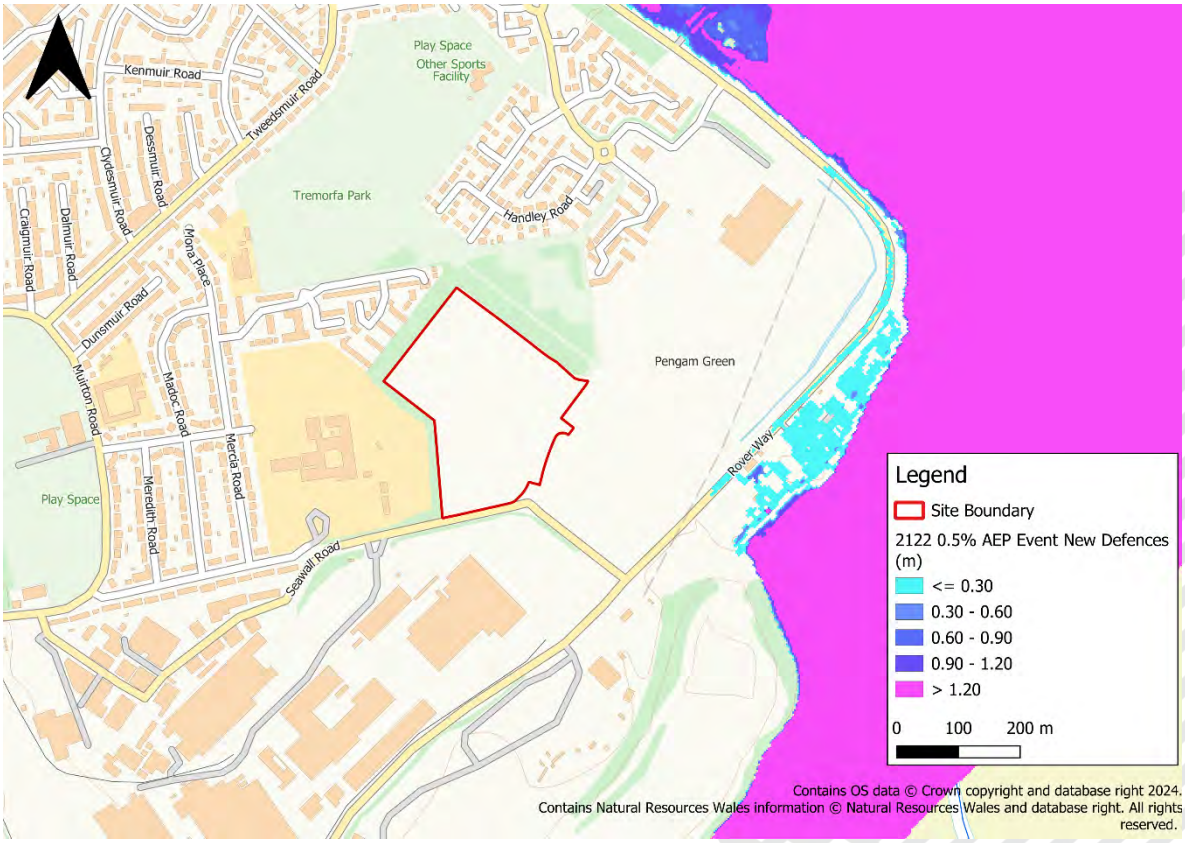

Figure 3-2 0.5% AEP plus Climate Change Event (Defended)

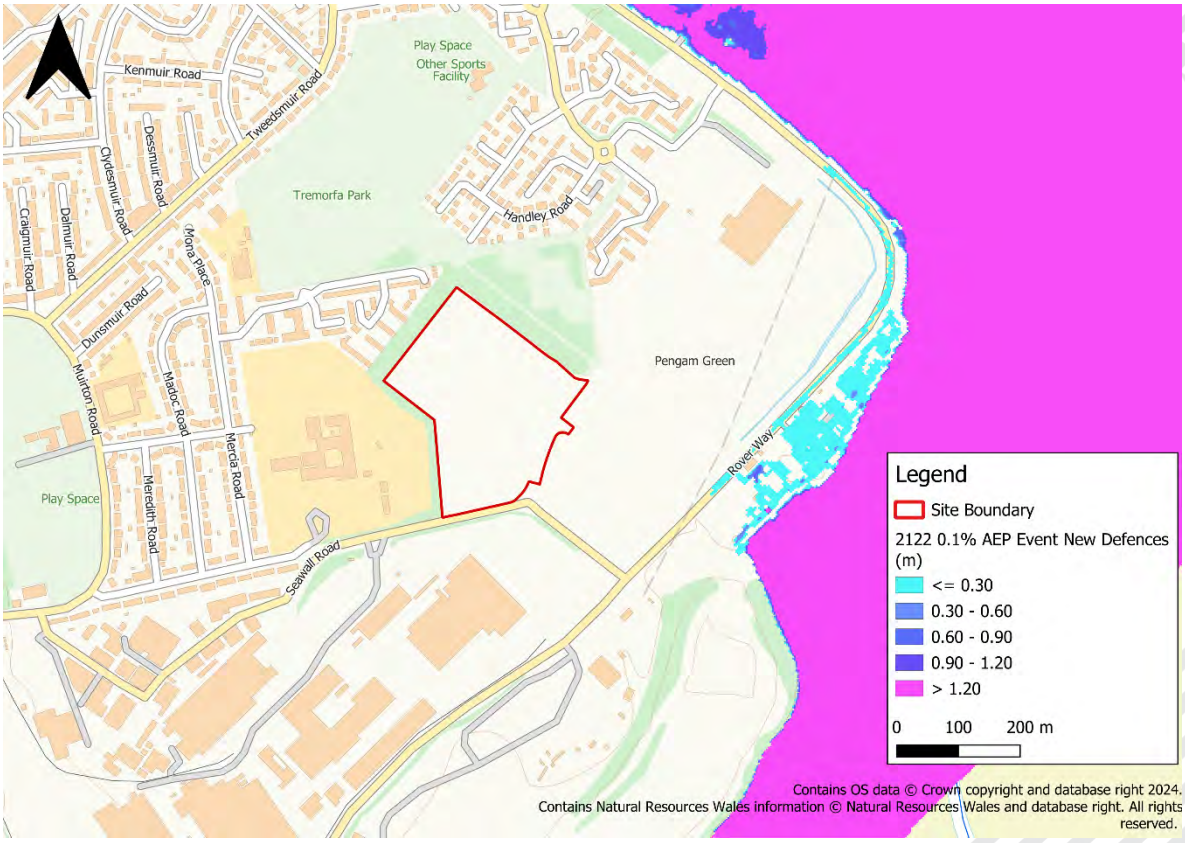

Figure 3-3 0.1% AEP Event (Defended)

3.2.3 Summary of Detailed Modelling

The entire site has been modelled to be flood-free for both the 2122 0.5% AEP and the 2122 0.1% AEP events. Therefore, the risk has been assessed to be **low** for the lifetime of the development, once the new Cardiff Coastal Flood Defence scheme is constructed and operational.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequences Assessment (FCA).

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is predominately at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-4. There are some areas that are shown to be at low risk close to the northern boundary and the south west corner. Low risk means that each year, this area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 200 (0.5%).

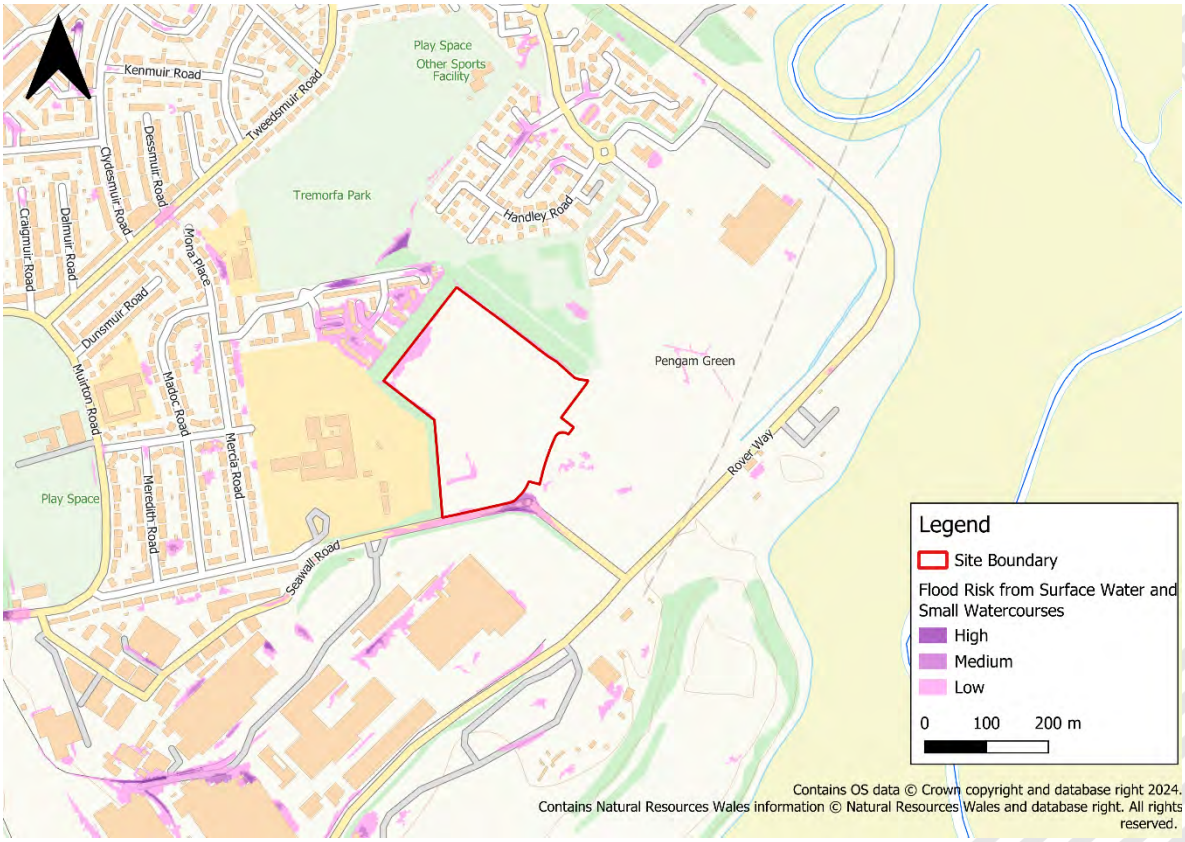

Figure 3-4 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The bedrock geology of Cardiff is predominantly comprised of Mudstone. Mudstone tends to have low porosity and permeability; however, this is dependent upon grain size percentages and level of compaction. As a result, upward percolation of groundwater and subsequent flooding should be considered.

The South East Wales Stage 1 – Strategic Flood Consequence Assessment (SFCA) includes JBA's Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area of 'low' risk from groundwater emergence. There have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Level 1-SFCA. Furthermore, the Cardiff Local Flood Risk Management

Strategy[1] also states that 'there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small

As a result, the groundwater flood risk at the site has been assessed to be **very low**.

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South-East Wales Level-1 Strategic Flood Consequence Assessment (SFCA) has identified there to be a high number (175) of historic sewer flood incidents within the Splott electoral ward, in which the site is located. However, no specific mention of the site has occurred in the South-East Wales Level-1 Strategic Flood Consequences Assessment (SFCA) or the Cardiff Local Flood Risk Management Strategy. The current location of existing sewers is unknown and further assessment of sewer flood risk would need to be undertaken as part of a Flood Consequences Assessment for this site to fully assess the risk posed by sewer flooding. With the current location of the existing sewers not known, the risk posed by sewer flooding is currently assessed to be **low to medium**.

3.7 Summary of Flood Risk

The main flood risk source to the site is from tidal flooding. However, detailed tidal modelling has been reviewed to assess the benefits of the new Cardiff coastal flood defences to the proposed development site. The site is predicted to be flood-free in the 2122 0.5% AEP and 2122 0.1% AEP events.

Table 3-1 below gives a summary of the flood risk on site.

Table 3-1 Summary of Flood Risk

Source of Flooding	Risk
Rivers	Very Low
The Sea	Low
Surface Water and small watercourses	Very Low
Groundwater	Very Low
Reservoir	Very Low
Sewers	Low to Medium

[1] https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN- 15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year..		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure managed and maintained by Risk Management Authorities provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure managed and maintained by Risk Management Authorities provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – flood risk from rivers shows the site is located in Flood Zone 1. This represents a less than 0.1% (1 in 1000 year) chance of flooding from fluvial sources in any given year, including the effects of climate change. No figure has been provided as Flood Zone 1 is depicted as a transparent layer on the FMfP.

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – Flood Risk from the Sea shows the site is located in Flood Zone 3, as shown in Figure 4-1. This represents a greater than 0.5% (1 in 200 year) chance of flooding from tidal sources in any given year.

The site is also located within the TAN-15 Defended Zone. The TAN-15 Defended Zones demonstrate that the site is protected up to the 0.5% AEP event, (including climate change and a freeboard if the defences were constructed after 2016).

Whilst the current TAN-15 Defended Zone does not reflect the climate change uplift and freeboard as the current defences were constructed prior to 2016, it is envisaged that the TAN-15 Defended Zone designation shall be retained, and the site shall be protected up to the 0.5% AEP event plus climate change as a minimum when the Cardiff Coastal Defence scheme is incorporated into the FMfP post-construction completion.

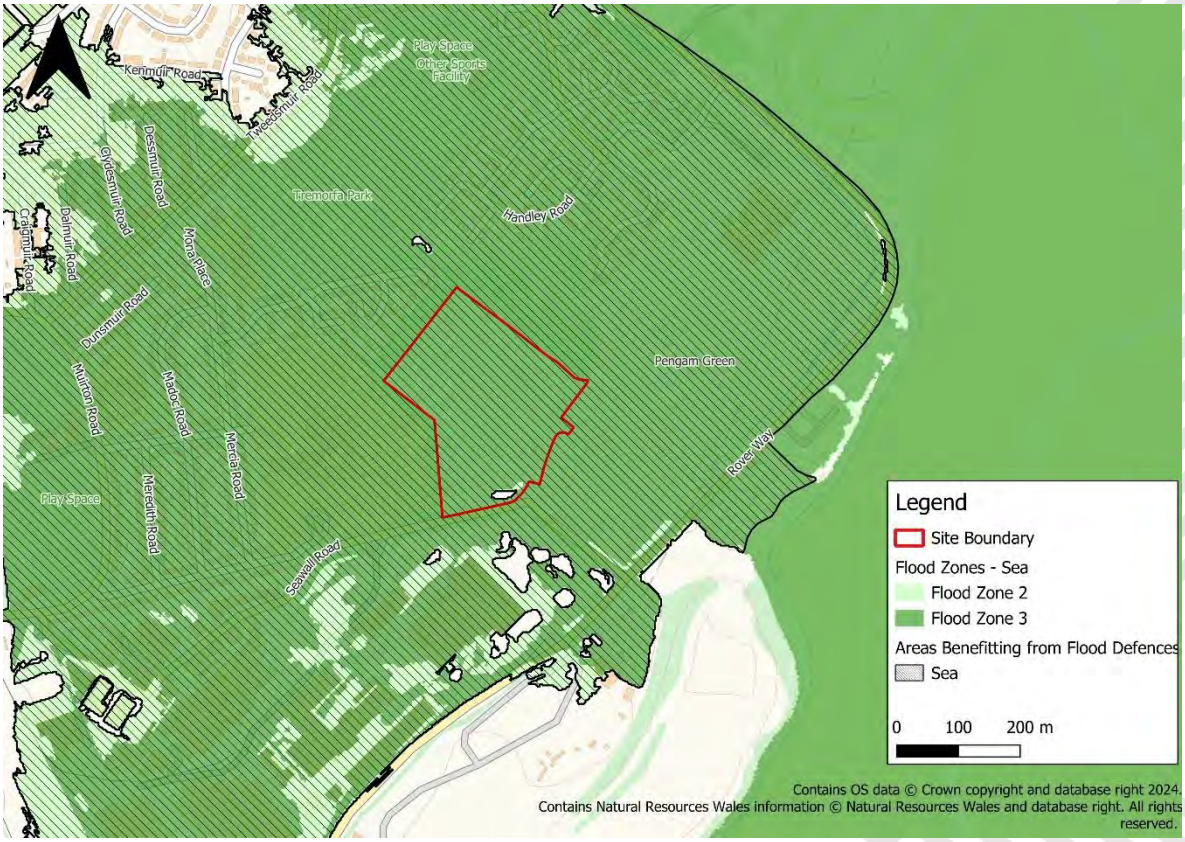

Figure 4-1 FMfP Risk from the Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is located mostly within Flood Zone 1. A small area of Flood Zone 2 and 3 is identified within the northern area of the site. Flood Zone 2 represents areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. Whereas Flood Zone 3 represents areas with a greater than 1% (1 in 100 year) chance of flooding in any given year including the effects of climate change. The area within Flood Zone 3 is small and isolated and its likely it will be managed through the use of SuDS.

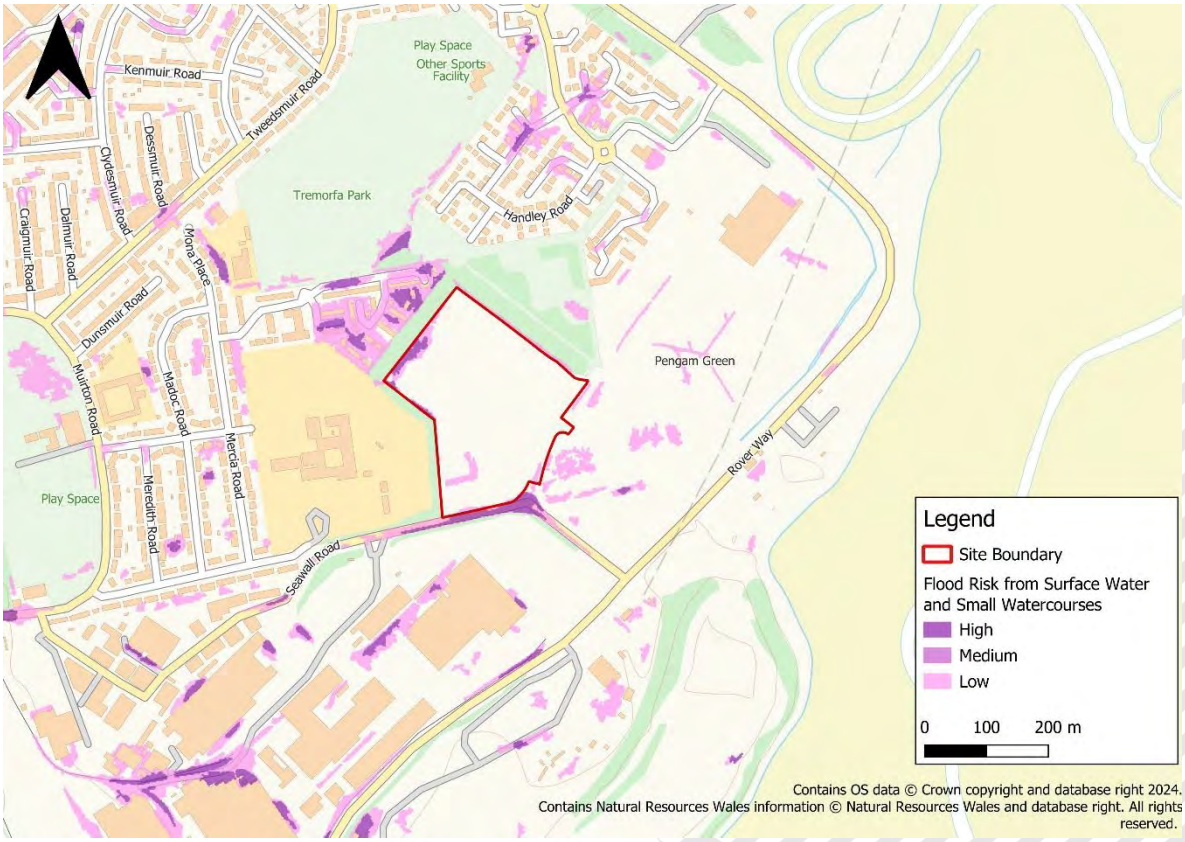

Figure 4-2 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to development, as shown in Table 4-2 below. As the proposed use for the site is for a Gypsy and Traveller site it is classified as a highly vulnerable development.

Table 4-2 TAN-15 Vulnerability Classification3

Development category	Types
Highly vulnerable development	**All residential premises (including hotels, Gypsy and Traveller sites caravan parks and camping sites).** Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood.
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of new development.

The TAN-15 defines New development as: "*development on any greenfield land; development of vacant or disused brownfield sites*"

Furthermore, TAN-15 states that:

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new developments for the purposes of this guidance. New developments increase the exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

All new developments will need to demonstrate that they meet the Justification Test and comply with the Acceptability criteria as set out in Sections 4.4 and 4.5 below.

4.4 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The requirements of the Justification Test are summarised in Table 4-3 and the proposed development has been assessed against the requirements of the Justification Test and found to satisfy them and thus pass the Justification Test.

Table 4-3 TAN-15 Justification Test[4]

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>The development will be justified in the TAN 15 Defended Zones if:</td><td>The development will be justified in Zone 2 if:</td><td>The development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives.
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable by the criteria contained in section 11 of TAN-15.</td></tr>
</table>

4.5 Acceptability Criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'Acceptability criteria'. There are three principal aspects to the Acceptability criteria:

4 TAN-15, Section 10

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depend on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[5]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[6]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water-compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

Note: The extreme flood event is defined as the 0.1% AEP flood event

5 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
6 TAN-15, Figure 6

4.6 Summary of Policy Position

The proposed development site is for residential uses (Gypsy and Traveller site), comprising New Development at Pengam Green, Cardiff. This proposed development is considered to be 'Highly Vulnerable' development.

Based on NRW's FMfP, the site is located within the TAN-15 Defended Zone. All types of development are permissible within the TAN-15 Defended Zone, subject to the application of the Justification Test. Post-completion of the Cardiff Coastal Defence Scheme, it is anticipated that the entire site shall be retained within the TAN-15 Defended Zone.

Sites within the TAN-15 Defended Zone pass the Justification Test where there is either a Community Adaptation and Resilience Plan in place, **or**, it has been demonstrated that the consequences of flooding have been considered and found to be acceptable

Detailed modelling demonstrates that the site is predicted to be flood free in all design events.

It is therefore considered that the site is likely to pass the requirements of the Justification Test and acceptability criteria. The proposed development set out in this site assessment is therefore permissible at this location on the grounds of flood risk.

5 Conclusion

Site Description

- Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Proposed Gypsy and Traveller site at Pengam Green.
- The proposed development site is located to the north of Rover Way on Pengam Green, Cardiff.

Overview of flood risk

- The primary risk of flooding to the site is from tidal sources, however detailed modelling indicates that the development site is predicted to be flood free in all design events post-construction completion of the Cardiff Coastal Defence Scheme;
- The site is at very low risk of flooding from fluvial, reservoir and groundwater sources;
- The site is predominantly at very low risk from surface water flooding;
- The site is at low to medium risk of flooding from sewers.

Consultation draft of new TAN-15

- It is anticipated that the entirety of the site shall be located within the TAN-15 Defended Zone on completion of the new Cardiff Coastal Defences.
- Highly Vulnerable developments are permissible within the TAN-15 Defended Zone, subject to the application of the Justification Test.
- The site satisfies the acceptability criteria. The site is predicted to be flood free in the 2122 0.5% AEP event and in the 2122 0.1% AEP event.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales in its current draft form.

Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	Elise Coughlin BSc (Hons)
Reviewer / Sign-off	Eleanor Maxfield BSc (Hons) MSc C.WEM MCIWEM
Subject	Allied Bakeries - Flood Risk Appraisal

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Allied Bakeries, Maes-Y-Coed Road. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development flooding and coastal erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located at current Allied Bakeries, Maes-Y-Coed Road, Heath, Cardiff, CF14 4UZ as shown in Figure 2-1. The site comprises the existing Allied Bakeries.

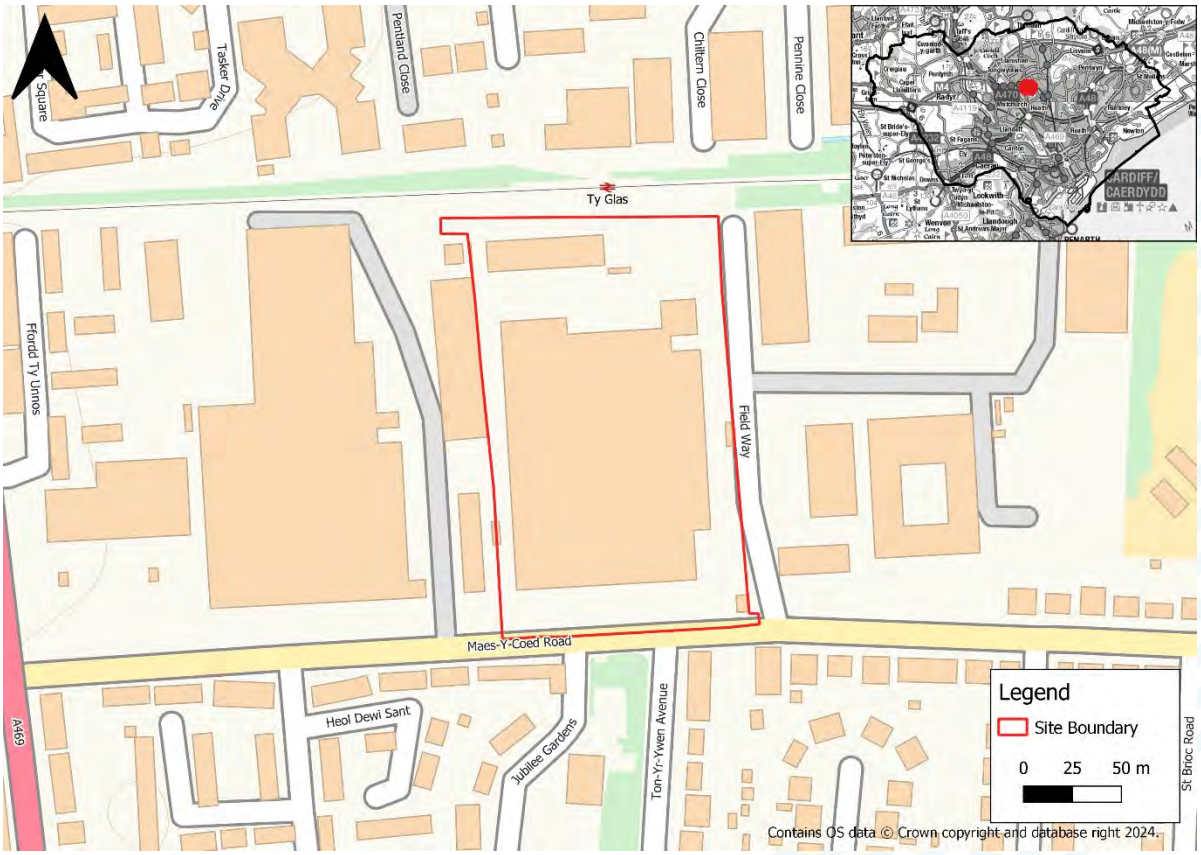

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development at this site is mixed use (housing / commercial).

2.2 Watercourses and Flood Defences

There is an unnamed ordinary watercourse located approximately 70m to the north-east of the site, this is a tributary of the Roath Brook which is an NRW Main River.

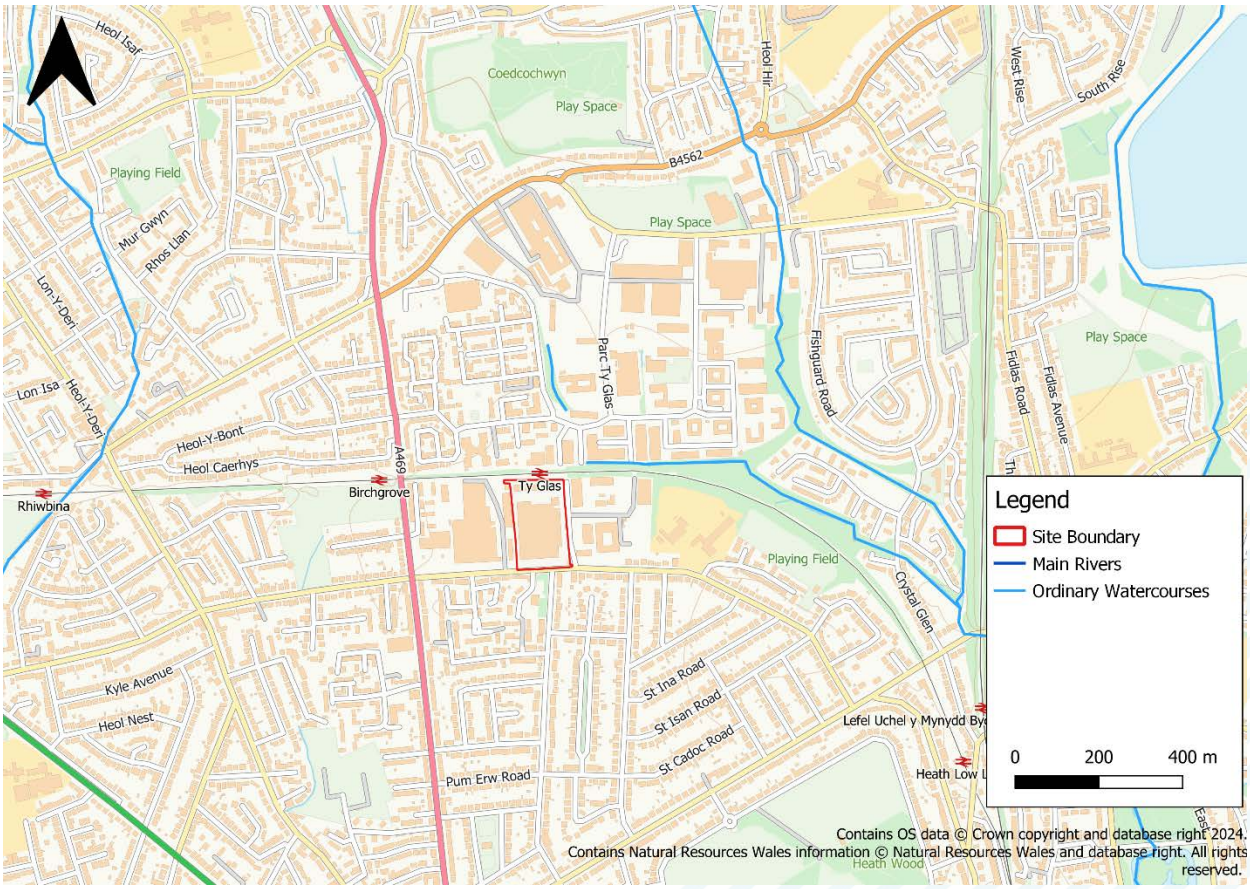

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the elevation across the site is relatively flat, with elevations of approximately 36m AOD across the site. The topography to the south and east of the site is similar to that of the site. The elevation is greater along the railway line bordering the north of the site and the area to the west, with elevations up to approximately 39m AOD.

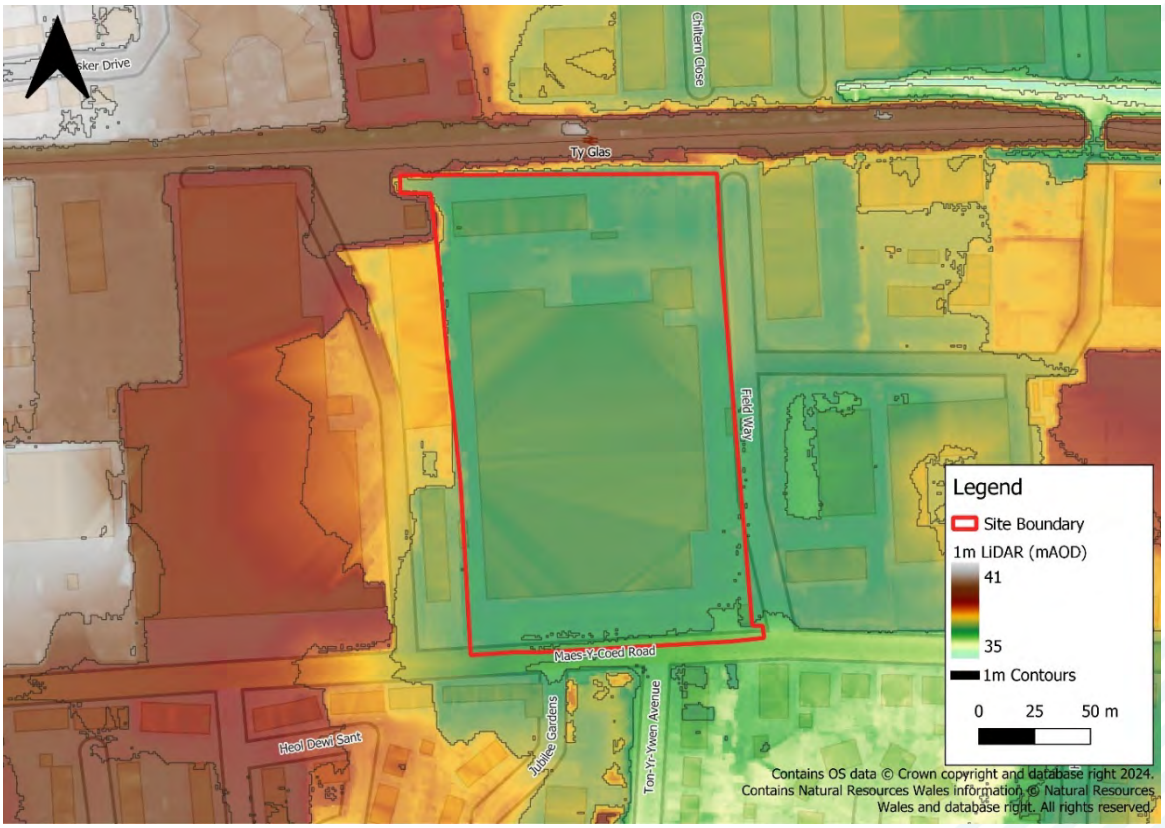

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from fluvial sources. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site has areas of **medium and low** surface water risk across the site as shown in Figure 3-1 below.

Areas of low risk of surface water flooding are located in the north west of the site and along the western boundary at the edge of the existing building. Three small, isolated areas of medium risk are also noted in these areas.

The areas of surface water flood risk are likely to be associated with ponding due to topographic depressions on the site. It is likely that surface water is running off the higher ground to the west and entering the site, ponding in the low topographic areas adjacent to the western edge of the existing building.

Any future development will include SuDS which, if designed properly would mitigate the risk from ponding. The potential flow path from the west of the site should also be considered and managed in any redevelopment proposals and SuDS design.

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months, and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The Cardiff City Council Flood Risk Management Plan states that 'low lying areas are particularly susceptible' but groundwater 'has not been a common issue in Cardiff since the Cardiff Bay Barrage was built'. Therefore, it is concluded there is **low risk** of flooding to the site.

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoirs. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

Cardiff Flood Risk Review – Appendix D1 from the South-East Wales Stage 1 SFCA indicates that Heath electoral ward has experienced 11 sewer flooding incidents. Therefore it is concluded that there is a **medium to low risk** of sewer flooding for the proposed development.

3.7 Summary of Flood Risk

The main flood risk source to the site is surface water and small watercourse flooding, with areas to the west of the site in Flood Zone 2 and some smaller areas to the north and south-west in Flood Zone 3. However, surface water flood risk can be managed through the design of an adequate drainage system that includes the use of SuDS. A summary of flood risk from all sources is given in Table 3-1 below.

Table 3-1 Summary of Flood Risk

Source of Flooding	Risk
Rivers	Very Low
Sea	Very Low
Surface Water and Small Watercourses	Predominantly Very Low risk. Isolated areas of Low and Medium risk.
Groundwater	Low
Reservoir Failure	Very Low
Sewer	Low to Medium

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it provides an indication as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development, and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 5-1 summarises the flood zones and their definitions.

Table 5-1 TAN-15 Definition of FMfP flood zones[1]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change	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, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard)	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard)	Not applicable

1 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers and Sea

The Flood Map for Planning – flood risk from rivers and the sea shows that the site is located in Flood Zone 1, as shown in Figure 3-1. The map is provided at a larger scale to show the distance of the site to the nearest areas of flood risk from these source.

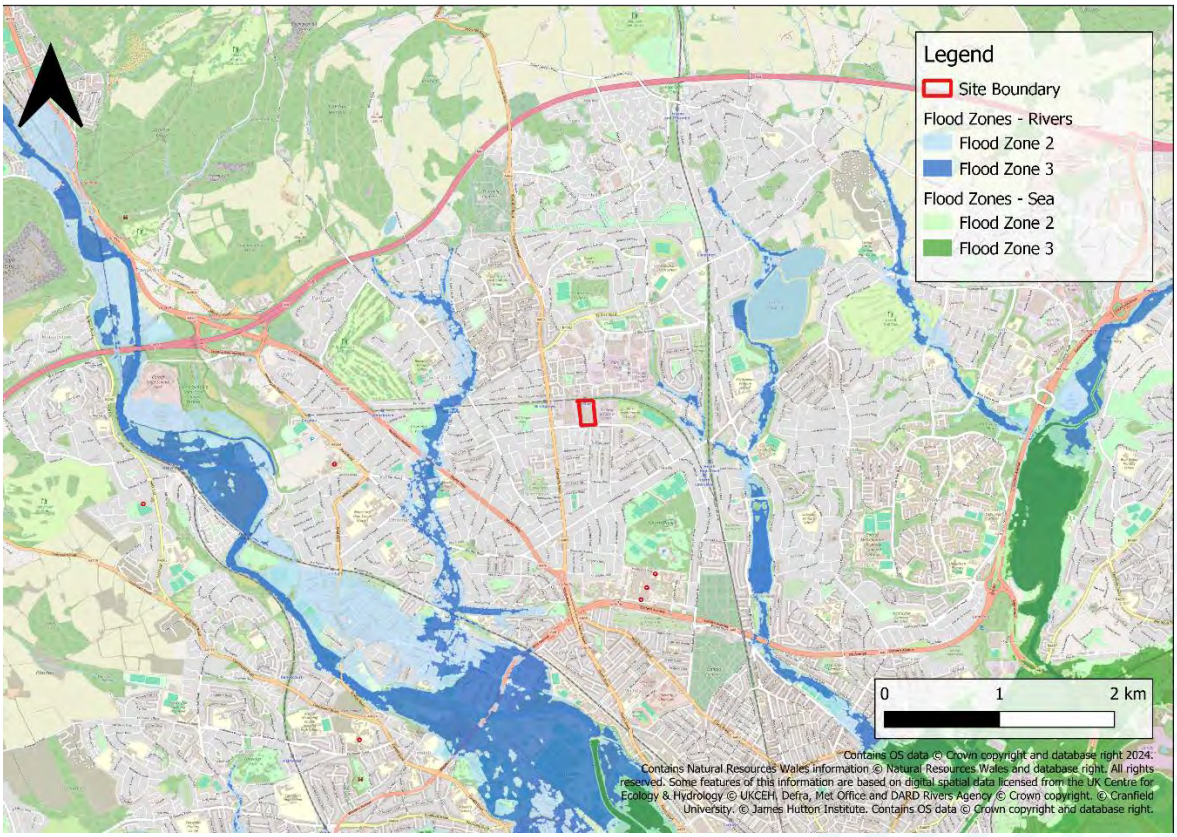

Figure 3-1 Flood Map for Planning- Rivers and Sea

4.1.2 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows that some areas of the site are located in Flood Zones 2 and 3, as shown in Figure 3-2.

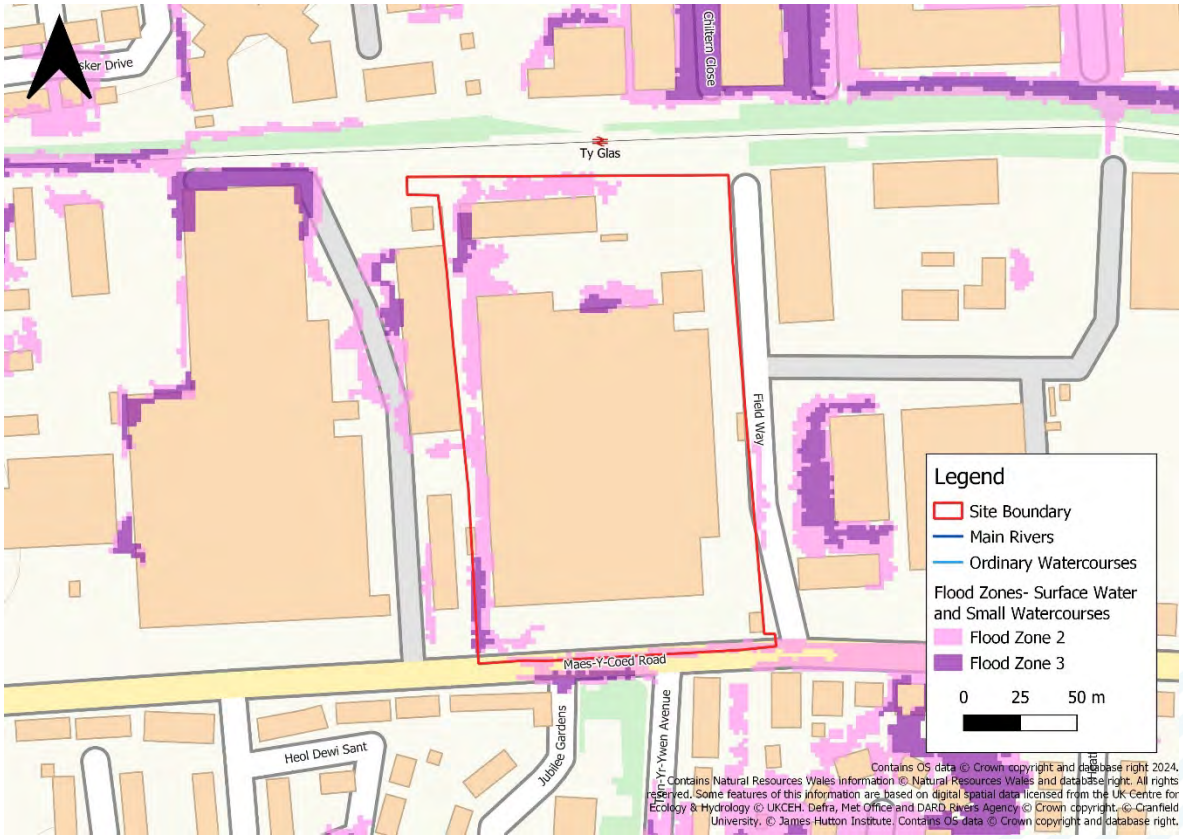

Figure 3-2 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 3-2 below. As the proposed use for the site is mixed use, for housing and commercial use, it is classified as highly vulnerable development.

Table 3-2 Development vulnerability categories[2]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

2 TAN-15, Figure 2

4.3 New development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice in relation to four types of development. These are **New Development, Redevelopment, Change of use or conversions, and Extensions**. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood risk areas.

TAN-15 defines Redevelopment as: "development that proposes to replace a building with an existing use (in full or in Part) with a new building".

The proposed development site is brownfield, comprising the existing housing complex. Consequently, any proposals for the site shall be classed as 'redevelopment'.

Furthermore, TAN-15 states that:

Proposals for redevelopment, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient then the expectation is that planning permission will not be granted (TAN-15 para 4.5).

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new development for the purposes of this guidance. New developments increase exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

Where buildings in flood risk areas are currently in use, there may be circumstances where redevelopment, changes of use or conversion proposals can bring clear benefits to the area and the building. These should be balanced and weighed against the flood risk considerations (TAN-15 para 10.4).

The current consultation draft of the revised TAN-15 appears to support redevelopment opportunities if they are able to further increase the resilience of a building. For the time being and to the best of our knowledge, the proposed site will be classified as 'change of use or conversion' for the purposes of the TAN-15 and the application of the Justification Test.

4.4 Justification Test and Acceptability Criteria

TAN-15 sets out the requirement for an FCA based on the sites location within the flood zones identified within the Flood Map for Planning. A Flood Consequences Assessment is only required as a consequence of a site being located within Flood Zones 2 and 3.

As per Section 4.1, the proposed development is located within Flood Zone 1 of the FMfP –Rivers and Sea.

TAN-15 states that within Zone 1, all types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

Consequently, no FCA is required as a result of tidal or fluvial flood risk, and the site does not need to be considered against the Justification Test or Acceptability Criteria.

However, as the site is located within Flood Zones 2 and 3 of the Flood Map for Planning –Surface water and small watercourses, a Flood Consequences Assessment shall be required as a result of the risk from this source. The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. Therefore, the FCA will be likely to be simple due to the risk. However, the FCA should include details on how the surface water risk will be managed including the use of SuDS with existing flow paths on site retained.

Surface water and ordinary watercourse flood risk management are the responsibility of the Lead Local Flood Authority which may have site-specific requirements for surface water management across the proposed development site.

The FCA should develop a full appreciation of:

- The risk and consequences of flooding on the development; and
- The risk and consequences of the development of flood risk elsewhere

4.5 Lifetime of development

The Welsh Government latest technical guidance[3] for climate change states:

When considering new development proposals, Technical Advice Note 15: Development, Flooding and Coastal Erosion (TAN-15) states that it is necessary to take account of the potential impact of climate change over the lifetime of development. A rule of thumb is that residential development has a lifetime of 100 years while a lifetime of 75 years is assumed for all other developments.

As the proposals are not for mixed residential and non-residential use, a 100-year lifetime of development has been used in the production of this FCA.

[3] Climate change allowances and flood consequence assessments. Welsh Government, September 2021

5 Conclusion

Site Description

- JBA Consulting have been commissioned to prepare a Flood Risk Appraisal in support of a candidate for the Cardiff Council replacement LDP. The site is located at the existing Allied Bakeries building on Maes-Y-Coed Road and is proposed for mixed use (housing / commercial).
- The site is located in the electoral ward of Heath in Cardiff and is predominantly flat in topography.

Overview of flood risk

- The primary risk of flooding to the site is from surface water and small watercourses;
- The site is at very low risk of flooding from tidal, fluvial and reservoir sources and is at low risk of flooding from groundwater.
- The site is at medium to low risk of flooding from sewers.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to support changes of use and redevelopment if these changes are able to further increase the resilience of a building.
- TAN-15 only requires a Flood Consequences Assessment where a site is located within Flood Zones 2 and 3 on the Flood Map for Planning. Redevelopment within these flood zones are required to satisfy the Justification Test and Acceptability of Consequences. As the site is in Flood Zone 1 for all sources of flooding, consequently the site does not need to be considered against the Justification Test or Acceptability Criteria.
- The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. However, it's been suggested that a site specific FCA is undertaken to demonstrate how surface water flood risk is managed. This will be done via the use of SuDS with existing flow routes retained.

Conclusion

- It is concluded that on the grounds of flood risk, the development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales.

Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	June 2024
Author	George Williams BSc (Hons)
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc C.WEM MCIWEM
Subject	Land at Areas 9-12 St Mellons- Flood Risk Appraisal

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Land at Areas 9-12 St Mellons. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site by per Welsh Government's policy, as set out in Technical Advice Note 15 (TAN-15): Development, Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is 3.98ha and is located at land to the south of Green Meadows and Hendre Road, St Mellons, as shown in Figure 2-1. The site comprises greenfield land with several pedestrian paths running through the site. It is bordered by houses to the north, Hendre Road to the east, greenfield land and a number of watercourses forming the Wentlooge Levels to the south, and Cemaes Community Park to the west.

Figure 2-1 Site location

2.1 Development Proposals

The proposed development at this site is for residential use.

2.2 Watercourses and Flood Defences

The site is located to the northern extent of the Wentlooge Levels, an extensive reen network ultimately draining to the Severn Estuary, as seen in Figure 2-2. The Wentlooge Levels comprises a network of tidally influenced reens, including the Pil-du Reen (classified as an ordinary watercourse) and the Tarwick Reen (classified as an NRW Main River).

The proposed site is within an area benefitting from flood defences for the sea. The Wentlooge Levels are protected by NRW flood defences which provide a standard of protection of 1 in 200 (0.5% AEP). Flood defences are present over a length of 1,113m in the form of an embankment.

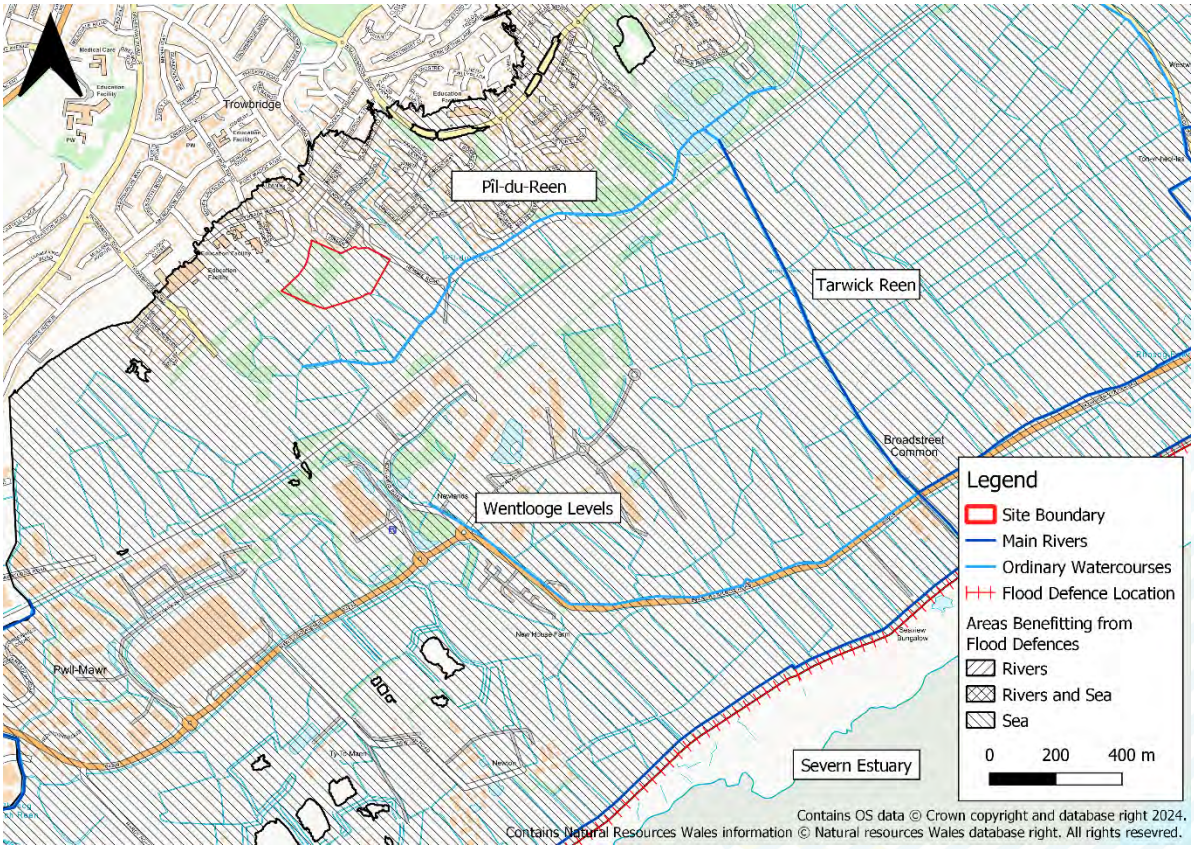

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the site is highest along the northern boundary with a highest ground level of 9.51mAOD. Ground levels fall towards the southern boundary, with a minimum ground level of 5.76mAOD. Across the site there are areas which

appear to be raised above the average surrounding ground levels, which are anticipated to be naturally formed.

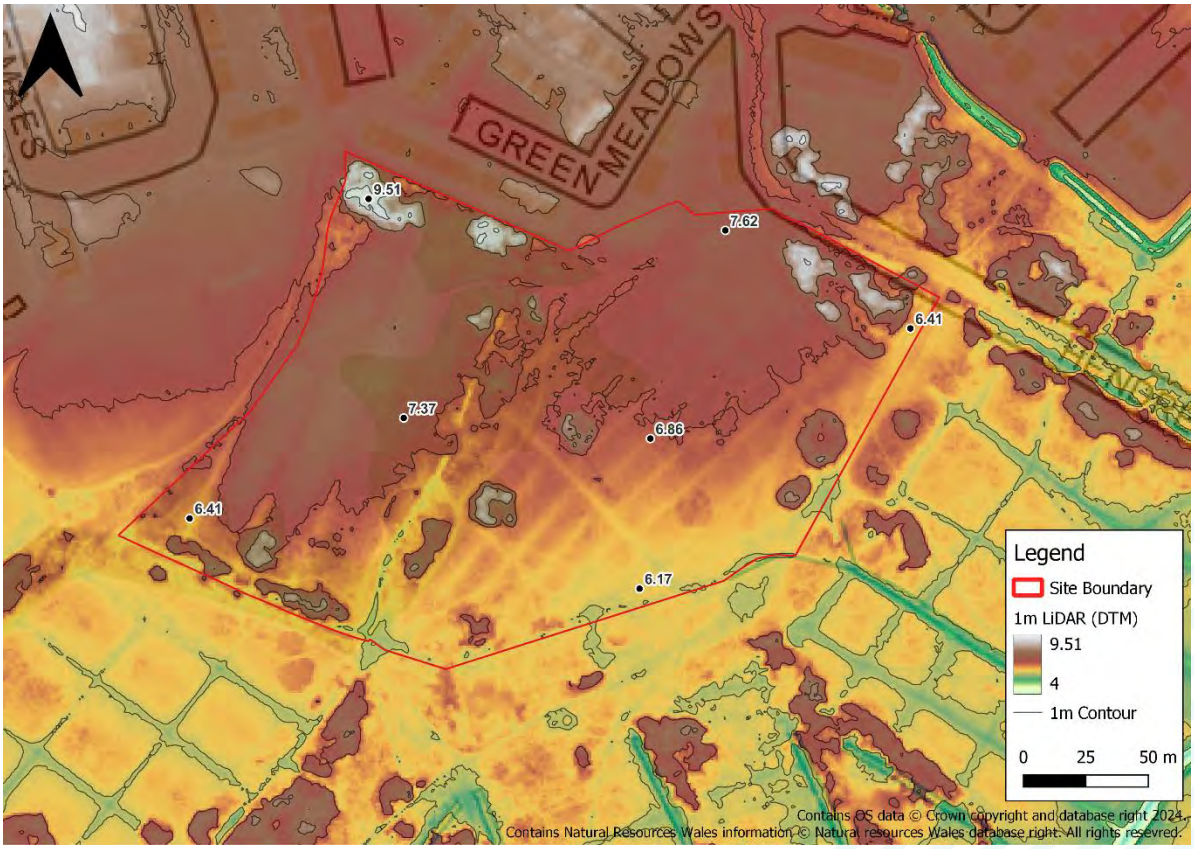

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from rivers. This means that there is a less than 0.1% AEP (1 in 1000) chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

Detailed flood modelling has been used to assess the risk of tidal flooding to the site. This has been detailed further below.

3.2.1 Model Availability

The NRW Wentlooge tidal model was developed in 2016 and extended from the River Rhymney estuary in Cardiff to the River Usk estuary in Newport.

This model has recently been updated by JBA, applying the new Coastal Flood Boundary (CFB) dataset, released in 2019. For this study, extreme sea level estimates were taken from Node 396 (River Usk) and 408 (River Rhymney) and applied across the tidal boundary of the model. Wave overtopping values have not been recalculated since the 2016 version, and therefore remain precautionary as they assume the 100 years of climate change.

For all coastal locations, future sea level rise is a major consideration and should be applied to the extreme sea level estimates. The UKCP18 User Interface has therefore been used per Welsh Government Guidance on Climate Change Allowances for Planning Purposes (September 2021) to provide climate change uplifts for the study area. The predicted tidal flood levels, including the impacts of climate change, which were applied to the updated Wentlooge model are shown in Table 3-1.

The Wentlooge model results for the present day (2022) and for 100 years (2122) have therefore been used to assess the flood risk at the site.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequence Assessment (FCA).

Table 3-1 Predicted tidal flood levels

	Modelled Tide Levels (mAOD)			
Year	**2022**		**2097**	
AEP	0.5%	0.1%	0.5%	0.1%
CFB_396	8.36	8.7	9.06	9.4
CFB_4080	7.94	8.3	8.64	9.0

3.2.2 Model Results

The site is predicted to be flood free in all design events, as shown in Figure 3-1 and 3-2. Site specific assessments submitted for planning approval are likely to require further consideration of climate change allowances on model results.

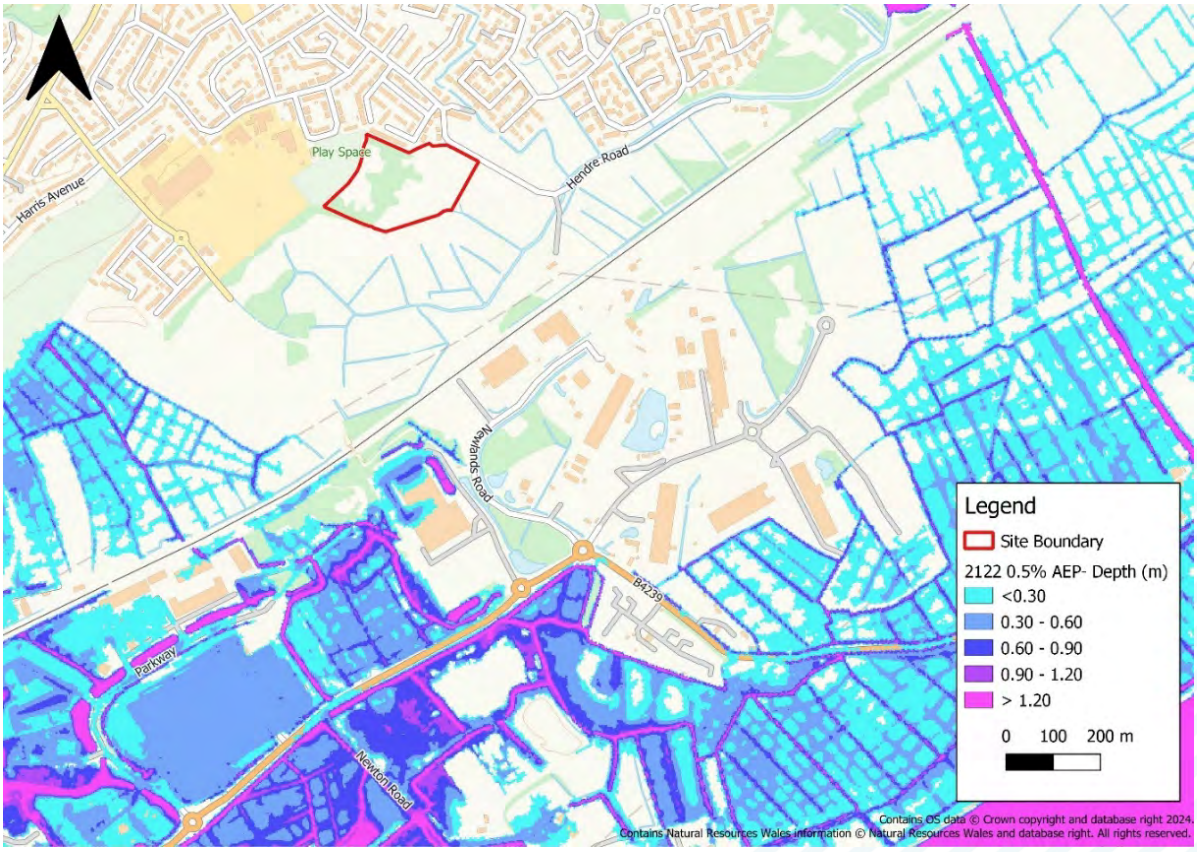

Figure 3-1 0.5% AEP plus Climate Change Event: Flood Depths

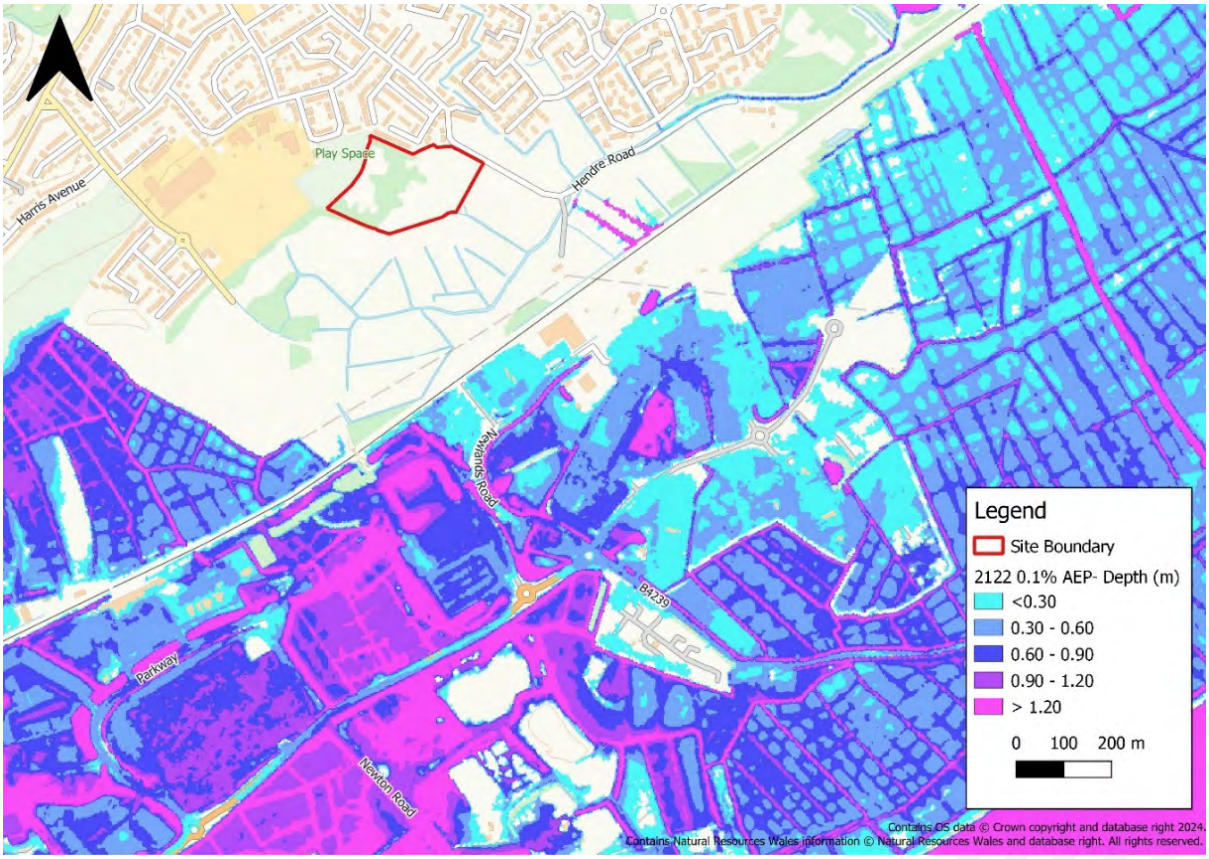

Figure 3-2 0.1% AEP plus Climate Change Event: Flood Depths

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is predominantly at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-3. This means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site.

Several areas of surface water ponding are present around the boundary of the site in the high and medium-risk events. High means that each year, this area has a chance of flooding of greater than 3.3% AEP and medium means that each year, an area has a chance of flooding of between 1% (1 in 100) AEP and 3.3% (1 in 30) AEP from surface water and small watercourse flooding.

Several flow paths and areas of ponding are present within the low-risk event in topographic depressions across the site and along the site boundary. Low risk means that each year, an area has a chance of flooding of between 0.1% AEP and 1% AEP from surface water and small watercourse flooding. Flood depths are predominantly below 0.3m and are deepest in the northwestern corner of the site.

It is recommended that surface water flow paths are retained during the site master planning process and that flood water on the site is managed appropriately, through the use of SuDS techniques.

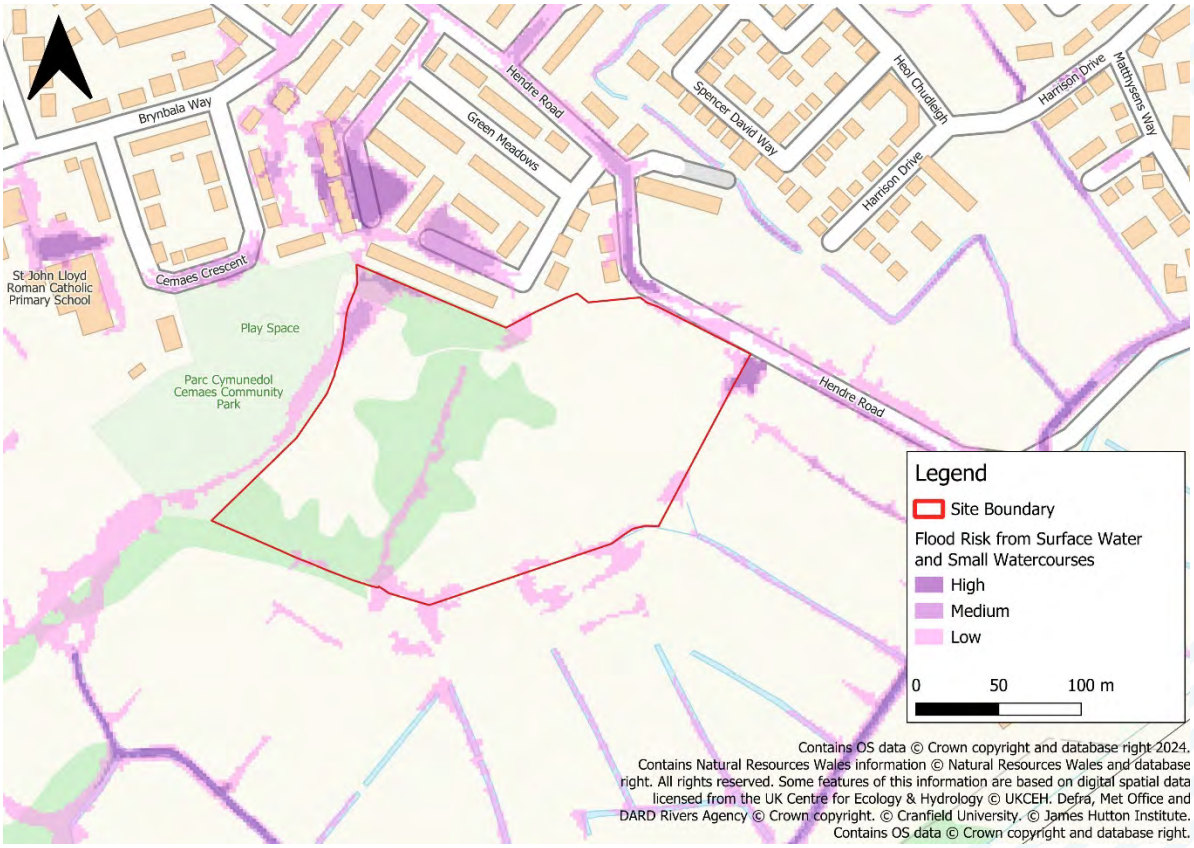

Figure 3-3 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

JBA has developed a range of Groundwater Flood Map products nationally. The 5m resolution JBA Groundwater Map has been used within the report. The modelling involves simulating groundwater levels for various return periods (including 1.33% year, 1%, and 0.5% AEP). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 1% AEP model outputs.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, which would represent an extreme scenario. The maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often

necessary for groundwater to have nowhere to go without ponding and flooding an area first.

The South East Wales Stage 1 SFCA includes JBA's Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area of 'low' risk from groundwater emergence as shown in Figure 3-4. There have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Stage 1 SFCA. Furthermore, the Cardiff Local Flood Risk Management Strategy also states that "there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small".

Therefore, it has been assessed that the risk of groundwater flooding at this site is **very low**.

Figure 3-4 Groundwater Emergence Risk Map

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South East Wales Stage 1 SFCA indicates that Dŵr Cymru Welsh Water (DCWW) has identified 17 incidents of sewer flooding within the Trowbridge ward, in which the proposed candidate site is located. The site is greenfield in nature and therefore there

is likely to be limited sewer infrastructure on the site. However, DCWW should be consulted on the current location of existing sewers when proposals for the site are developed. It is concluded that there is a **low risk** of sewer flooding.

3.7 Summary of Flood Risk

The main flood risk source to the site is surface water flooding. The site is shown to be at risk during the high to low-risk events with shallow depths predicted in these events. It is recommended that the risk of surface water flooding is managed appropriately on the site during the site master planning stage ensuring surface water flow paths are retained and the risk of flooding is not increased. The flood risk from all other sources has been summarised in Table 3-2 below.

Table 3-2 Summary of Flood Risk

Source of Flooding	Risk
River	Very Low
Sea	Very Low
Surface Water and Small Watercourses	Predominately Very Low, but some areas of the site having Medium and High-risk areas.
Groundwater	Very Low
Reservoir	Very Low
Sewers	Low

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it provides an indication as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP Flood Zones[1]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

4.1.1 FMfP: Flood Risk from Rivers

1 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

The Flood Map for Planning – Flood Risk from Rivers shows the site is located in Flood Zone 1. This means there is less than a 0.1% AEP chance of fluvial flooding in any given year, including climate change. This area is shown as transparent in the Flood Map for Planning and therefore has not been graphically represented.

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – Flood Risk from the Sea shows the site is located in Flood Zone 3 as well as being located in a TAN-15 Defended Zone, as shown in Figure 4-1.

Areas within Flood Zone 3 represent areas with more than 0.5% AEP (1 in 200) chance of flooding from the sea in any given year, including the effects of climate change. Whereas areas within a TAN-15 Defended Zone are areas that benefit from Risk Management Authority flood defences with a minimum standard of protection of 1 in 200 years (present day) for the sea. Any defences built post-2016 will also have an allowance for climate change built into the standard of protection.

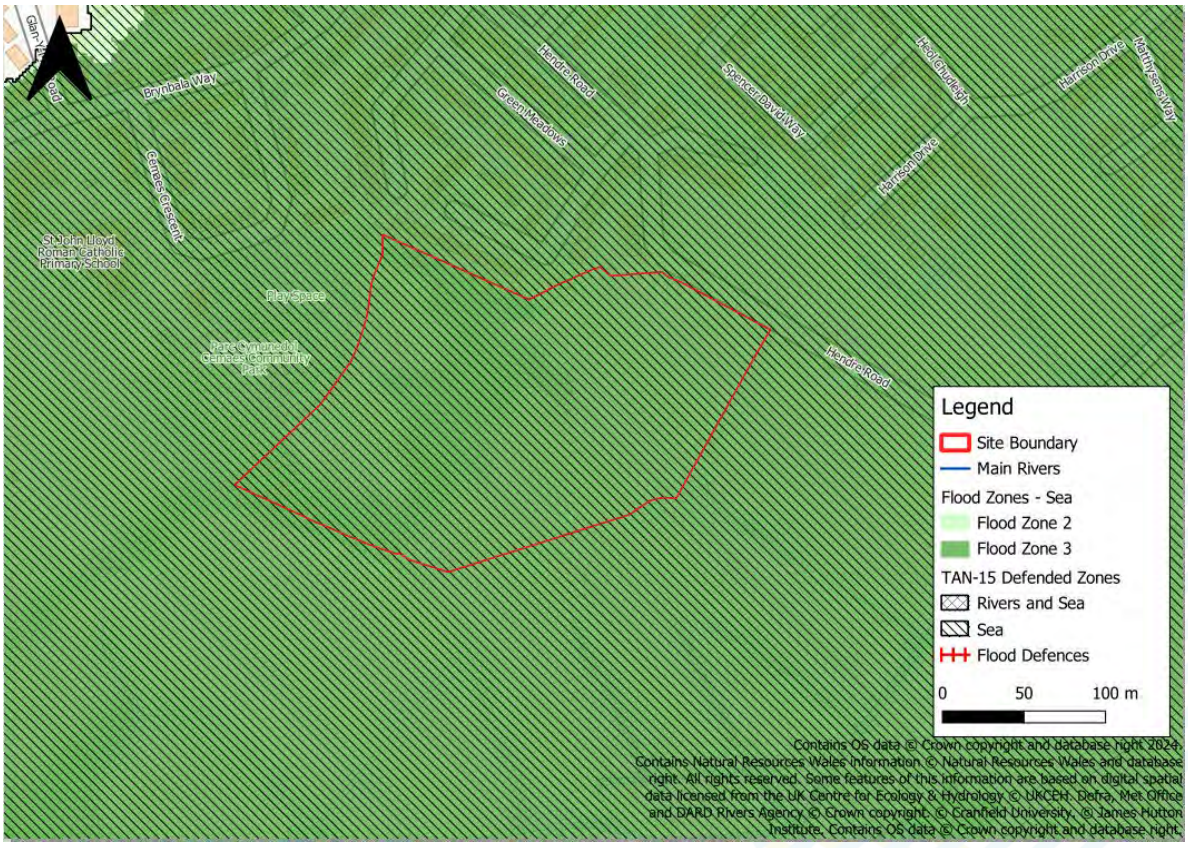

Figure 4-1 FMfP -Flood Risk from the Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominantly located in Flood Zone 1 with several areas shown to be in Flood Zone 2 and 3, as shown in Figure 4-2. Flood Zone 1 shows areas with a less than 0.1% AEP (plus climate change) chance of flooding in a given year. Flood Zone 2

represents areas that have a less than 1% AEP but greater than 0.1% AEP chance of flooding in a given year, including climate change. Flood Zone 3 means the area has a greater than 1% AEP chance of flooding in a given year, including climate change.

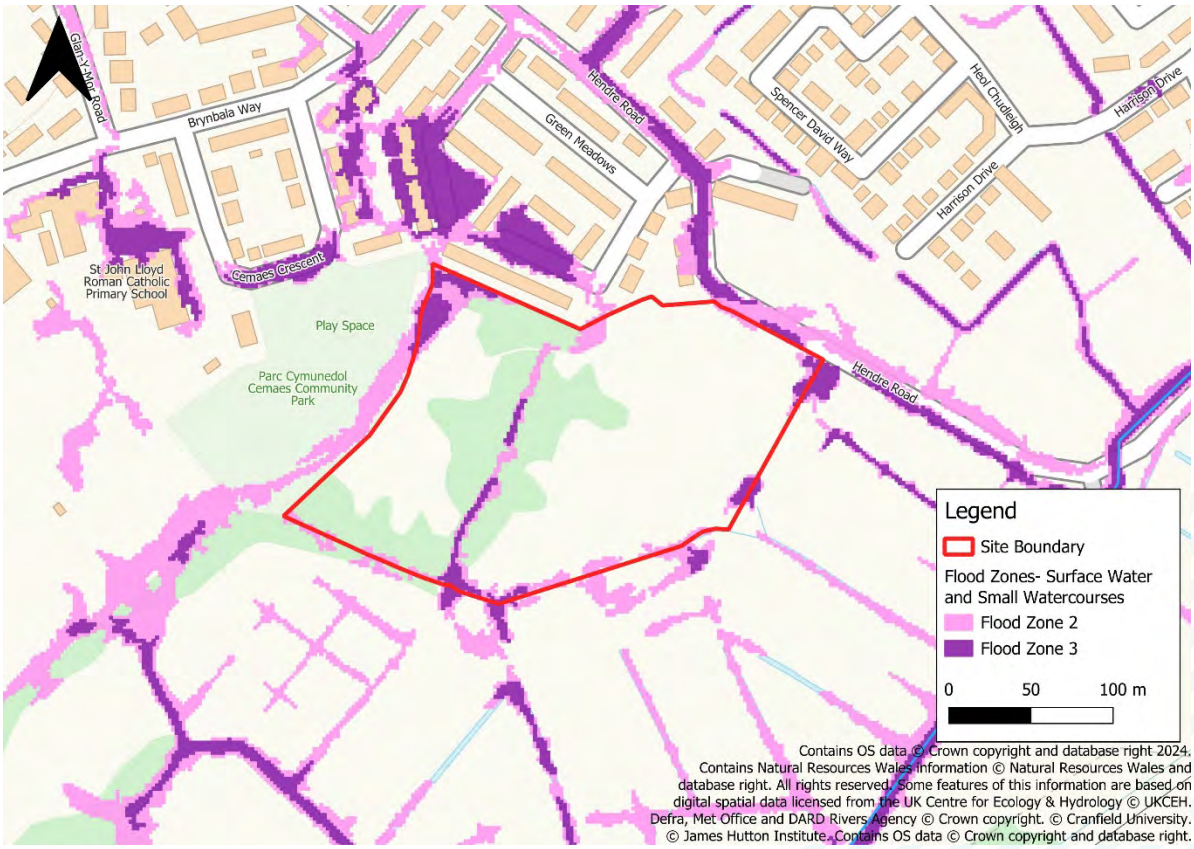

Figure 4-2 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for residential development it is classified as a highly vulnerable development.

Table 4-2 Development vulnerability categories[2]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood.
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

2 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed. TAN-15 provides differing advice for New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood risk areas.

Of most relevance to this appraisal are the definitions of new development.

The consultation draft of the new TAN-15 defines New development as "*development on any greenfield land; development of vacant or disused brownfield sites*".

Furthermore, TAN-15 states that:

"Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new developments for the purposes of this guidance. New developments increase the exposure of people, property, and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3)."

All new developments will need to demonstrate that they meet the Justification Test and comply with the Acceptability Criteria as set out in Sections 4.4 and 4.5 below.

4.4 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The requirements of the Justification Test are summarised in Table 4-3 and the proposed development has been assessed against the requirements of the Justification test. As the site is located within a TAN-15 Defended Zone all forms of development are considered to be justified as long as any potential consequences of flooding have been considered and deemed acceptable following the guidance of the Acceptability Criteria.

Table 4-3 Justification Test[3]

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>The development will be justified in the TAN-15 Defended Zones if:</td><td>The development will be justified in Zone 2 if:</td><td>The development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or[4]</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding.</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable per the criteria contained in section 11 of TAN-15.</td></tr>
</table>

[3] TAN-15, Section 10
[4] This has not been included within the current draft of TAN-15 however it is our understanding that this section should include this.

4.5 Acceptability Criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'Acceptability Criteria'. There are three principal aspects to the Acceptability Criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable, depending on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depending on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[5]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[6]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water-compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

5 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
6 TAN-15, Figure 6

4.6 Summary of Policy Position

The proposed development of the site is for residential purposes, which is considered to be a 'highly vulnerable' development.

Based on NRW's FMfP, the proposed development site is located within a TAN-15 Defended Zone. All forms of development are permissible within the TAN-15 Defended Zone, subject to the application of the Justification Test. Consequently, the development can be justified subject to there being a Community Adaptation and Resilience Plan in place, or, the demonstration that the consequences of flooding have been considered and found to be acceptable.

TAN-15 advises that a site-specific FCA is completed for sites where there is a presence of surface water and small watercourse flooding. The aim of the FCA will be to demonstrate how the surface water flood risk at the site will be managed. This will likely be via an adequate surface water drainage strategy that will be required to meet the requirements of the SuDS Approval Body (SAB). However, the risk from surface water and small watercourses has no impact on site's ability to pass the Justification Test or Acceptability Criteria.

As the site is expected to remain flood-free in all design events from tidal sources; therefore satisfying the Acceptability Criteria, the proposed development set out in this assessment is permissible on the grounds of flood risk.

5 Conclusion

Site Description

- JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Areas 9-12 St Mellons (residential use).
- The site is located at land to the south of Green Meadows and Hendre Road, St Mellons.

Overview of flood risk

- The primary flood risk source to the site is surface water flooding. The site is shown to be at risk during the high to low-risk events with shallow depths predicted in these events.
- The site is at very low risk of flooding from tidal, fluvial, reservoir and groundwater sources.
- The site is at low risk of flooding from sewers.

Consultation draft of new TAN-15

- The proposed development of the site is for residential development at land at Areas 9-12 St Mellons.
- Based on NRW's FMfP, the proposed development site is located within the TAN-15 Defended Zone. Consequently, development can be justified subject to either there being a Community Adaptation and Resilience Plan in place, or, the demonstration that the consequences of flooding have been considered and found to be acceptable.
- All forms of development are permissible within the TAN-15 Defended Zone, subject to the above. The proposed nature of the site means that it is classified as highly vulnerable.
- The presence of flood risk from surface water and/or small watercourses will not prevent the site from passing the Justification Test or satisfying the acceptability criteria. However, an FCA will be required to demonstrate that this risk is manged. This will likely be via the design of a surface water drainage strategy that satisfies SAB requirements.
- The development site is predicted to be flood-free during all design events as a result of the NRW Wentlooge Levels flood defences, therefore complying with the requirements of the Justification Test and acceptability criteria.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales in its current form.

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Land at Rover Way, Pengam Green. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site per Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located to the north of Rover Way and covers Pengam Green, Cardiff. The site is approximately 21.99ha in area, as shown in Figure 2-1. The proposed development site covers much of Pengam Green, including the former RAF Pengam Moors airfield. To the west of the site is The Willows High School, and Celsa Manufacturing is located to the southwest of the site. Rover Way bounds the proposed development site from the southwest to the northwest of the site boundary, with a Tesco Extra and residential development located to the north. The site is currently comprised of scrubland.

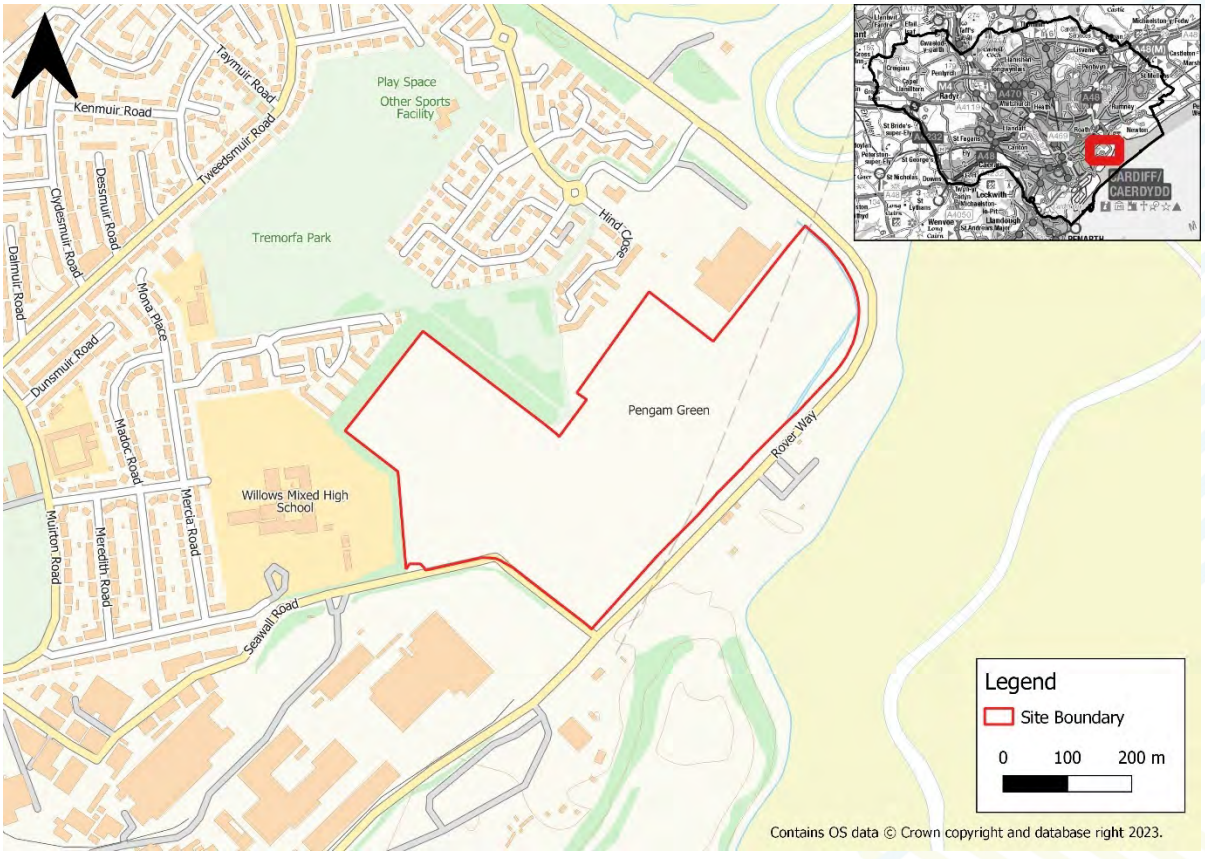

Figure 2-1 Site location

2.1 Development Proposals

The proposed development at this site is for Business (use class B1), General Industrial (use class B2) & Storage & Distribution (use class B8).

2.2 Watercourses and Flood Defences

The site is located near the Rhymney River as seen in Figure 2-2 below. The Rhymney River outfalls into the Severn estuary and it passes through the Cardiff Mudflats, which is approximately 100m to the east of the proposed site at its closest point.

An unnamed ordinary watercourse is present in the south of the site and follows the site boundary from the south to the northeast of the site. Its downstream route is currently unknown; however, it is likely to outfall to the Severn Estuary or Rhymney River.

The proposed candidate site is within an area benefitting from defences, as shown in Figure 2-2. Flood defences are present along the banks of the River Rhymney and the Severn Estuary. Along the Severn Estuary, defences comprise the remnants of rock armour, whilst along the River Rhymney defences are revetments, a sheet-pile wall, earth embankment, and a section of severely eroded block stone defences along the western bank. These flood defences have a standard of protection of 75 to 150 years. Tidal and fluvial erosion of these defences and the associated coastline has taken place to the extent that extensive sections of defences have either been completely lost or are in very poor condition and are at significant risk of failure in the near future.

Planning permission (planning reference-21/02138/MJR) was granted in September 2021 for the Cardiff Coastal Flood Defence scheme. This scheme will provide improved flood defences along the banks of the River Rhymney and the Severn Estuary. The coastal defences comprise four main sections and will enhance the standard of protection across this area to increase resilience to climate change. Construction of these flood defences commenced in 2024.

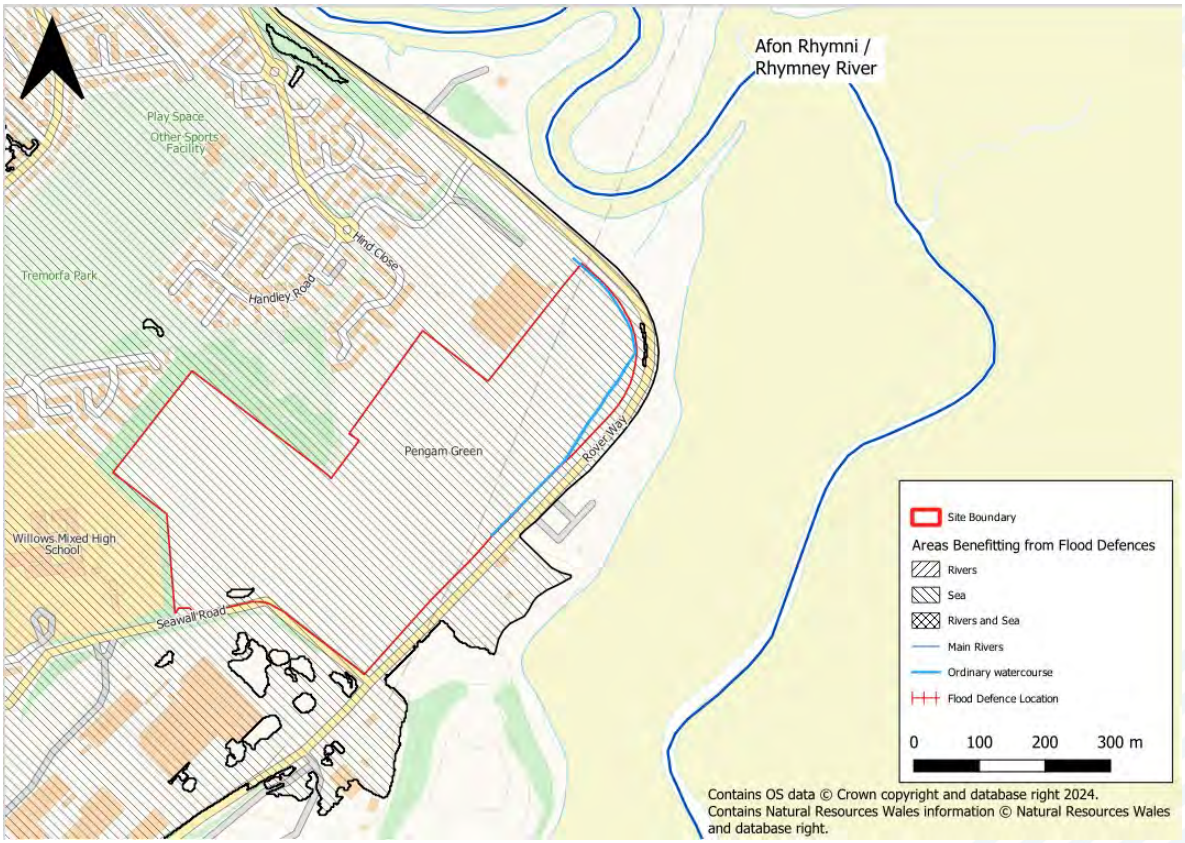

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows that the site is relatively flat and generally low lying with a general fall in a northwest-to-southeast direction. The highest elevation of 10.24mAOD was found in the west of the site and associated with a topographic high point. The lowest elevation of 5.35mAOD is located in the southeast of the site.

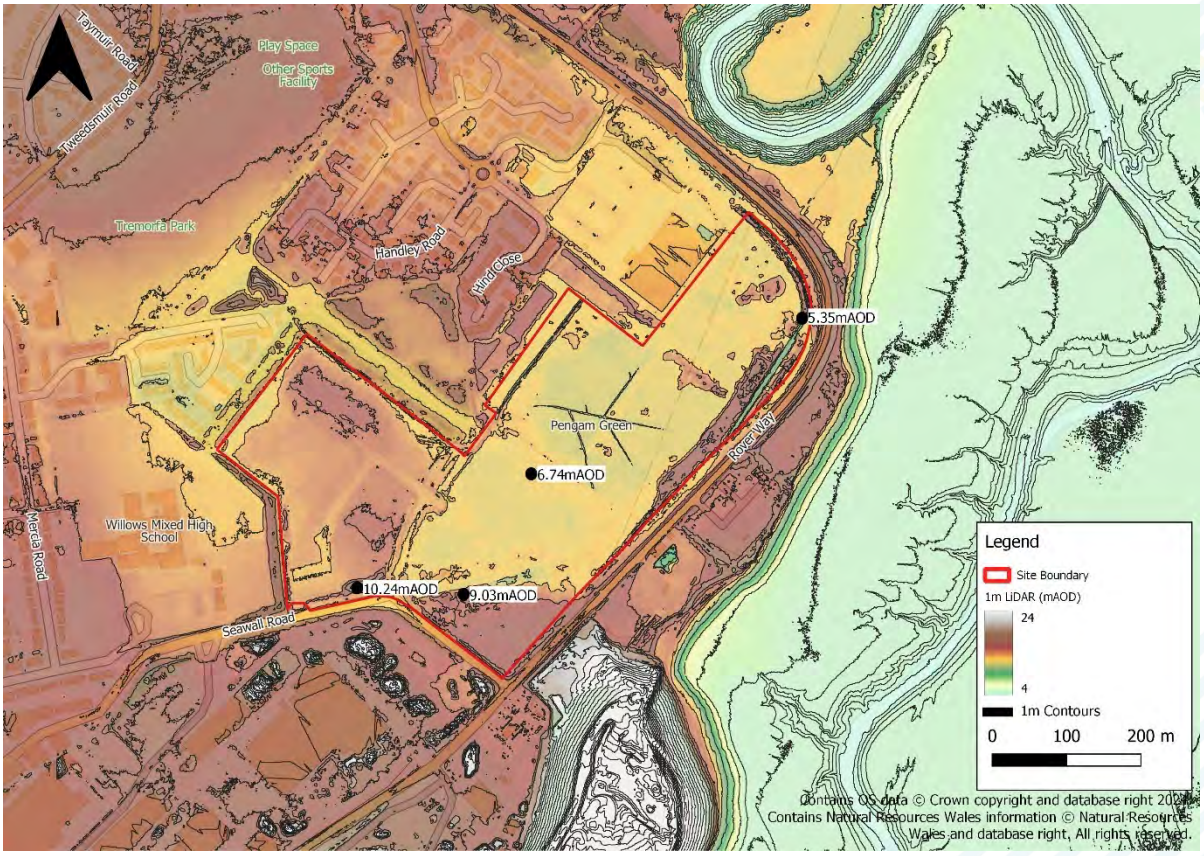

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that most of the site is at very low risk of flooding from Rivers. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at **low risk** of flooding from the sea as shown in Figure 3-1. Low risk means that each year, this area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 200 (0.5%). Furthermore, the entire site is within an area 'Benefiting' from Flood Defences, with protection up to the 1 in 200 event (0.5% AEP).

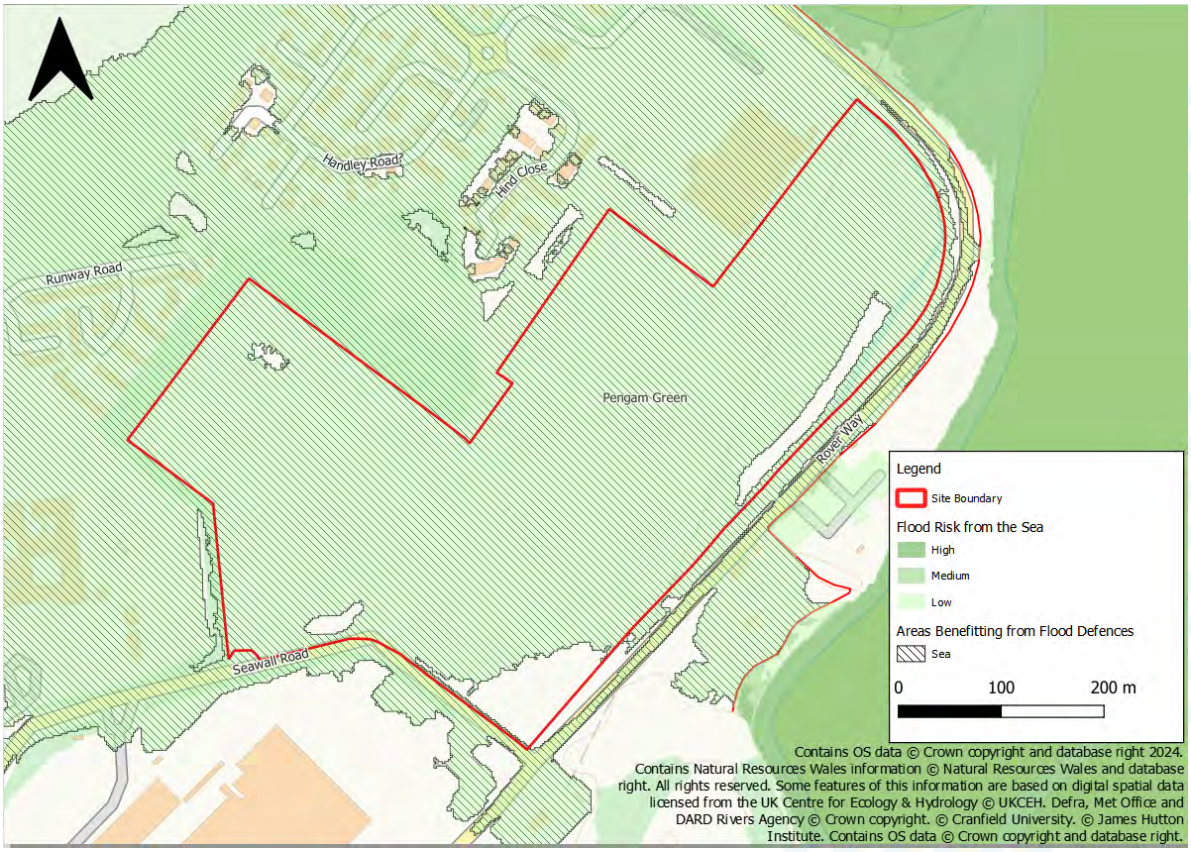

Figure 3-1 FRAW- Flood Risk from the Sea

3.2.1 Model Availability

A detailed tidal flood model for Cardiff and the River Rhymney was developed by JBA Consulting in 2020 and updated in 2022. The updated model was used to simulate results for a 100-year lifetime of development, to the year 2122. Furthermore, the model simulated the risk of flooding both with and without the Cardiff Coastal Flood Defence Scheme. For this assessment, only the defended scenario with the new defences has been used due to the commencement of the scheme in 2024.

Despite the modelling assessing a 100-year lifetime of development, it is assumed that this development would have a lifetime of 75 years in line with TAN-15 guidance for non-residential developments. Therefore, any results are precautionary as they assess the site beyond the lifetime of the development.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequence Assessment.

3.2.2 Model Results

Figures Figure 3-2 and Figure 3-3 demonstrate that the proposed candidate site is predicted to be flood-free in both the 2122 0.5% AEP and the 2122 0.1% AEP events. As the model results are for 2122 they assume a lifetime of development of 100 years, this is greater than the intended lifetime of development of 75 years that is typical of industrial or business use developments.

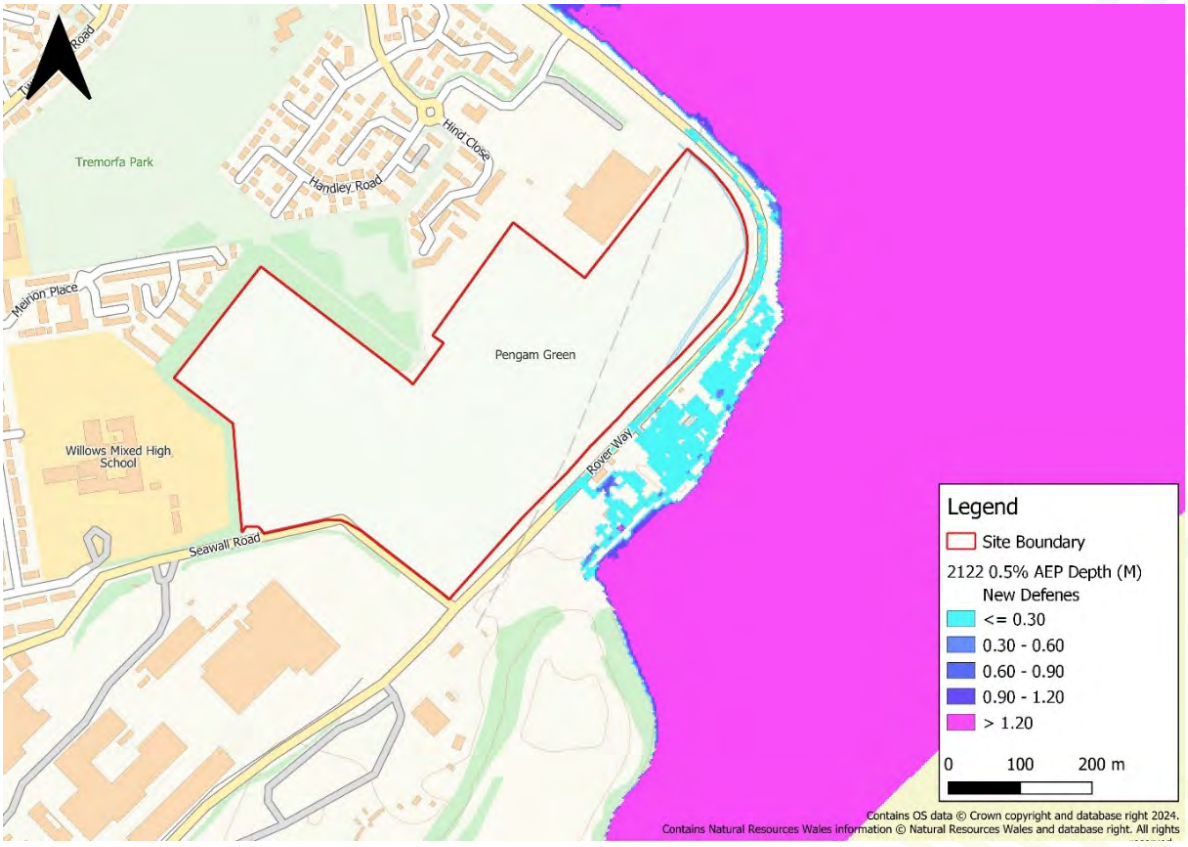

Figure 3-2 2122 0.5% AEP plus climate change event (Defended)

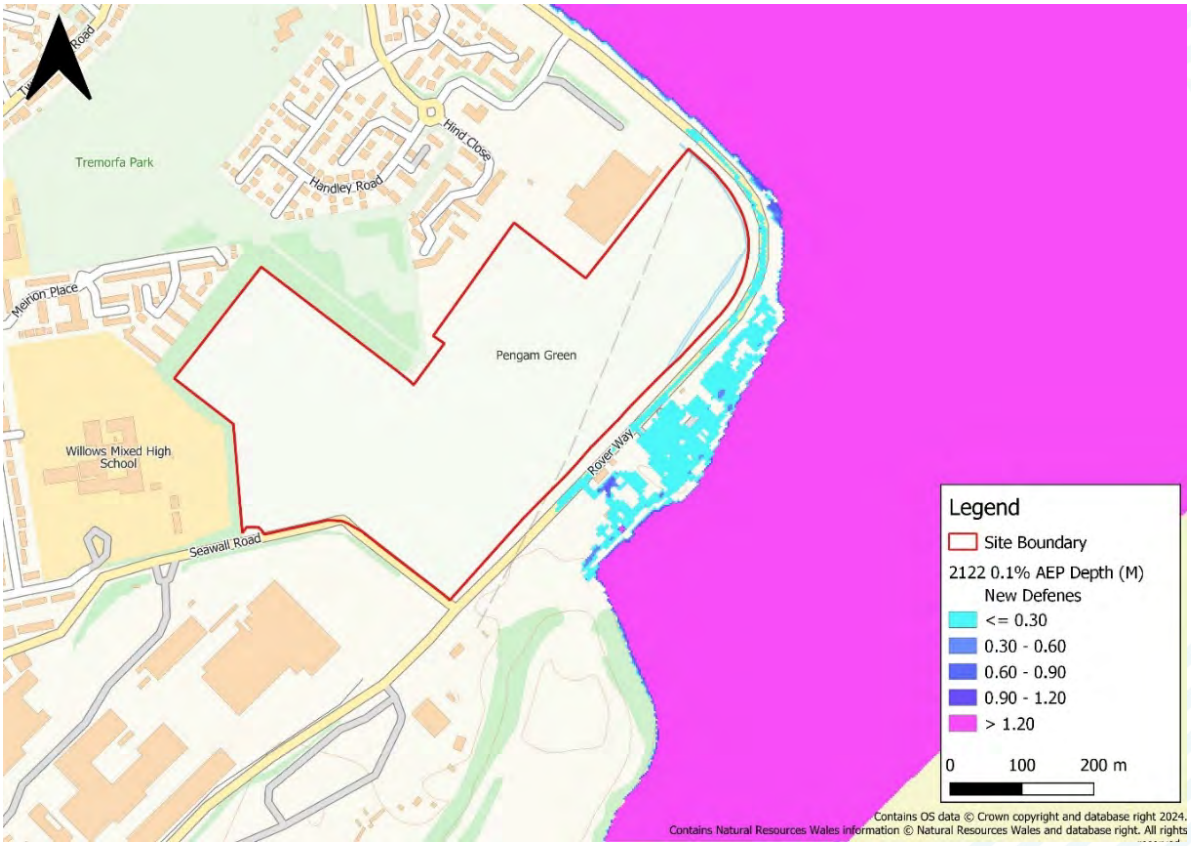

Figure 3-3 0.1% AEP plus Climate Change event (Defended)

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that most of the site is predominantly at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-4. This means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site.

However, there are isolated areas at low and medium risk of surface water flooding, the largest areas are found at the south-western boundary of the site, and along the northwestern boundary of the site. Areas at low risk have a between 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year. Whereas areas at medium risk have a between 1% to 3.3% (1 in 100 to 1 in 30) chance of flooding from surface water and/or small watercourses each year.

Areas of medium risk are likely a result of localised topographic depressions. These can and should be managed through considerate site design and an adequate surface water drainage strategy that includes the use of SuDS.

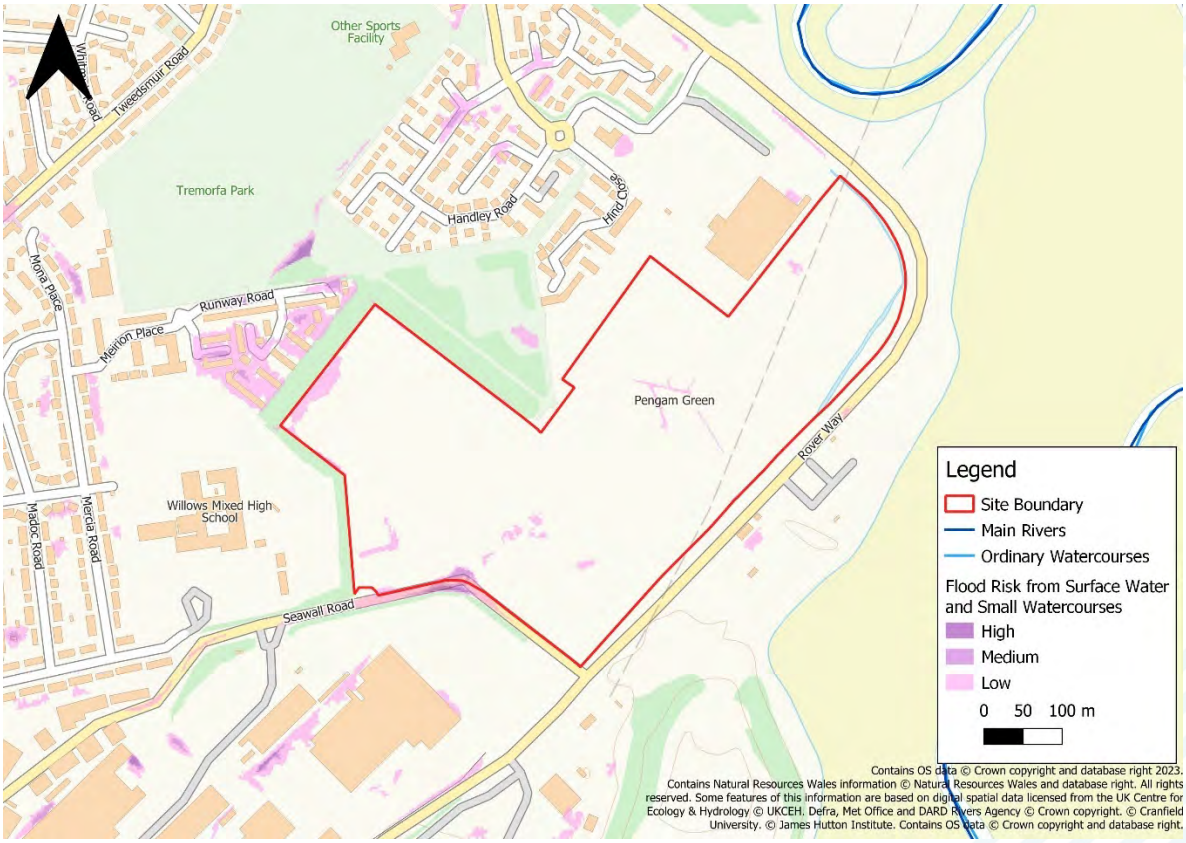

Figure 3-4 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The bedrock geology of Cardiff is predominantly comprised of Mudstone. Mudstone tends to have low porosity and permeability; however, this is dependent upon grain size percentages and level of compaction. As a result, upward percolation of groundwater and subsequent flooding should be considered.

The South East Wales Stage 1 SFCA includes JBAs Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area of 'low' risk from groundwater emergence. There have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Stage 1-SFCA. Furthermore, the Cardiff Local Flood Risk Management Strategy[1] also states that 'there is little documented

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx

evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small

Therefore, it has been assessed that the risk of groundwater flooding at this site is **very low.**

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South-East Wales Stage 1 SFCA has identified there to be a high number (175) of historic sewer flood incidents within the Splott electoral ward, in which the proposed candidate site is located. The current location of existing sewers is unknown and DCWW should be consulted on development proposals for the site. No specific mention of the proposed candidate site has been provided by DCWW in relation to sewer flooding, and there is no known history of flooding on the site. Consequently, it is considered that the risk associated with sewer flooding on the site is **low to medium**.

3.7 Summary of Flood Risk

The main flood risk source to the site is from tidal flooding. However, the most up to date detailed tidal model of the area which assesses the benefits of the new Cardiff coastal flood defences shows the site to remain flood-free for both the 0.5% and 0.1 % AEP events plus CC. Table 3-1 below summarises the flood risk from all sources.

Table 3-1 Summary of Flood Risk

Source of Flooding	Risk
River	Low
Sea	Very Low
Surface Water and Small Watercourses	Predominantly Very Low, but some isolated areas of Medium risk
Groundwater	Very Low
Reservoir	Very Low
Sewer	Low to Medium

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure managed and maintained by Risk Management Authorities provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure managed and maintained by Risk Management Authorities provides a minimum standard of protection against flooding from the sea .of 1:200 (plus climate change and freeboard).	Not applicable.

4.1.1 FMfP: Flood Risk from Rivers

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

The Flood Map for Planning – flood risk from rivers shows the site is located in Flood Zone 1. No figure has been provided as Flood Zone 1 is depicted as a transparent layer on the FMfP.

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – flood risk from the sea shows the site is located in Flood Zone 3 and the TAN-15 Defended Zone, as seen in Figure 4-1.

Areas within Flood Zone 3 represent areas with more than 0.5% (1 in 200) chance of flooding from the sea in a given year, including the effects of climate change. Areas within a TAN-15 Defended Zone are areas that benefit from Risk Management Authority flood defences with a minimum standard of protection of 1 in 200 years (present day) for the sea. Any defences-built post-2016 will also have an allowance for climate change built into the standard of protection

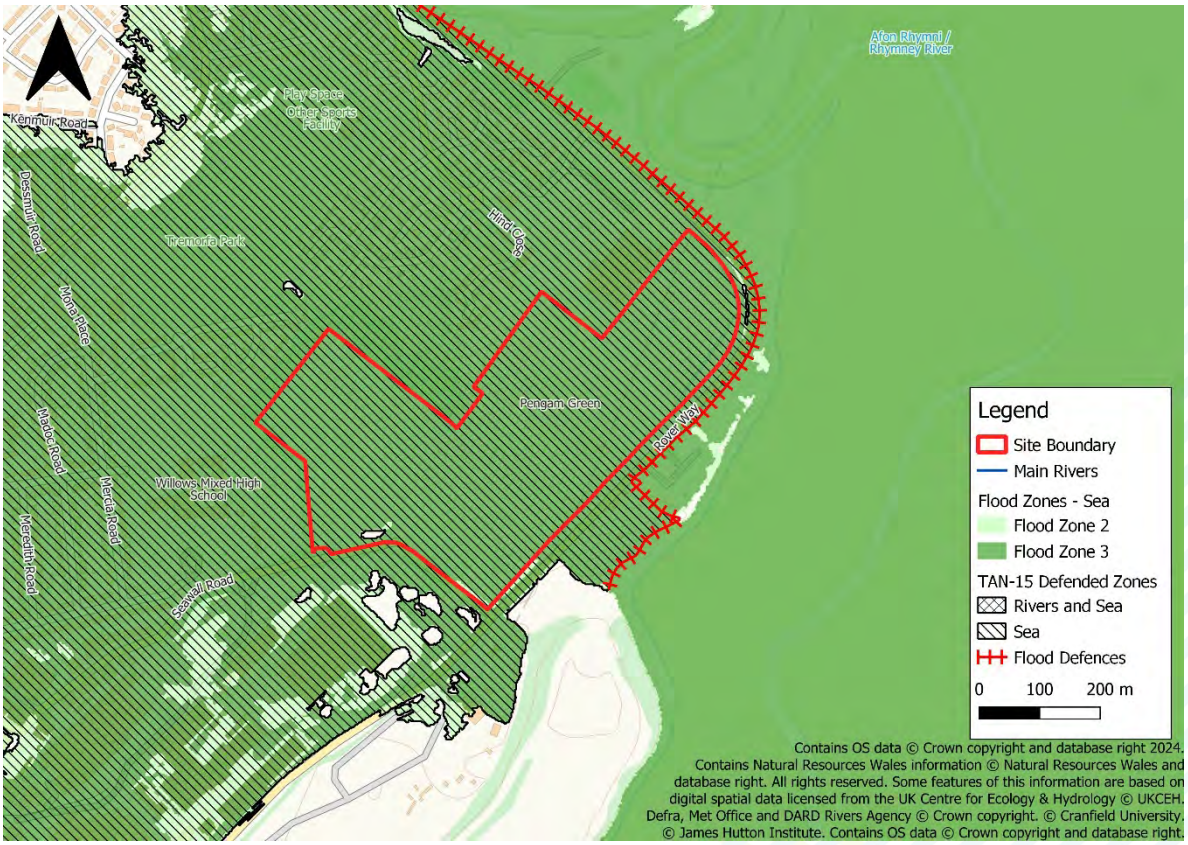

Figure 4-1 FMfP - Flood Risk from the Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominantly within Flood Zone 1. However, there are areas located in Flood Zone 3 and 2, as shown in Figure 4-2. Flood Zone 2 represents Areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses each year, including the effects of climate change. Whereas Flood Zone 3 Represent those areas with more than 1% (1 in 100) chance of flooding from surface

water and/or small watercourses in a given year, including the effects of climate change.

Areas in Flood Zone 3 can be found at the southwest boundary, adjacent to Seawall Road, and to the northern boundary of the site. There is an additional isolated area in Flood Zone 3 located in the central southern extent of the site.

The risk likely arises due to localised topographic depressions where surface water will 'pond' during high rainfall events. This can be managed through good site design and the use of SuDS.

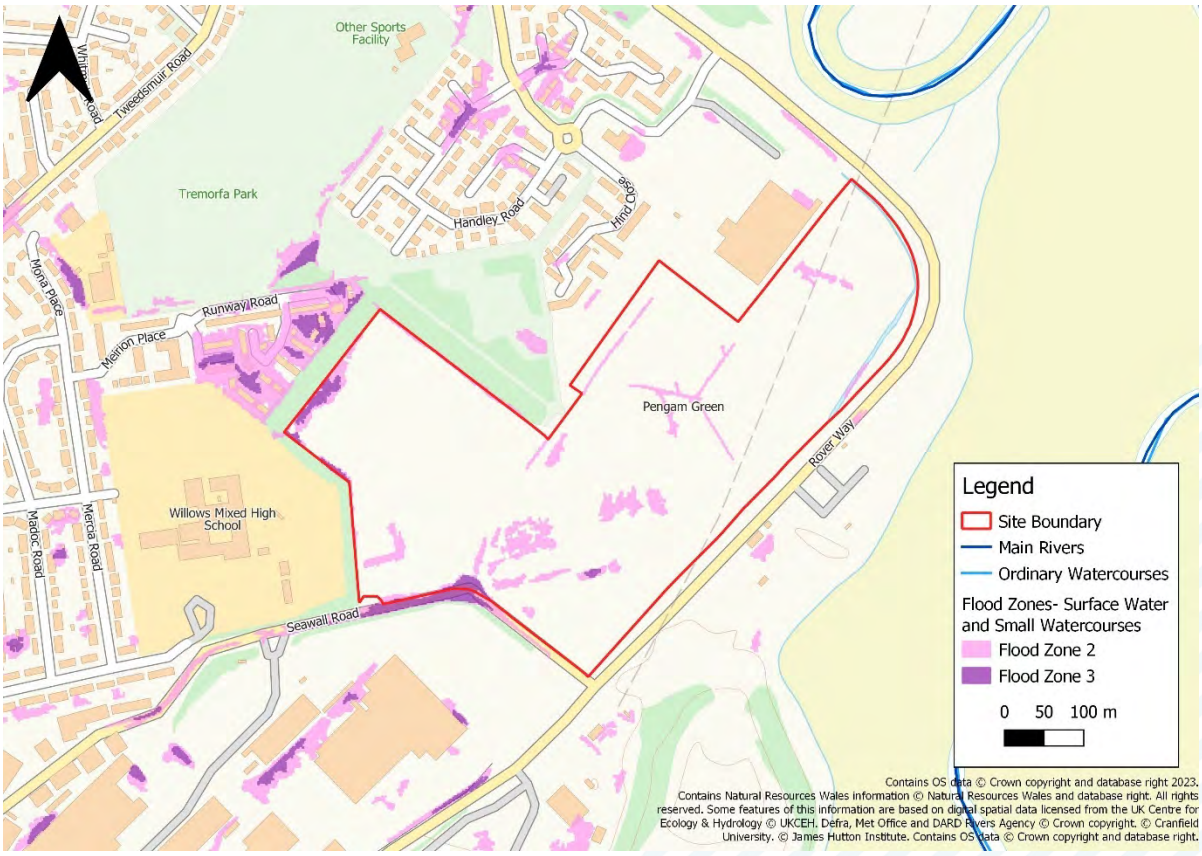

Figure 4-2 FMfP Flood Risk from Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for business and industrial use it is classified as a Less vulnerable development.

Table 4-2 Vulnerability Classification[3]

Development category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood.
Less vulnerable development	**General industrial, employment, commercial and retail development.** Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of new development.

The TAN-15 defines New development as: "*development on any greenfield land; development of vacant or disused brownfield sites*"

Furthermore, TAN-15 states that:

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new developments for the purposes of this guidance. New developments increase the exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

All new developments will need to demonstrate that they meet the Justification Test and comply with the Acceptability criteria as set out in Sections 4.4 and 4.5 below.

4.4 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The requirements of the Justification Test are summarised in Table 4-3 and the proposed development has been assessed against the requirements of the Justification Test. The Justification Test for new development within the TAN-15 Defended Zone is applicable for this development site.

Table 4-3 Justification Test[4]

<table>
<tr><th>Zone 1</th><th>TAN-15 Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>The development will be justified in the TAN 15 Defended Zones if:</td><td>The development will be justified in Zone 2 if:</td><td>The development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration scheme or[5]</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable per the criteria contained in section 11 of TAN-15.</td></tr>
</table>

4 TAN-15, Section 10

[5] This has not been included within the current draft of TAN-15 however it is our understanding that this section should include this.

4.5 Acceptability criteria

If the planning authority is satisfied that the proposed development is justified in a flood-risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'acceptability criteria'. There are three principal aspects to the acceptability criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable depends on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depending on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[6]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water-compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[7]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water-compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

Note: The extreme flood event is defined as the 0.1% AEP flood event

6 Technical Advice Note 15- Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
7 TAN-15, Figure 6

4.6 Summary of Policy Position

The proposed development of the site is for Business (use class B1), General Industrial (use class B2) & Storage & Distribution (use class B8), comprising New Development at Rover Way, Cardiff. This proposed development is considered to be a 'less-vulnerable' development.

Based on NRW's FMfP, the proposed development site is located within a TAN-15 Defended Zone. All forms of development are permissible within the TAN-15 Defended Zone, subject to either there being a Community Adaptation and Resilience Plan in place, **or**, the demonstration that the consequences of flooding have been considered and found to be acceptable.

As the site is predicted to remain flood free in all design events for the lifetime of the development it therefore satisfies the acceptability criteria, and consequently passes the Justifcation Test.

The proposed development set out in this site assessment is therefore permissible at this location on the grounds of flood risk.

5 Conclusion

Site Description

- JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Land at Rover Way Pengam Green (business and industrial use)
- The site is located north of Rover Way on Pengam Green, Cardiff.

Overview of flood risk

- The primary risk of flooding to the site is from Tidal sources;
- The site is at very low risk of flooding from Fluvial, reservoir and groundwater sources;
- The site is predominantly at very low risk from Surface water flooding but there are isolated areas at medium and low flood risk, this should be managed via an adequate drainage strategy that includes the use of SuDS;
- The site is at low to medium risk of flooding from sewers.

Consultation draft of new TAN-15

- The proposed development of the site is for Business (use class B1), General Industrial (use class B2) & Storage & Distribution (use class B8), comprising New Development at Rover Way, Cardiff.
- Based on NRW's FMfP, the proposed development site is located within the TAN-15 Defended Zone. Consequently, development can be justified subject to either there being a Community Adaptation and Resilience Plan in place, or, the demonstration that the consequences of flooding have been considered and found to be acceptable.
- All forms of development are permissible within the TAN-15 Defended Zone, subject to the above. The proposed nature of the site means that it is classified as Less vulnerable.
- The development site is predicted to be flood free during all design events for the lifetime of the development as a result of the Cardiff Coastal Defence Scheme, on which construction commenced in 2024. The defence scheme also results in safe access and egress to the site in all design events.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales in its current draft form.

Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	George Williams BSc MSc
Reviewer / Sign-off	George Baker BEng AIEMA CEnv IEng MCIWEM C.WEM
Subject	Land at Llwynnioli Farm - Flood Risk Appraisal

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Land at Llwynioli Farm. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site per Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and coastal Erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located in the northwest of Cardiff in the electoral ward of St Fagans and is approximately 3.3ha in area. Approximately 600m to the south of the site is the M4 Motorway, with the A4119 located approximately 150m to the north. The proposed candidate site is located on agricultural land and includes existing agricultural buildings. An overview of the location of the site can be seen in Figure 2-1.

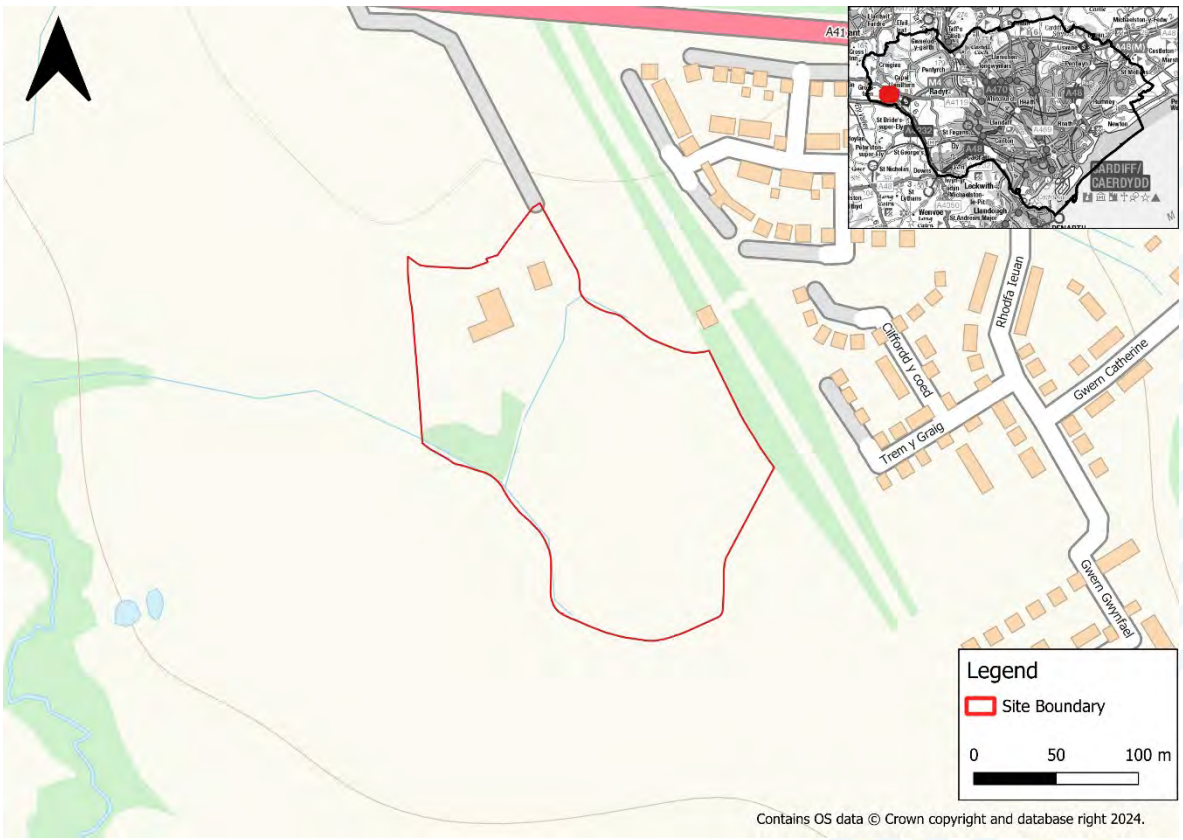

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development at this site is for a mixed-use development with further details currently unknown.

2.2 Watercourses and Flood Defences

Two ordinary watercourses flow across the development site. An unnamed ordinary watercourse flows in a northerly direction along the western boundary of the site. A second ordinary watercourse flows into this main channel, flowing in a westerly direction across the development site.

The ordinary watercourse flows in a predominantly south-easterly direction to its confluence with the Nant Henstaff approximately 850m from the site.

The closest main river to the site is the Nant-Y-Glaswg which is situated approximately 1.5km south-east of the site.

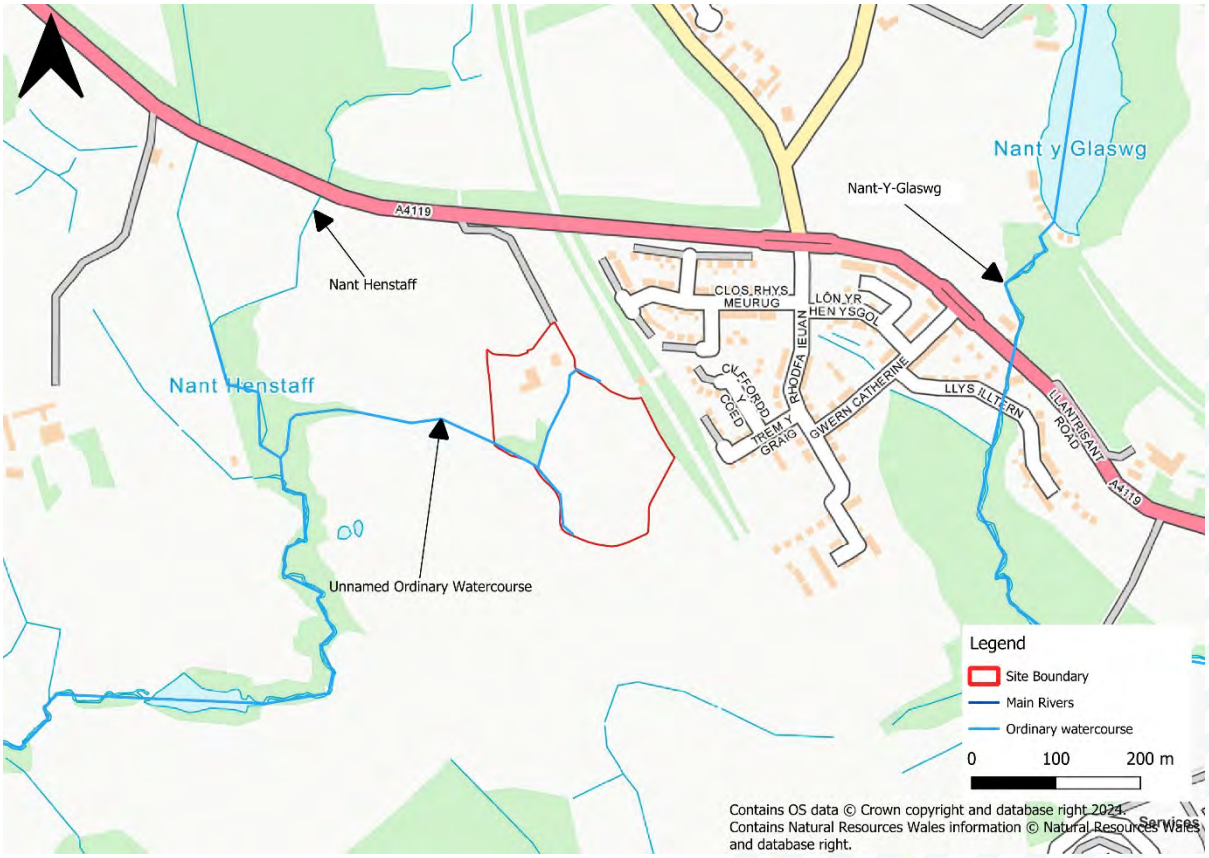

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data suggests that the site falls towards the west with the central areas representing a depression in the local topography. The highest point of the site is approximately 59mAOD and is located in the far north-west of the site. The lowest point is located on the western boundary on the confluence of the two unnamed watercourses that pass through the site, with an approximate ground level of 49.66mAOD.

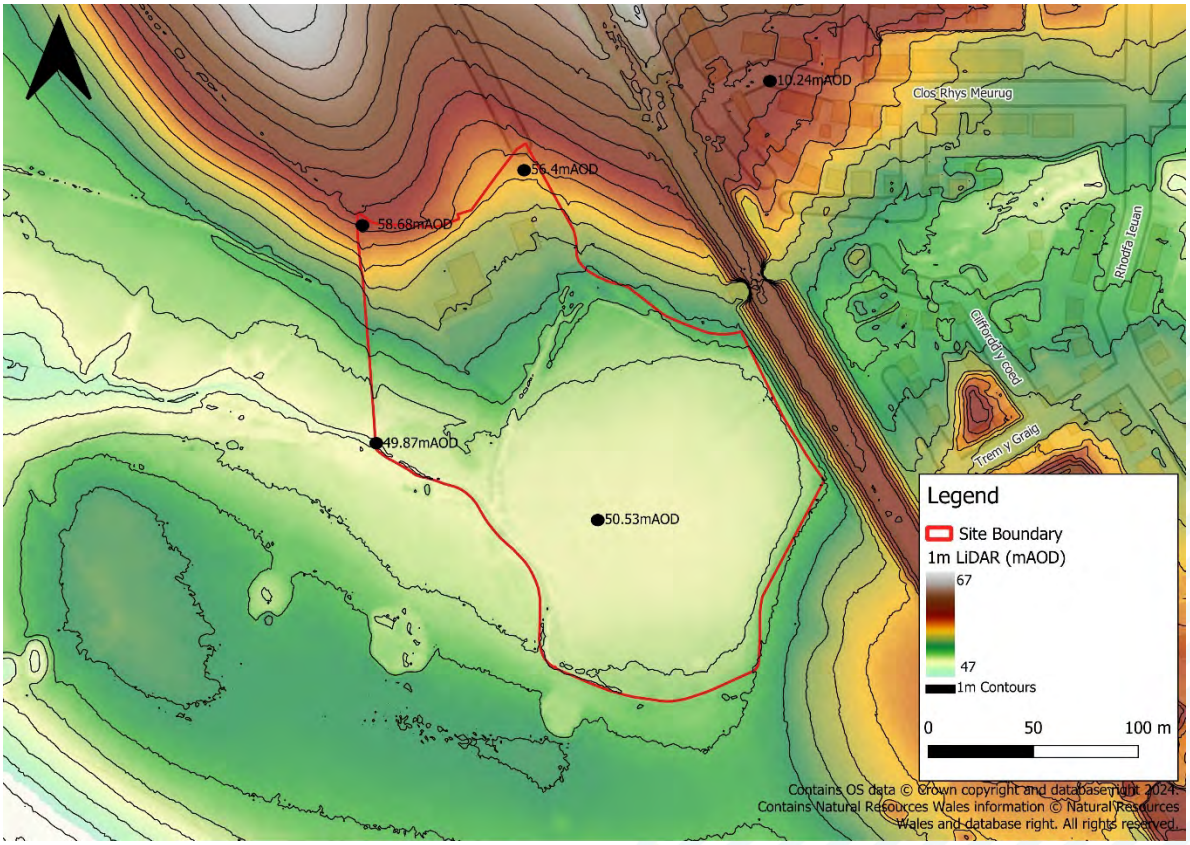

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from Rivers. This means that there is a less than 0.1% AEP chance of fluvial flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is predominately at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-1. This means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site.

However, the is a small area in the central to southeastern extent of the proposed site that is at 'Low' risk from flooding from surface water and a small watercourse. Low risk means that each year, this area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).

This area is likely associated with a local topographic depression and this risk is posed by surface water. However, this risk can be managed through considerate site design and SuDS.

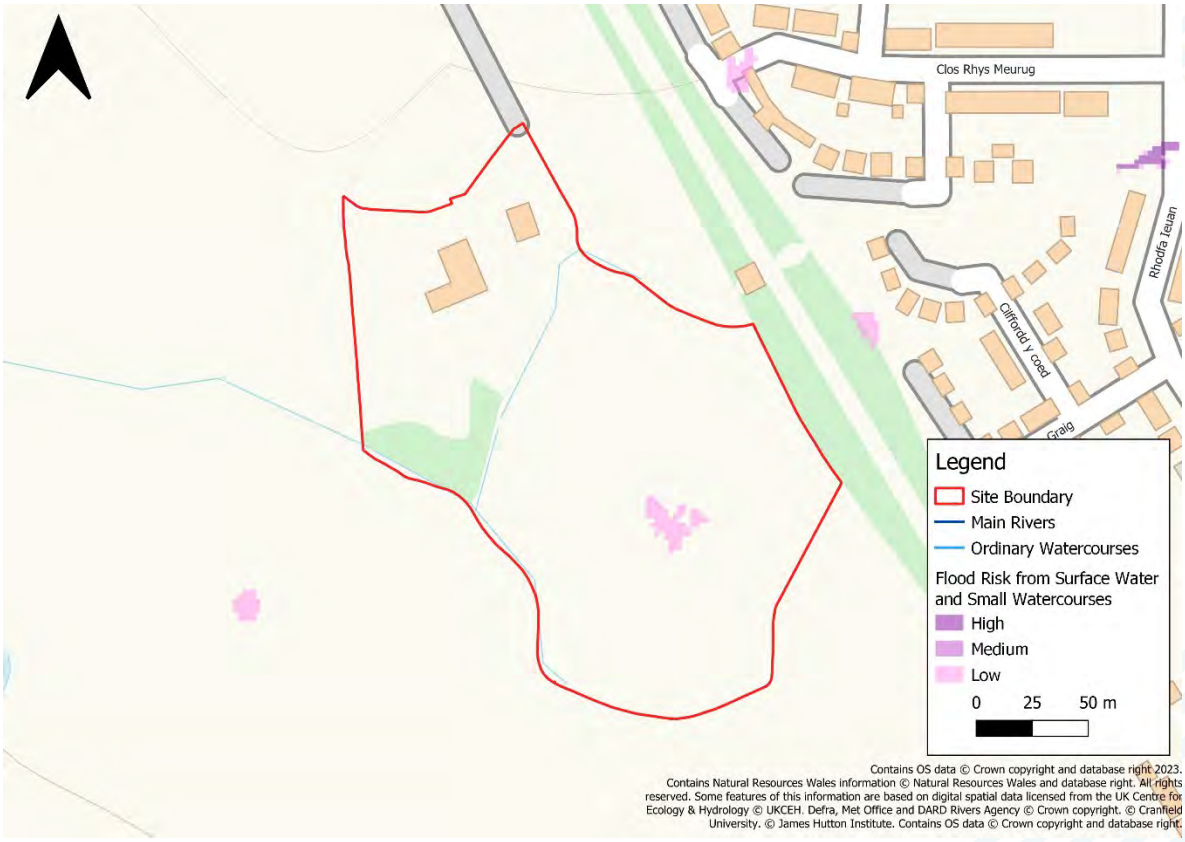

Figure 3-1 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The bedrock geology of Cardiff is predominantly comprised of Mudstone. Mudstone tends to have low porosity and permeability; however, this is dependent upon grain size percentages and level of compaction. As a result, upward percolation of groundwater and subsequent flooding should be considered.

The South East Wales Stage 1 SFCA includes JBAs Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area of 'low' risk from groundwater emergence. There have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Stage 1-SFCA. Furthermore, the Cardiff Local Flood Risk Management Strategy[1] also states that 'there is little documented

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx>

evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small.

Therefore, it's been assessed that the risk from groundwater flooding is **Very low**.

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South-East Wales Stage 1 SFCA has identified there to be a low number (15) of historic sewer flood incidents within the St Fagans electoral ward. The current location of existing sewers is unknown and further assessment of sewer flood risk would need to be undertaken as part of the Flood Consequence assessment for this site to prove that sewer flooding doesn't pose a risk to any proposed development at the site. However, due to the low number of record sewer flood incidents the risk of flooding from sewers is assessed to be **Low**.

3.7 Summary of Flood Risk

Much of the site is at very low risk from all sources of flooding with the main source of flooding being from an isolated area of surface water flood risk. However, if it can be proved in an FCA that surface water risk can be managed then this should have little impact upon the proposed site.

Table 3-1 Summary of Flood Risk

Flood Source	Risk
River	Very Low
The Sea	Very Low
Surface Water	Low – Very Low
Groundwater	Very Low
Reservoirs	Very Low
Sewers	Low

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests.

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers and the Sea

The Flood Map for Planning – flood risk from rivers shows the site is in Flood Zone 1. This represents a less than 0.1% (1 in 1000 year) chance of flooding from fluvial or tidal mechanisms in any given year including the effects of climate change. Figure 4-1 below clearly shows the site is located outside of Flood Zone 2 and 3 for rivers and the sea.

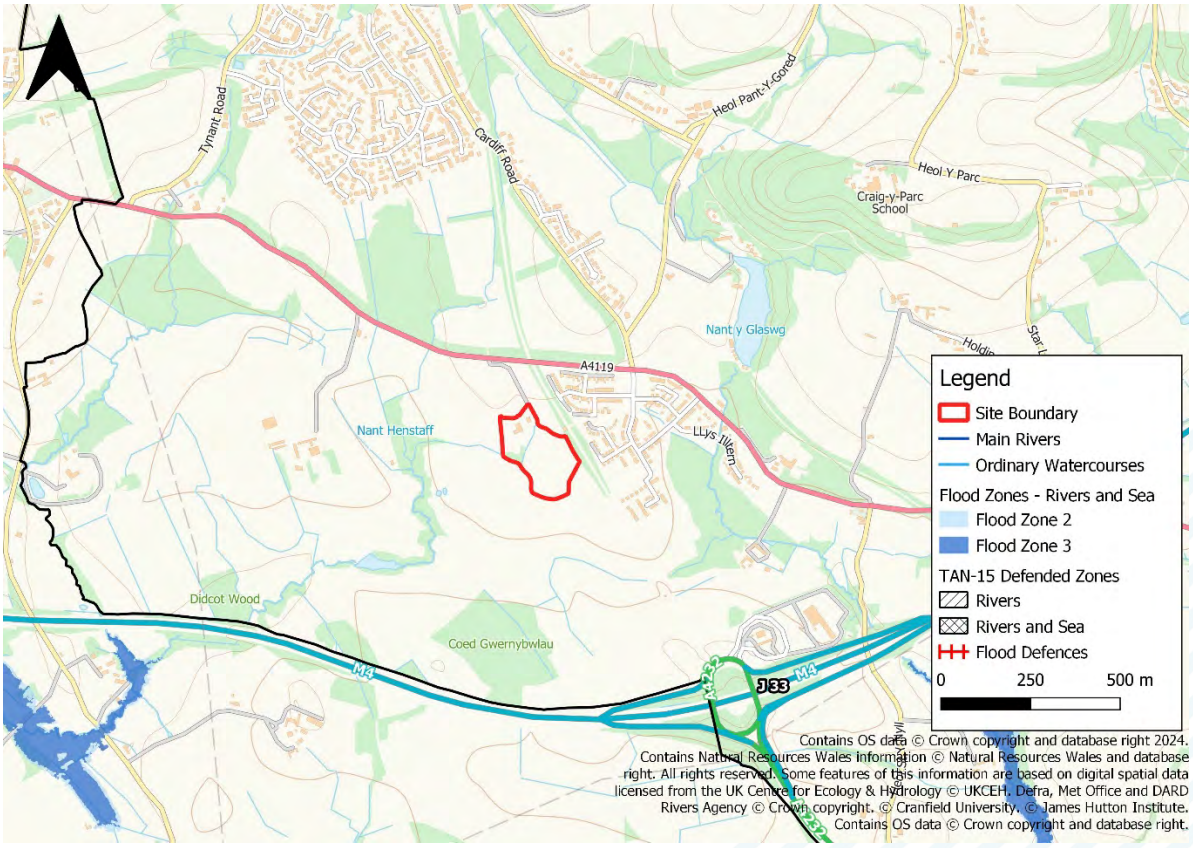

Figure 4-1 FMfP- Flood Risk from Rivers and the Sea

4.1.2 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is predominantly located in Flood Zone 1, as shown in Figure 4-2. This means that most of the site has a Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year from surface water or small watercourses.

There are however three isolated areas of surface water flood risk within the site, as shown in Figure 4-2.

One of these areas is associated with the confluence of the two unnamed ordinary watercourses within the site boundary. This area is associated with Flood Zone 2.

Two areas are associated with small areas of ponding within local topographic depressions within the northern and southern extents of the site. The southern area of ponding is designated as Flood Zone 2, whilst the northern area is Flood Zone 3.

As the site is partially located within Flood Zones 2 and 3 for surface water and small watercourses map, a detailed FCA shall be required, in accordance with TAN-15, to demonstrate that the risk can be managed/mitigated appropriately. Given the nature of the risk associated with this site, localised topographic depressions are likely to be addressed through the design and construction process, with surface water managed appropriately, through the use of SuDS techniques. The Justification Test and Acceptability criteria, as set out in TAN-15, do not apply to surface water and small watercourse risk.

Section 8.5 of TAN-15 advises that small watercourses should not be built over/ culverted and should be considered as a natural asset to the development site and integrated with SuDS features from the outset, where appropriate.

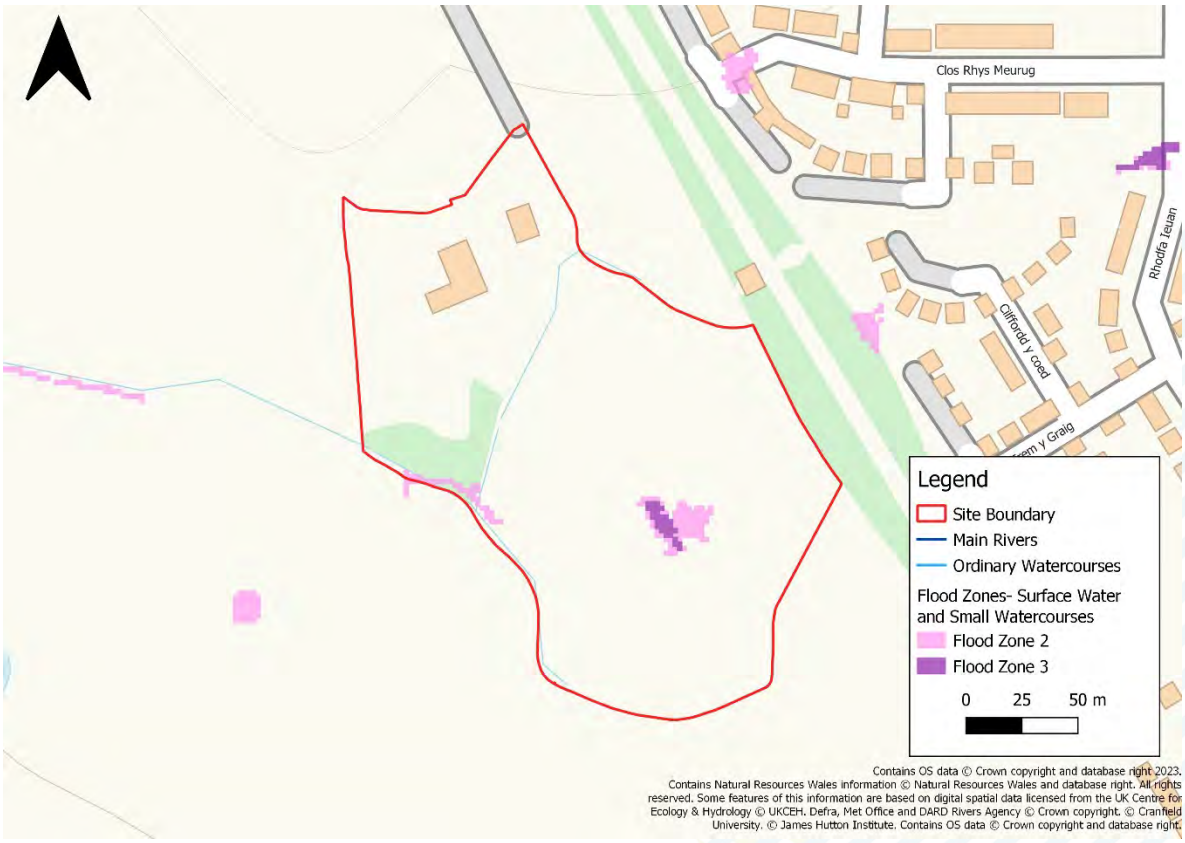

Figure 4-2 FMfP - Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. The site has been proposed for a mixed-use development. The details regarding the makeup of this 'Mixed-use' have yet to be specified, however, it will be assumed that it will include a mixture of Highly vulnerable and Less Vulnerable aspects of development. Under the new TAN-15 a more sequential approach can be taken at the site than under the previous iteration. This will provide

greater flexibility to the development of the site whilst ensuring that the most vulnerable developments are in the areas of least risk.

Table 4-2 Development vulnerability categories[3]

Development category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites, caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New development

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of new development.

The TAN-15 defines New development as: "*development on any greenfield land; development of vacant or disused brownfield sites*"

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new developments for this guidance. New developments increase the exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

For the time being and to the best of our knowledge, the proposed site will be classified as a 'New Development' for the TAN-15 and the application of the Justification Test.

4.4 Justification Test and Acceptability Criteria

As per Section 4.1, the proposed development is located within Flood Zone 1 of the FMfP –Rivers and Sea.

Tan-15 states that within Zone 1, all types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

Consequently, no FCA is required as a result of tidal or fluvial flood risk, and the site does not need to be considered against the Justification Test or Acceptability Criteria.

However, as the site is located within Flood Zones 2 and 3 of the Flood Map for Planning –Surface water and small watercourses, a Flood Consequences Assessment shall be required as a result of the risk from this source. The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. Therefore the FCA will be likely to be simple due to the risk. However, the FCA should include details on how the surface water risk will be managed including the use of SuDS with existing flow paths on site are retained.

Surface water and ordinary watercourse flood risk management are the responsibility of the Lead Local Flood Authority which may have site-specific requirements for surface water management across the proposed development site.

The FCA should develop a full appreciation of:

- The risk and consequences of flooding on the development; and
- The risk and consequences of the development of flood risk elsewhere

5 Conclusion

Site Description

- JBA Consulting has been commissioned to prepare a Flood Risk Appraisal in support of a proposed candidate site in the upcoming Cardiff Council Local Development Plan at Land at Llwynnioli Farm for mixed-use.
- The proposed development site is located in the northwest of Cardiff in the electoral ward of St Fagans. Approximately 600m to the south of the site is the M4 Motorway, with the A4119 located approximately 150m to the north.
- An unnamed ordinary watercourse that is a tributary to the Nant Henstaff

Overview of flood risk

- The primary risk of flooding to the site is from surface water, however, this is still isolated with the site a predominantly low risk;
- The site is at very low risk of flooding from fluvial, tidal, reservoir, groundwater and sewer sources;

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to suggest that the proposed mixed-use development would be justified and appropriate at this location.
- The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. However, it's been suggested that a site-specific FCA is undertaken to demonstrate how surface water flood risk is managed. This will be done via the use of SuDS with existing flow routes retained.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales.

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	George Williams BSc MSc
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc C.WEM MCIWEM
Subject	Land at Cwym Farm- Flood Risk Appraisal

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Land at Cwym Farm. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site per Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development, Flooding and Coastal Erosion and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located north of Morgantown Cardiff and directly to the south of the Taffs Well Quarry. The total site area is approximately 29.3ha of greenfield land, comprising woodland and grassland. The proposed site is split into two parcels of land one large parcel north of Ffordd Treforgan (Parcel 1) and a small parcel to the south of the highway (Parcel 2), as shown in Figure 2-1. The site is located approximately 250 north of the M4 motorway at its closest point.

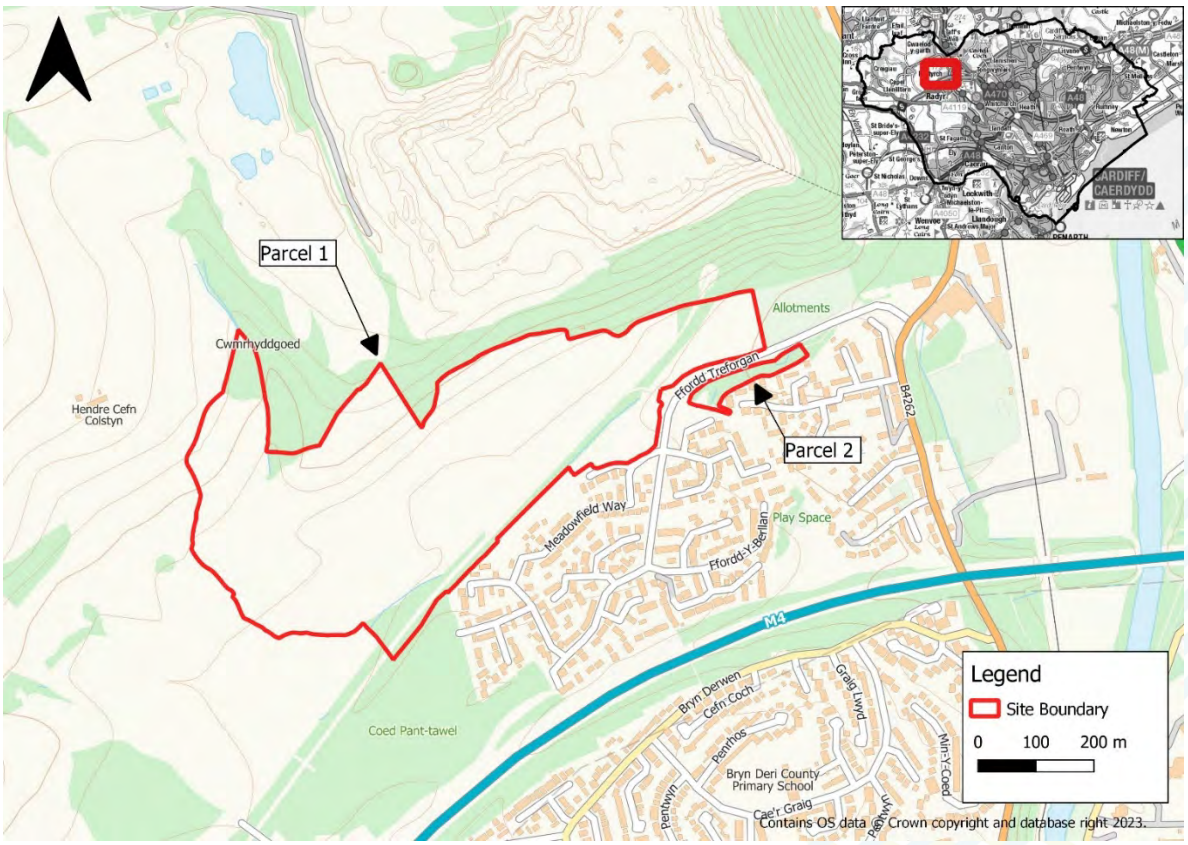

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development is for residential purposes.

2.2 Watercourses and Flood Defences

Two watercourses pass through the proposed candidate site as shown in Figure 2-2.

One small watercourse flows into the northern boundary of Parcel 1. It is unclear as to where this watercourse drains to. The other larger watercourse is an unnamed tributary to the River Taff that flows in a general easterly direction through Parcel 1 before passing beneath Ffordd Treforgan and across Parcel 2.

The nearest Main River is the River Taff, located approximately 575m to the east of the site at its closest point on Parcel 2. The site does not benefit from flood defences.

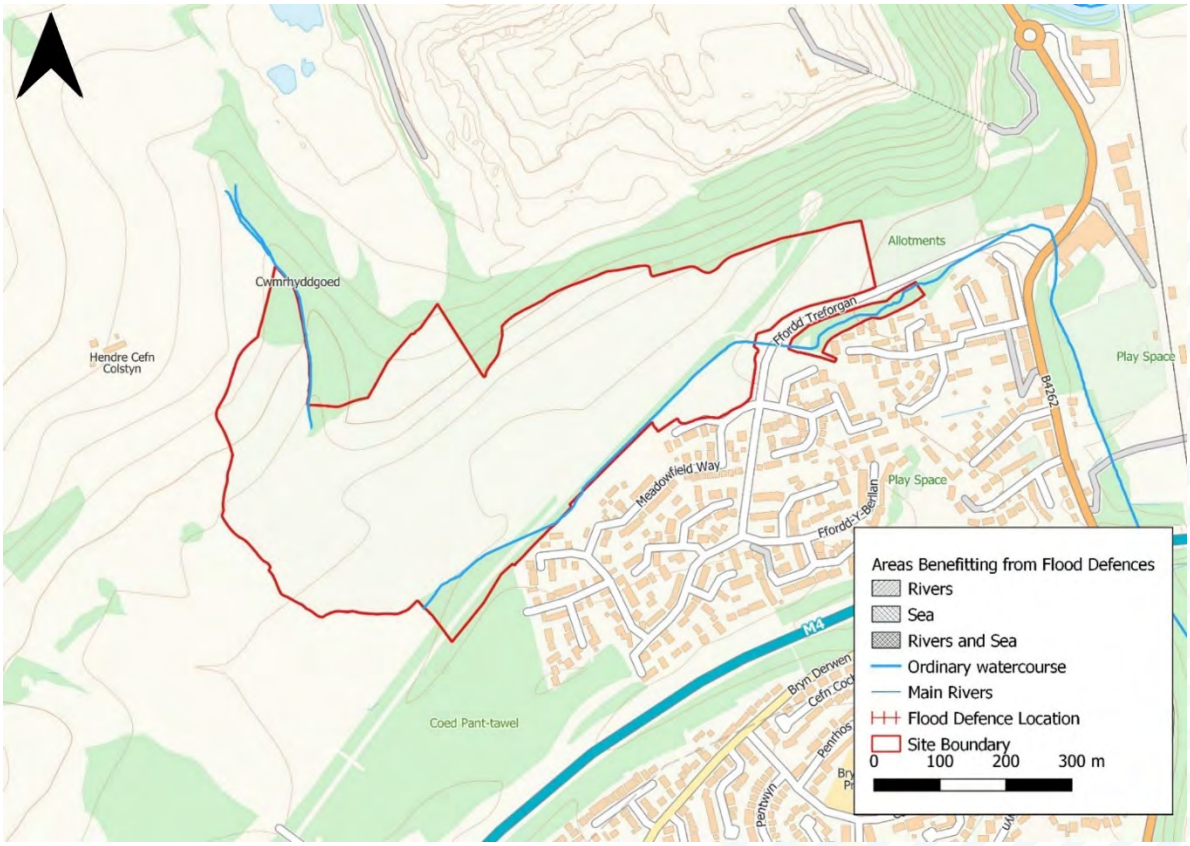

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3.

The LiDAR data shows that the site generally falls in a southeasterly direction across Parcel 1, and in a west-to-east direction, towards the River Taff, across Parcel 2.

Elevations in parcel 1 are highest in the far north of the site and lowest in the southeast. The highest elevation is approximately 120.78mAOD with the lowest being approximately 52.07mAOD close to the ordinary watercourse that passes through this point of the site.

Parcel 2 falls in a general west-to-east direction following the direction of the ordinary watercourse that passes through. The highest elevation of 53.01mAOD is located in on the western boundary of the site with the lowest elevation of 41.57mAOD located on the eastern boundary.

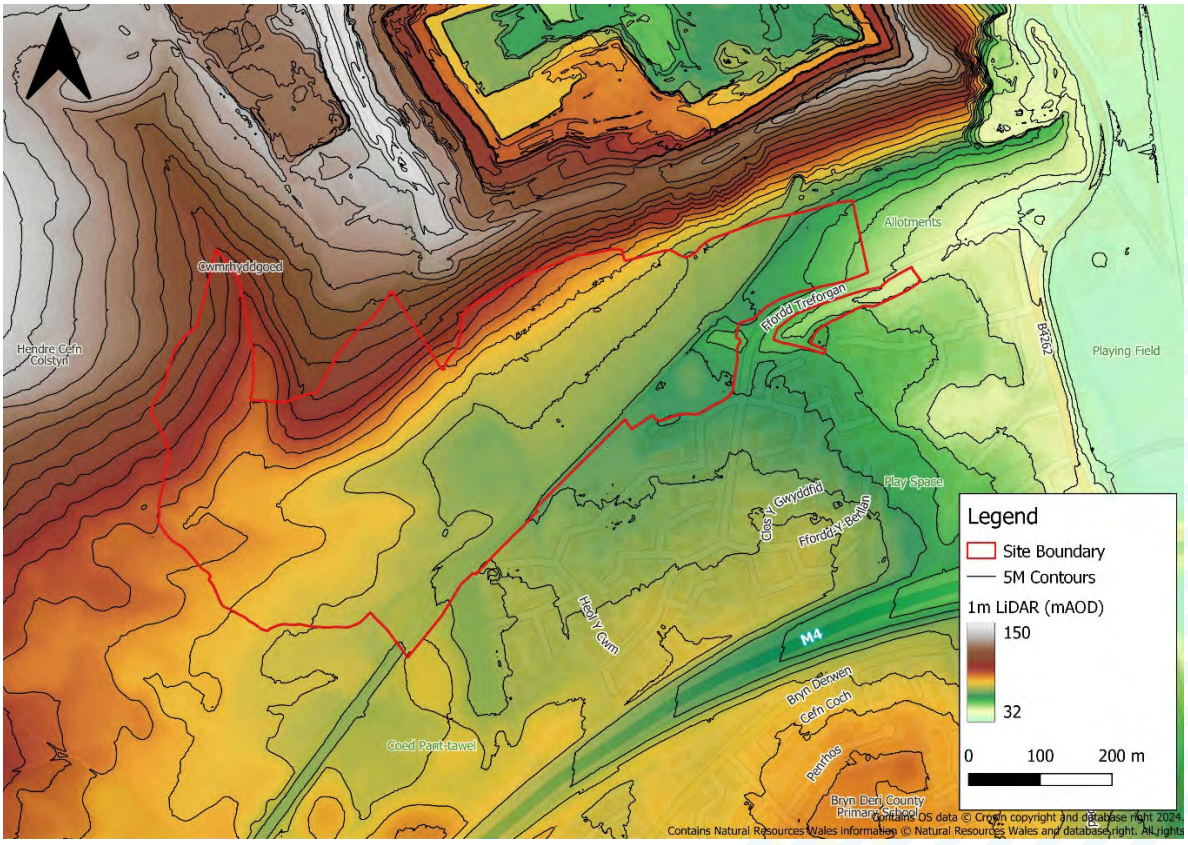

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from Rivers. This means that there is a less than 0.1% AEP chance of fluvial flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the majority site is at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-1. This means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site.

However, the presence of two small unnamed watercourses that run through the site as well as an existing overland flow route are indicated by the areas that have medium or high flood risk.

Areas at medium risk mean that there is between 1% (1 in 100 year) and 3.3% (1 in 30 year) of flooding whereas high risk means there is a greater than 3.3% chance of flooding in any given year.

The overland flow route and the ordinary watercourse will have to be retained within the proposed site layout and should not be built over or channelled into a culverted system. It is recommended that during the master planning design of the site residential buildings should be located outside of these areas. Furthermore, it is recommended that the overland flow route and the ordinary watercourse should be fully incorporated into any SuDS drainage system present at the site. This will add biodiversity and amenity benefits whilst recognising the presence of the overland flow route and ordinary watercourses as an assist to the site.

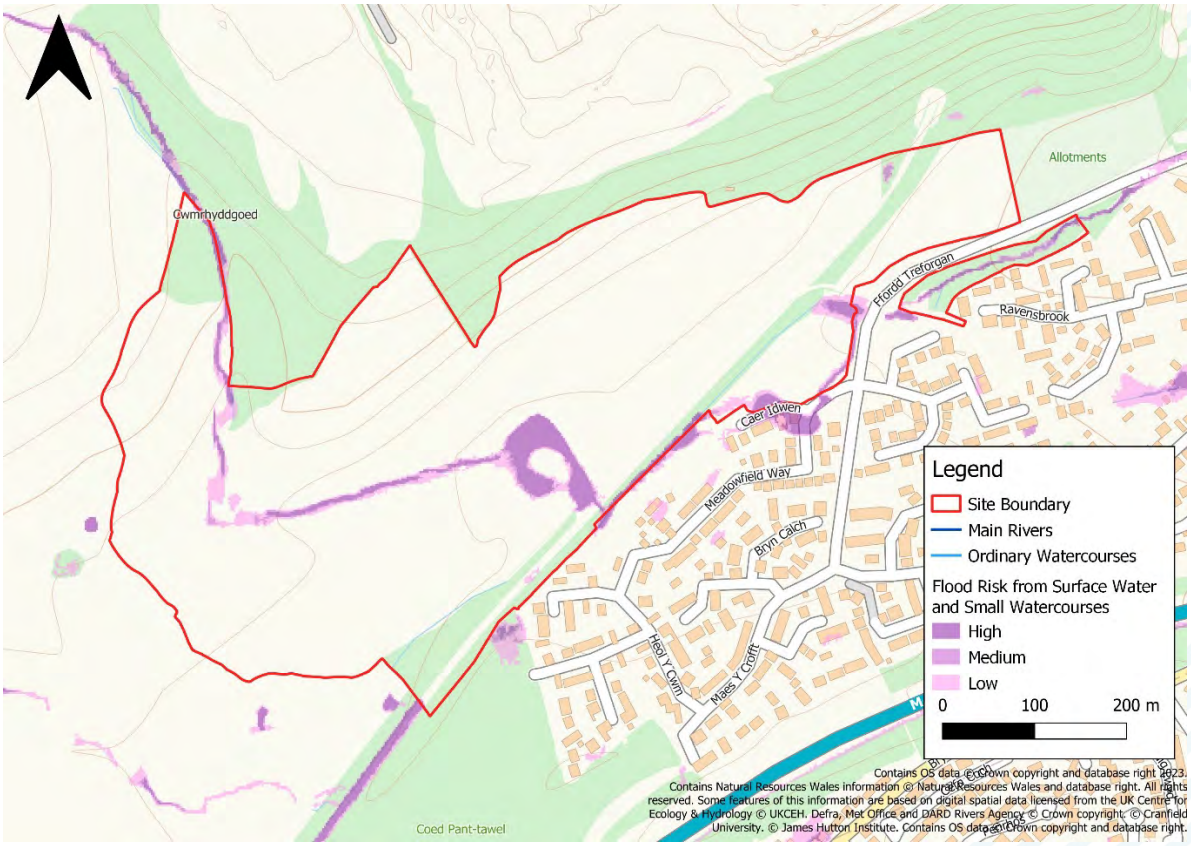

Figure 3-1 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The South East Wales Stage 1 SFCA includes JBA's Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area that has a varying level of groundwater emergence risk, as shown in Figure 3-2.

JBA has developed a range of Groundwater Flood Map products nationally. The 5m resolution JBA Groundwater Map has been used within the report. The modelling involves simulating groundwater levels for various return periods (including 1.33% year, 1%, and 0.5% AEP). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 1% AEP model outputs.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, which would represent

an extreme scenario. The maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often necessary for groundwater to have nowhere to go without ponding and flooding an area first.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad-scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding, this may include review of historical flood records, historical borehole logs, consultation with the LLFA and groundwater monitoring.

In Parcel 1 the areas to the north and east are at low risk of groundwater emergence and have modelled groundwater levels at least 5m below the ground surface. To the south of this parcel of land is an area that is at medium-high risk of emergence with groundwater levels at between 0.025m and 0.5m below the ground surface. Just to the north of this band is an area of medium-low risk of emergence where groundwater is modelled to be between 0.5 and 5m below ground level.

Across Parcel 2, the west of the site is a low risk where groundwater levels are modelled to be at least 5m below ground level and at medium-low risk of groundwater emergence.

There have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Stage 1 SFCA. It's therefore assessed that the groundwater flood risk is low-medium. Furthermore, the Cardiff Local Flood Risk Management Strategy[1] also states that 'there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small'. However, caution should be taken especially during excavations and the building of groundwater-sensitive structures i.e. basements or during excavations.

It has therefore been assessed that the risk of Groundwater flooding at the site is **low-medium**.

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx>

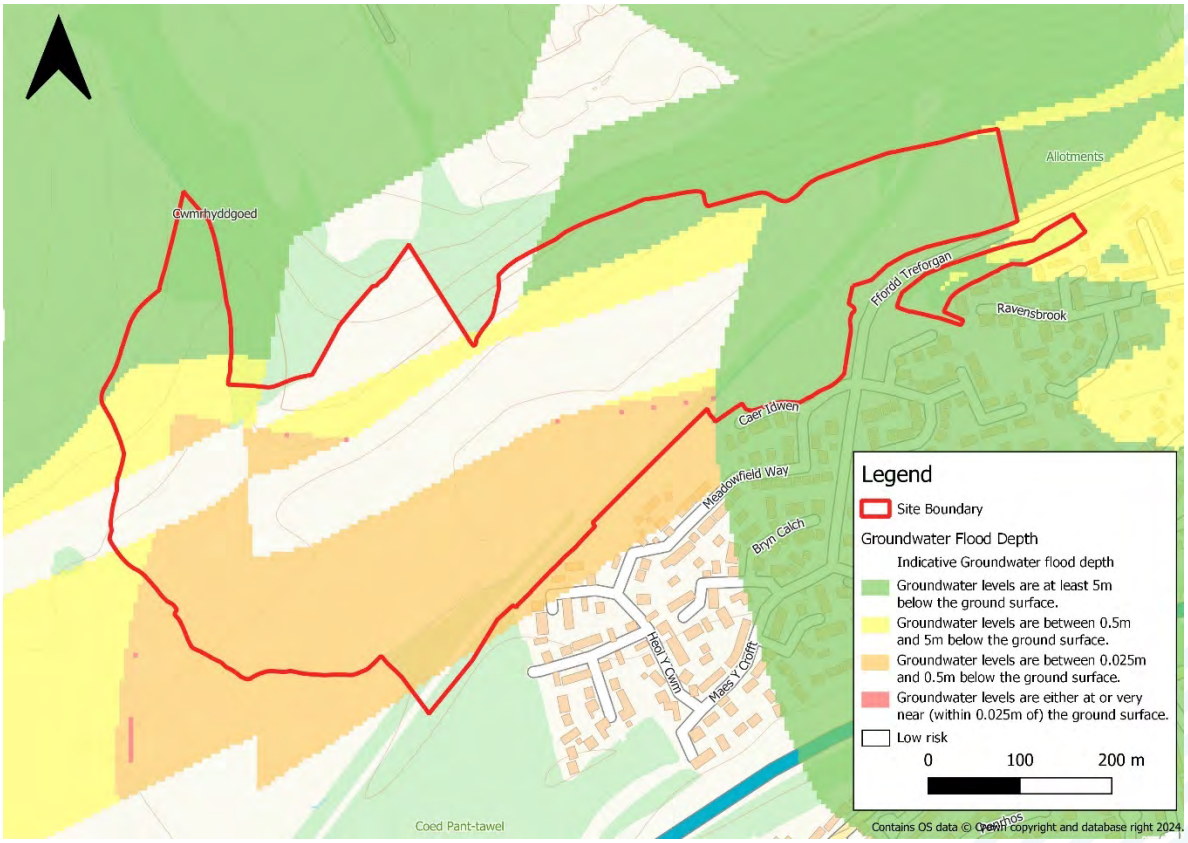

Figure 3-2: Groundwater Emergence Risk Map

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South East Wales Stage 1 SFCA has identified there to be a total of 18 historic sewer flood incidents for the Cardiff electoral wards of Pentyrch and Radyr in which the development site is located within. Despite the number of historic sewer flood incidents being relatively high there unlikely to be any associated with this site as it is currently greenfield land.

Therefore, the proposed candidate site has been assessed to have a **low risk of sewer flooding**.

3.7 Summary of Flood Risk

The main flood risk source to the site is surface water and small watercourse flooding. Further investigation into surface water flood risk for the site should be completed through a site-specific Flood Consequence Assessment (FCA). Flood risk from other sources is as outlined in Table 3-1:

Table 3-1 Summary of Flood Risk

Source of Flooding	Risk
River	Very Low
Sea	Very Low
Surface Water and Small Watercourses	Predominantly Low, although areas of medium-high exist but can be managed/ avoided during the development's lifetime
Groundwater	Low-Medium
Reservoir	Very Low
Sewer	Low

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. **Table 4-1** summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers and the Sea

The Flood Map for Planning – Flood Risk from Rivers shows the site is located in Flood Zone 1 for the sea, meaning there is a less than 0.1% (1 in the 1000 year) chance of flooding from fluvial and tidal mechanisms in any given year including the effects of climate change. Figure 4-1 has been provided and clearly shows the site outside of Flood Zone 2 and 3 for Flood Risk from River and the Sea.

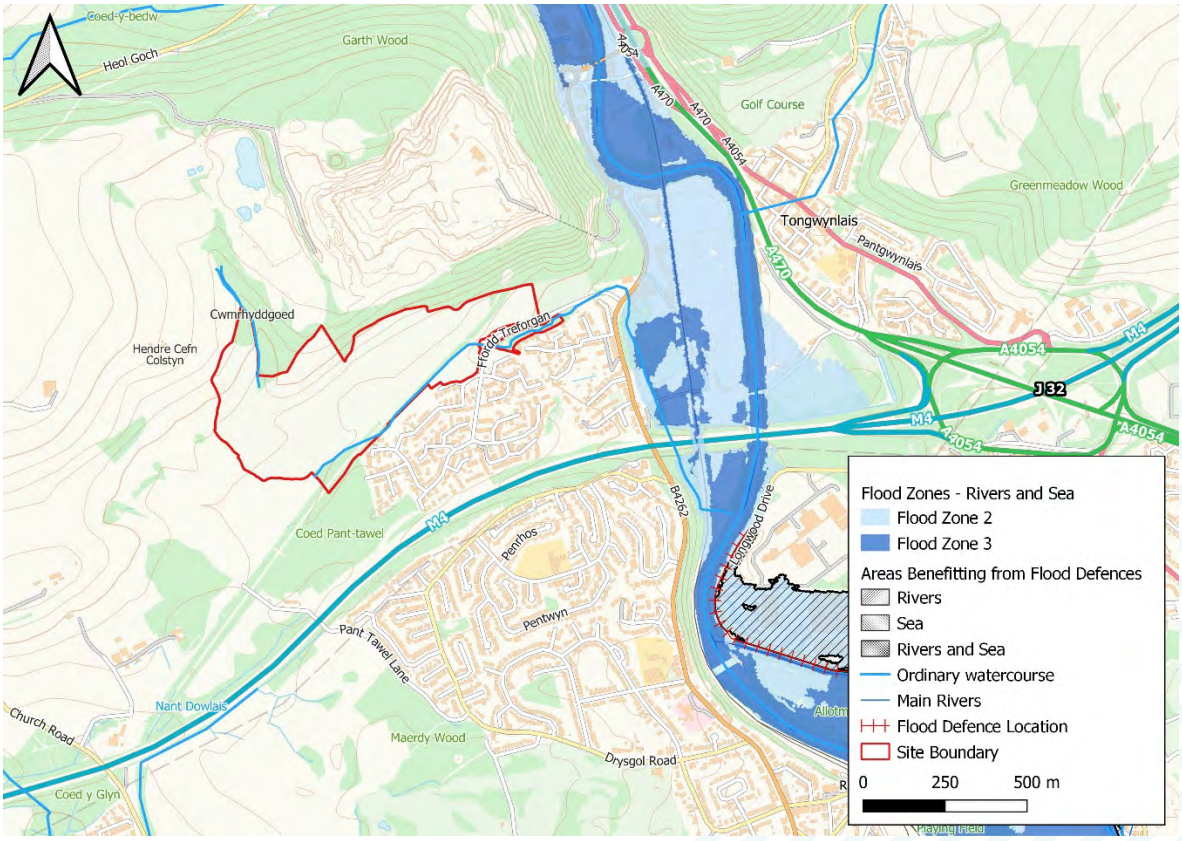

Figure 4-1 FMfP Flood Risk Rivers and the Sea

4.1.2 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is located predominantly in Flood Zone 1, as shown in Figure 4-2.

However, as can also be seen in Figure 4-2, the site has an Ordinary Watercourse that bisects Parcel 1's western extent in a north-south direction following a natural valley that is present along the site, prior to flowing along the southern boundary of Parcel 1. This overland flow route is predominantly Flood Zone 3, with isolated areas of Flood Zone 2.

A small unnamed watercourse that is a tributary of the River Taff flows in an easterly direction through Parcel 2. The watercourse channel is associated with Flood Zone 3.

As some of the site is located in Flood Zone 3 a site-specific FCA will need to be produced to demonstrate that the risk can be managed.

It is recommended that built aspects of this development are located outside the areas at risk from Surface water and Small Watercourse flooding. This will ensure that flow paths are retained, and small watercourses not culverted. This will, however, likely rule out any development in Parcel 2 as much of the parcel is constrained by the ordinary watercourse that runs through it.

This does not impact on the site passing the justification and acceptability criteria.

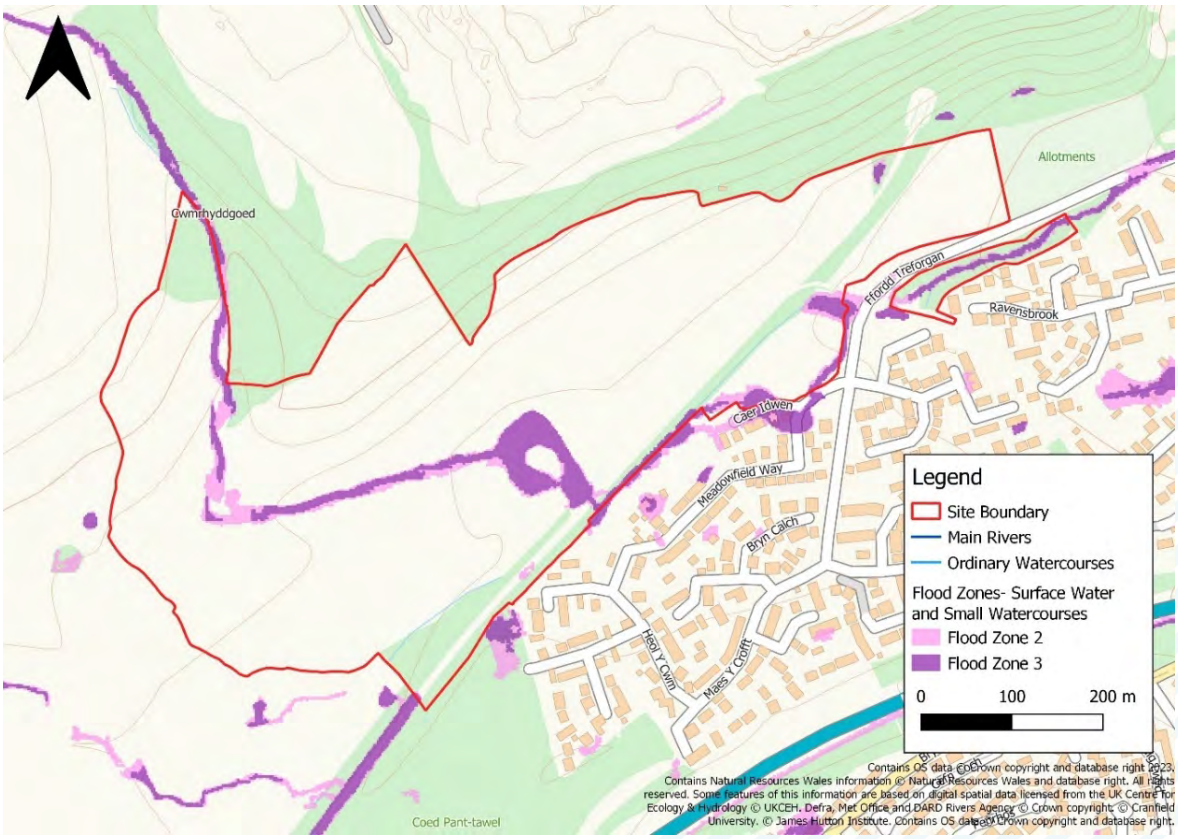

Figure 4-2 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to development, as shown in Table 4-2 below. As the proposed use for the site is for residential development it is classified as a highly vulnerable development.

Table 4-2 Development vulnerability categories[3]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this proposed candidate appraisal are the definitions of new development.

The TAN-15 defines New development as: "*development on any greenfield land; development of vacant or disused brownfield sites*"

Furthermore, TAN-15 states that:

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new developments for the purposes of this guidance. New developments increase the exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

The proposed site will be classified as a 'new development' under the new TAN-15.

4.4 Justification Test and Acceptability Criteria

As per Section 4.1, the proposed development is located within Flood Zone 1 of the FMfP –Rivers and Sea.

Tan-15 states that within Zone 1, all types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

Consequently, no FCA is required as a result of tidal or fluvial flood risk, and the site does not need to be considered against the Justification Test or Acceptability Criteria.

However, as the site has areas that are in Flood Zone 2 and 3 of the FMfP- risk from Surface water and small watercourses, a Flood Consequences Assessment shall be required as a result of the risk from this source.

The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. Therefore the FCA will be likely to be simple due to the risk. However, the FCA should include details on how the surface water risk will be managed including the use of SuDS with existing flow paths on site retained.

Surface water and ordinary watercourse flood risk management are the responsibility of the Lead Local Flood Authority which may have site specific requirements for surface water management across the proposed development site.

The FCA should develop a full appreciation of:

- The risk and consequences of flooding on the development; and
- The risk and consequences of the development of flood risk elsewhere
- How surface water flood risk will be managed appropriately through the use of SuDS techniques and a robust surface water drainage strategy.

- How existing flow routes and watercourses will be retained in the proposed site layout.

5 Conclusion

Site Description

- JBA Consulting has been commissioned to prepare a Flood Risk Appraisal in support of a proposed candidate site at Cwym Farm, Morgantown, Cardiff for residential use.
- The site is located in Morgantown, Cardiff south of the Taffs Wells Quarry and is currently undeveloped greenfield land.

Overview of flood risk

- The primary risk of flooding to the site is from surface water and/or small watercourses. The overland flow path and ordinary watercourses will need to be retained as open channels in any future development with any built development located away from these areas;
- The site is at very low risk of flooding from fluvial, tidal, and reservoir sources;
- The site is at low-medium risk of groundwater emergence.
- The site is at low risk of flooding from sewers.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to suggest that the proposed residential development would be justified and appropriate at this location.
- The site is located within Flood Zone 1 for Rivers and the Sea, therefore the Justification Test and Acceptability criteria are not applicable to the site.
- However, an FCA will need to be produced for the site in line with TAN-15 guidance as some of the site is located in Flood Zone 3 for Surface water and Small Watercourses. The FCA will need to demonstrate the risk can be managed, that overland flow paths are retained, and ordinary watercourses are not channelled
- This will likely rule out any development for Parcel 2 as it is mostly constrained by the ordinary watercourse that passes through it.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales.

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	George Williams BSc MSc MCIWEM
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc C.WEM MCIWEM
Subject	Land off Forest Road- Flood Risk Appraisal

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Land off Forest Road. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping.

2 Site Description

The proposed development site is located south of Heol-Y-Forest Road, Tongwynlais in the north of Cardiff as shown in Figure 2-1 Site location. The proposed site is split into two parcels one is situated on the former Cefngarw Quarry site and is the eastern parcel. The western parcel is located to the northwest of the existing residential development on Maes Y Draenog.

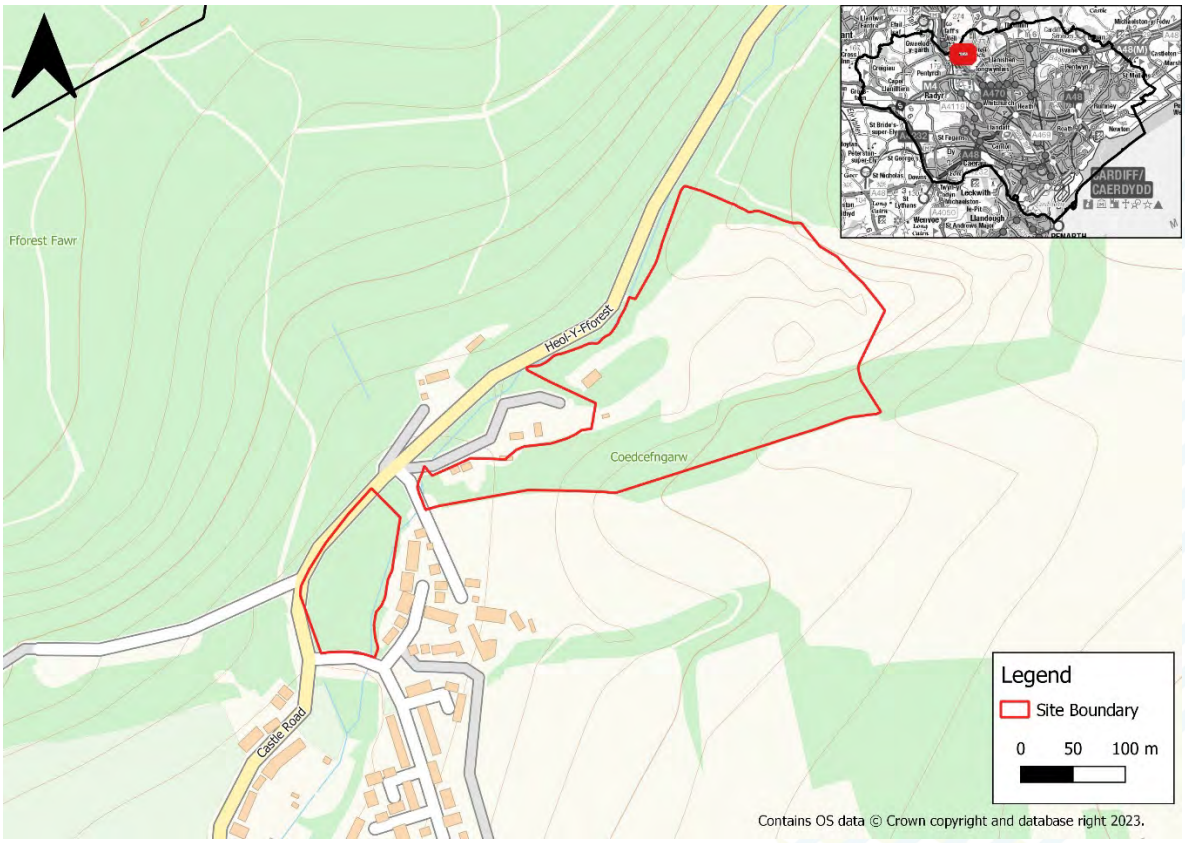

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development at this site is for Residential use.

2.2 Watercourses and Flood Defences

The nearest main watercourse to the proposed site is the River Taff which is located approximately 600m to the south-west of the western portion of the site. Furthermore, an unnamed tributary to the River Taff passes through the western parcel of the proposed site following the eastern boundary of the proposed site as seen in Figure 2-2. This ordinary watercourse doesn't enter the eastern parcel of the site but runs close to the northern boundary between the site and Heol-Y-Forest Road.

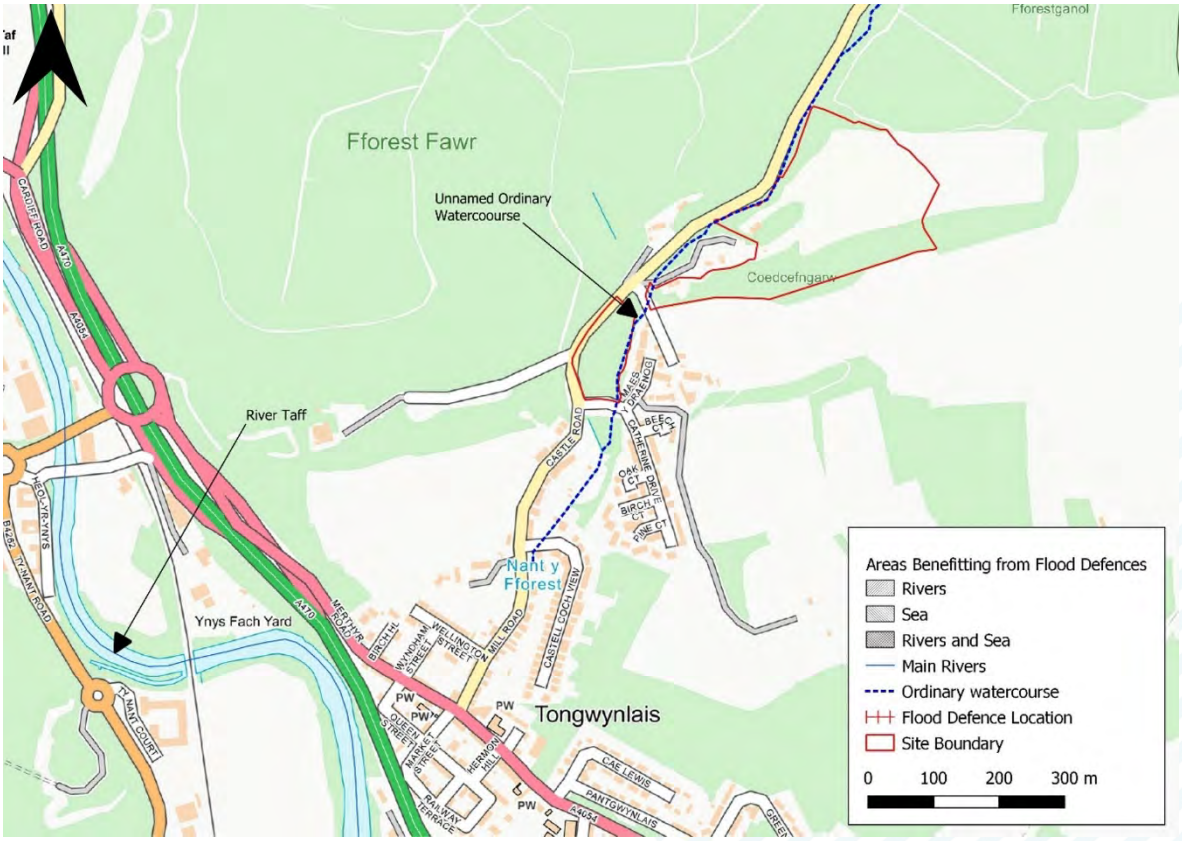

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows there to be a large difference between site levels for the western and eastern parcels of land.

The Western parcel of land falls in a general east-to-west direction, however, is worth noting that there are varying levels across the site with many topographic depressions and highs, mostly likely related to former quarrying at the site. The highest elevation of 120.26mAOD is found in the far southeast boundary of the site. In contrast, the

lowest elevation of 63.09mAOD is found at the far western boundary adjacent to the access road and the unnamed watercourse that runs through the site.

For the eastern parcel, there is less of a contrast in topography with the height elevation of 65.75mAOD being located on the northern boundary of the site adjacent to Heol-Y-Fforest Road. The lowest elevation is situated in the southeastern corner of the site on the banks of the unnamed ordinary watercourse and has an elevation of 59.19mAOD. In general, this parcel falls in a north-to-south direction.

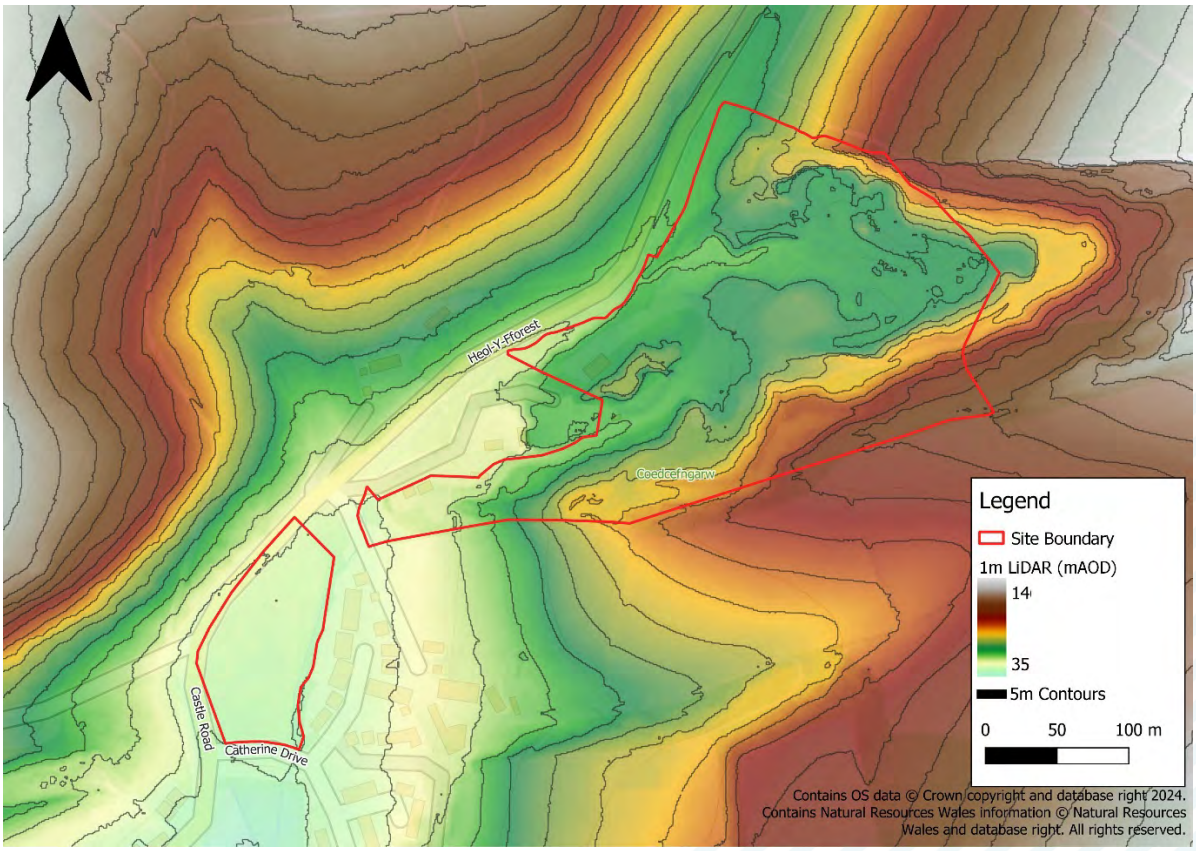

Figure 2-3 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from Rivers. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the site is predominantly at **very low risk** of flooding from the surface water and small watercourses, as shown in Figure 3-1. This means there is a less than 0.1% AEP chance of surface water and small watercourse flooding for much of the site.

However, areas of the site that are transgressed by the unnamed ordinary watercourse are shown to be at High risk and Medium risk. Medium-risk areas have a between 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses each year, whereas high-risk areas have a more than 1% (1 in 100) chance of flooding in a given year. In addition to this in the eastern parcel of land, there are six isolated areas of areas that are at risk from surface water flooding, two high risks located furthest east, three low-risk areas located centrally and then one medium-risk area located furthest west. These are likely associated with topographic depressions within the site where surface water will 'pond' during high rainfall events.

This risk is thought to be manageable as buildings could be placed in those areas at the least risk from flooding. Furthermore, the areas associated with a local topographic depression and this risk is posed by surface water. However, this risk can be managed through considerate site design and SuDS.

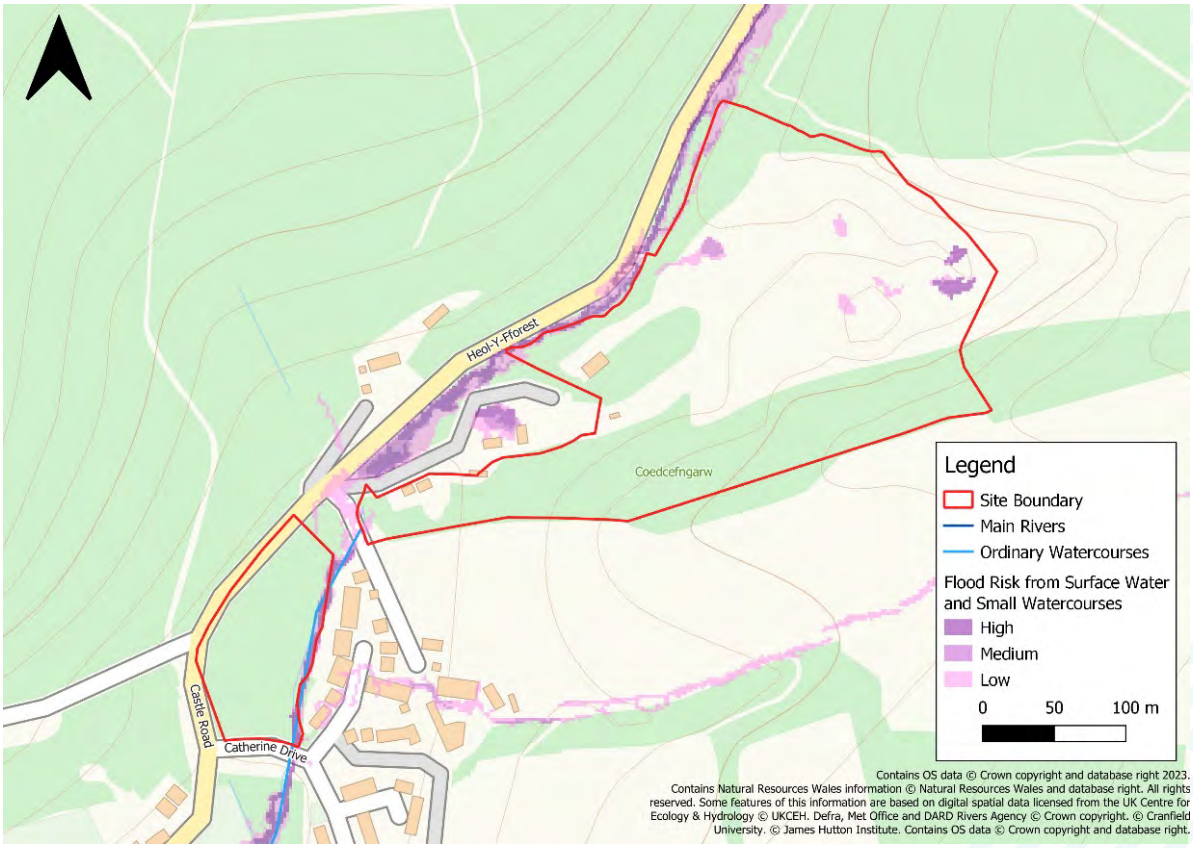

Figure 3-1 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The South East Wales Stage 1 SFCA includes JBA's Groundwater Flood map as part of the assessment and shows the proposed site to be at varying levels of risk as seen in Figure 3-2 below. Across this proposed candidate site, the bedrock geology varies and consists of Limestone and Mudstone formations. Areas of medium-high groundwater (within 0.25-0.5m of the ground surface) located centrally are associated with the Pembroke limestone formation and its highly permeable nature. Areas of interbedded limestone and mudstone associated with the Castle Coch formation have a medium-low potential of groundwater emergence with groundwater levels between (0.5-5m of the ground surface)

Areas of Mudstone located in the far southeast or on the western parcel of land have indicative groundwater levels at least 5m below the ground surface.

JBA has developed a range of Groundwater Flood Map products at the national scale. The 5m resolution JBA Groundwater Map has been used within the report. The

modelling involves simulating groundwater levels for a range of return periods (including 1.33% year, 1%, and 0.5% AEP). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 1% AEP model outputs.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, and so would represent an extreme scenario. The maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often necessary for groundwater to have nowhere to go without ponding and flooding an area first.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad-scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding, this may include review of historical flood records, historical borehole logs, consultation with the LLFA and groundwater monitoring.

There have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the Stage 1 SFCA. Furthermore, the Cardiff Local Flood Risk Management Strategy[1] also states that 'there is little documented evidence of groundwater flooding in Cardiff' and therefore the risk of flooding from this source is considered to be small. It's therefore assessed that the groundwater flood risk is **low-medium**, however, caution should be taken especially during excavations and building of groundwater-sensitive structures i.e. basements.

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx

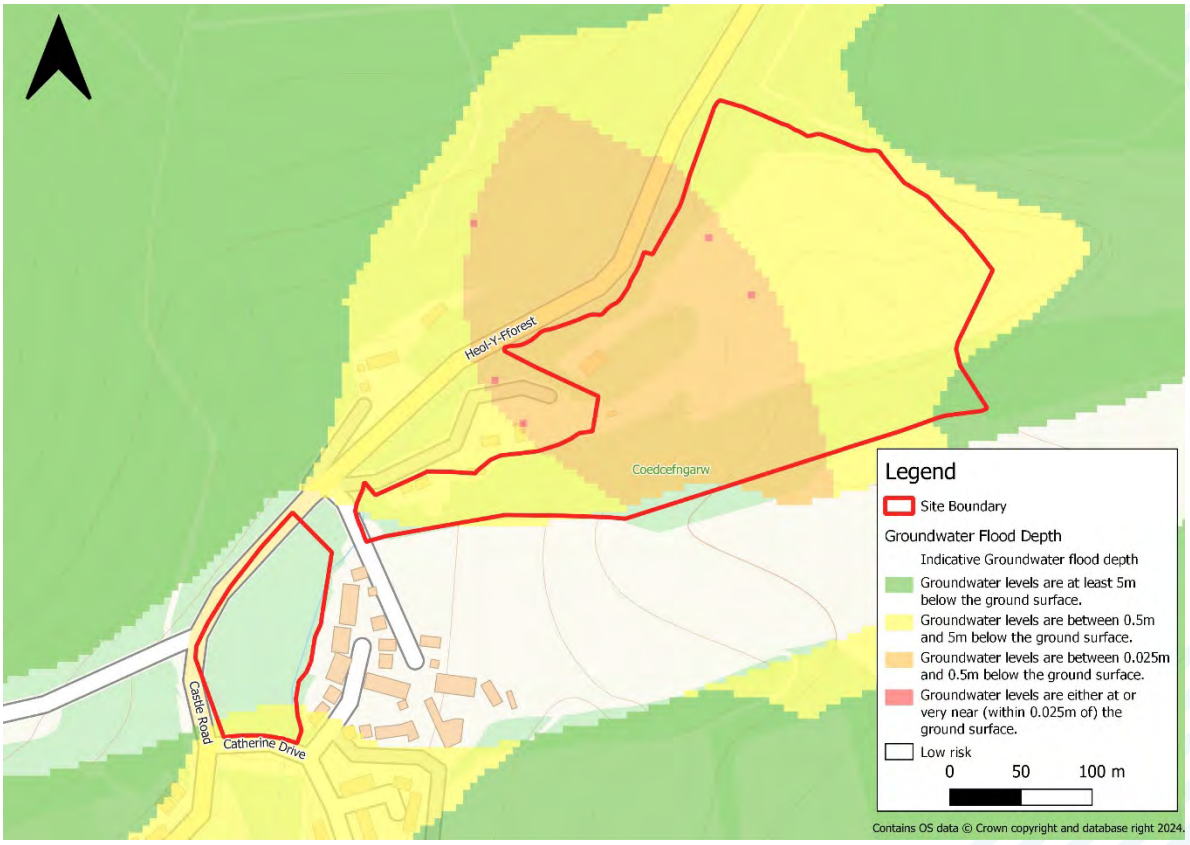

Figure 3-2 Groundwater Emergence Risk Map

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South-East Wales Stage 1 SFCA has identified there to be a high number (59) of historic sewer flood incidents within the Whitchurch and Tongwynlais electoral ward. The current location of any existing sewers is unknown and further assessment would be required. However, given the site's greenfield nature it's unlikely that any sewers transgress the site. With the current location of the existing sewers not known, the risk posed by sewer flooding is currently assessed to be **medium-low**.

3.7 Summary of Flood Risk

The main flood risk source to the site is from surface water and/or small watercourse flooding. However, much of the site is still at very low risk from surface water and/or small watercourse flooding, with the at-risk areas being mostly isolated or focused on the ordinary watercourse that transgresses the site. A summary of the flood risk if given in Table 3-1 below.

Table 3-1 Summary of Flood Risk

Source of Flooding	Risk
Rivers	Very Low
Sea	Very Low
Surface Water and Small Watercourses	Mostly Very Low, some areas high- medium, however risk can be managed
Groundwater	Low- medium
Reservoir	Very Low
Sewers	Medium-Low

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 FMfP Flood Zones and Definitions[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure managed and maintained by Risk Management Authorities provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers and the Sea

The Flood Map for Planning – flood risk from rivers shows the site is in Flood Zone 1. This represents a less than 0.1% (1 in 1000 year) chance of flooding from fluvial or tidal mechanisms in any given year including the effects of climate change.

4.1.2 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is located predominantly in Flood Zone 1, as shown in Figure 4-1. Flood Zone One represents less than 0.1% (1 in 1000 years) chance of flooding from surface water or small water courses in any given year including the effects of climate change. However, there are isolated areas of differing risks.

Areas of the site that are transgressed by the unnamed ordinary watercourse are located within Flood Zone 3 with areas within Flood Zone 2 located predominantly adjacent to those areas within flood zone 3. However, within the eastern parcel of land, there are isolated areas within Flood Zone 3 and Flood Zone 2, likely a result of topographic depressions.

As the site is partially located within Flood Zones 2 and 3 for surface water and small watercourses map, a detailed FCA shall be required, in accordance with TAN-15, to demonstrate that the risk can be managed/mitigated appropriately. Given the nature of the risk associated with this site, localised topographic depressions are likely to be addressed through the design and construction process, with surface water managed appropriately, through the use of SuDS techniques. The Justification Test and Acceptability criteria, as set out in TAN-15, do not apply to surface water and small watercourse risk.

Section 8.5 of TAN-15 advises that small watercourses should not be built over/ culverted and should be considered as a natural asset to the development site and integrated with SuDS features from the outset, where appropriate.

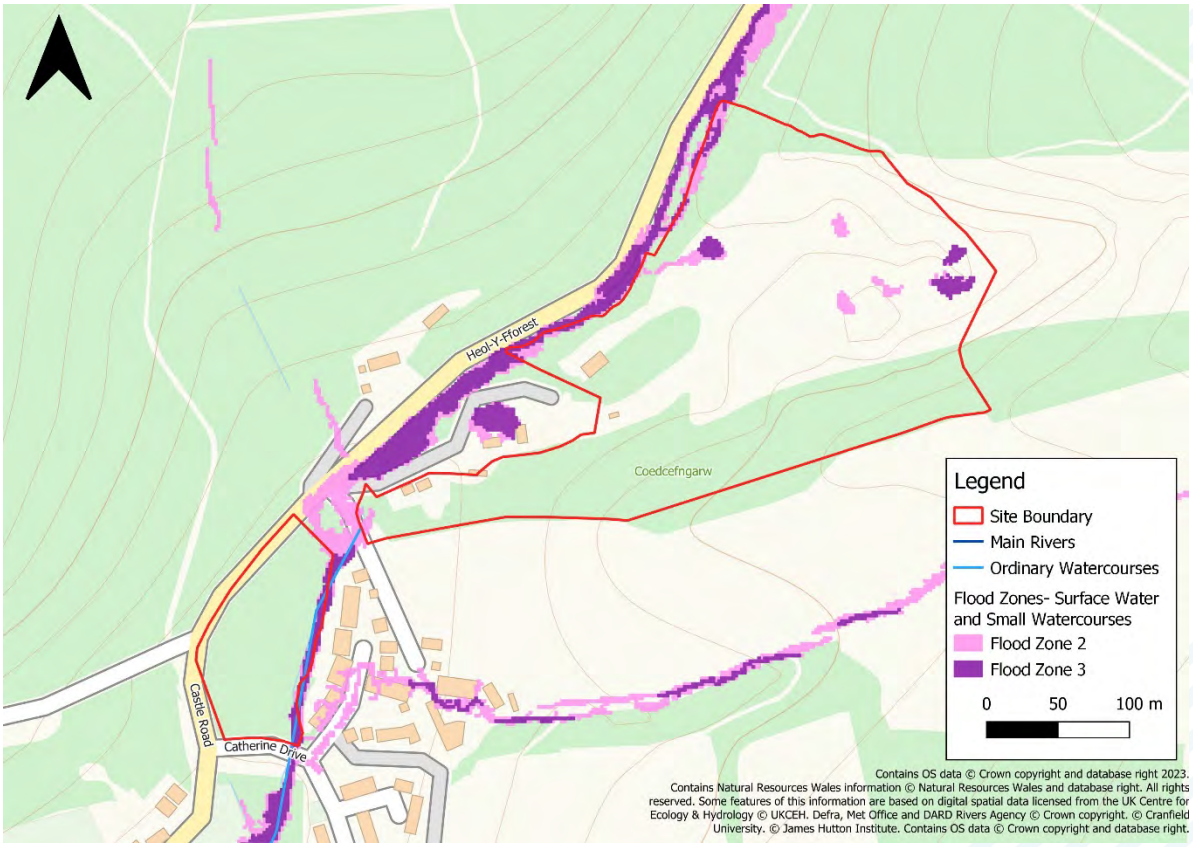

Figure 4-1 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for residential development it is classified as a highly vulnerable development.

Table 4-2 Development vulnerability categories[3]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites, caravan parks and camping sites). Schools and childcare establishments, colleges, and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New development

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice concerning four types of development. These are **New Development, Redevelopment, Change of use or conversions, and Extensions**. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of new development.

The TAN-15 defines New development as: "*development on any greenfield land; development of vacant or disused brownfield sites*"

Furthermore, TAN-15 states that:

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new developments for the purposes of this guidance. New developments increase the exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

For the time being and to the best of our knowledge, the proposed site will be classified as a 'New development' for the TAN-15 and the application of the Justification Test.

4.4 Justification Test and Acceptability Test

TAN-15 sets out the requirement for an FCA based on the sites location within the flood zones identified within the Flood Map for Planning. A Flood Consequences Assessment is only required as a consequence of a site being located within Flood Zones 2 and 3.

As per Section 4.1, the proposed development is located within Flood Zone 1 of the FMfP –Rivers and Sea.

Tan-15 states that within Zone 1, all types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

Consequently, no FCA is required as a result of tidal or fluvial flood risk, and the site does not need to be considered against the Justification Test or Acceptability Criteria.

However, as the site is located within Flood Zones 2 and 3 of the Flood Map for Planning –Surface water and small watercourses, a Flood Consequences Assessment shall be required as a result of the risk from this source. The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. Therefore the FCA will be likely to be simple due to the risk. However, the FCA should include details on how the surface water risk will be managed including the use of SuDS. Furthermore, ordinary watercourses should not be channelised or culverted.

Surface water and ordinary watercourse flood risk management are the responsibility of the Lead Local Flood Authority which may have site-specific requirements for surface water management across the proposed development site.

The FCA should develop a full appreciation of:

- The risk and consequences of flooding on the development; and
- The risk and consequences of the development of flood risk elsewhere

5 Conclusion

Site Description

- JBA Consulting have been commissioned to prepare a Flood Risk Appraisal in support a proposed candidate site at Land of Fforest Road.
- The site is located south of Heol-Y-Forest road, Tongwynlais in the north of Cardiff
- An unnamed ordinary watercourse that is a tributary to the River Taff runs along the north of the site

Overview of flood risk

- The primary risk of flooding to the site is from surface water and/or small watercourses. However, it is worth noting most of the site is at very low risk of surface water and/or small watercourse flooding and the risk that is present is manageable;
- The site is at very low risk of flooding from fluvial, tidal, and reservoir sources;
- The site is at low-medium risk of groundwater flooding.
- The site is at medium-low to low risk of flooding from sewers.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to suggest that the proposed residential development would be justified and appropriate at this location.
- The Justification Test and acceptability criteria are not applicable for sites at risk from surface water and small watercourse flooding. Therefore the site has not been assessed against them in this assessment.
- An FCA will need to be produced to demonstrate that the surface water and small watercourse flood risk at the site is managed through the use of SuDS and that small watercourses are not channelised or culverted.

Conclusion

- It is concluded that on the grounds of flood risk, development proposals do comply with the aims and objectives of TAN-15 and Planning Policy Wales.

Flood Risk Appraisal

JBA Project Code	2023s1700
Contract	Cardiff Stage 2 Strategic Flood Consequence Assessment
Client	Cardiff Council
Date	July 2024
Author	George Williams BSc MSc
Reviewer / Sign-off	Faye Tomalin BSc (Hons) MSc C.WEM MCIWEM
Subject	Velindre Station - Flood Risk Appraisal

1 Introduction

Cardiff Council has commissioned JBA Consulting to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan: Velindre Station. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development Flooding and Coastal Erosion (January 2023) and includes a review of NRW flood mapping.

2 Site Description

The proposed development site is located at land south of Hollybush Estate, Whitchurch approximately 6.8km from Cardiff City centre as shown in Figure 2-1. The site is approximately 0.096Ha in area. The site is partially in a former railway cutting and as such is a localised topographical depression. Currently, the site comprises of wooded greenfield land, with a public footpath running through the site. The proposed site is bounded by greenfield land in all directions with Hollybush Estate being located approximately 200 m to the north of the site. Coryton train station is located approximately 400m to the east and the M4 motorway is located approximately 750m to the northwest of the site.

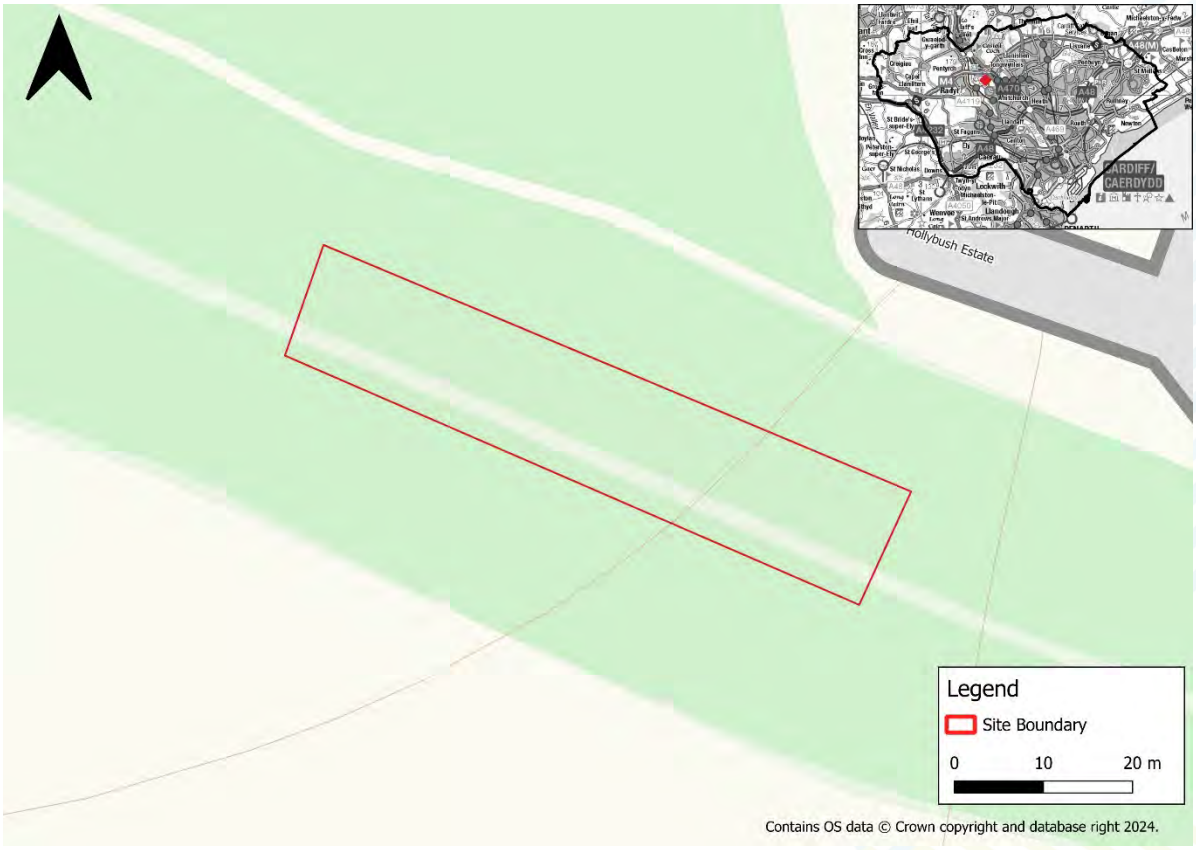

Figure 2-1 Site Location

2.1 Development Proposals

The site proposal is for the development of a train station that will form part of the South Wales Metro that is currently being developed in Southeast Wales around the central hub of Cardiff Central Station.

2.2 Watercourses and Flood Defences

The Glamorganshire Canal is located approximately 200m to the south of the proposed site, as shown in Figure 2-2. The watercourse flows in a general north-to-south direction before flowing into the Melingriffith Feeder, which itself flows into the River Taff a further 100m downstream from its confluence with the Glamorganshire Canal.

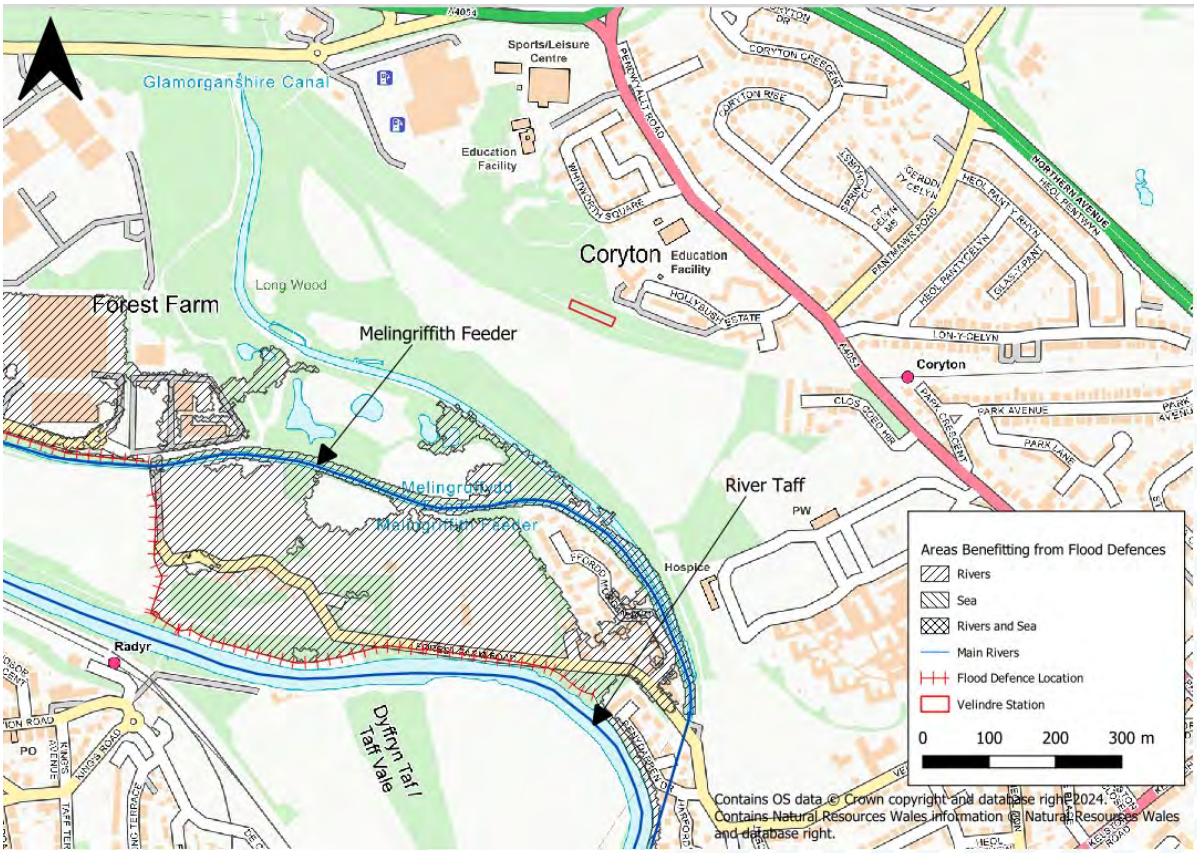

Figure 2-2 Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in Figure 2-3. The LiDAR data shows the site to be relatively flat in the southern half before rising steeply by approximately 5m in the northern half. The site is highest in the north of the site at approximately 43.85mAOD and lowest in the south of the site at approximately 39.08mAOD with the site falling in a north-to-south direction. This relatively flat southern half of the site is associated with the railway cutting and explains the steep increase in elevation as you move northward.

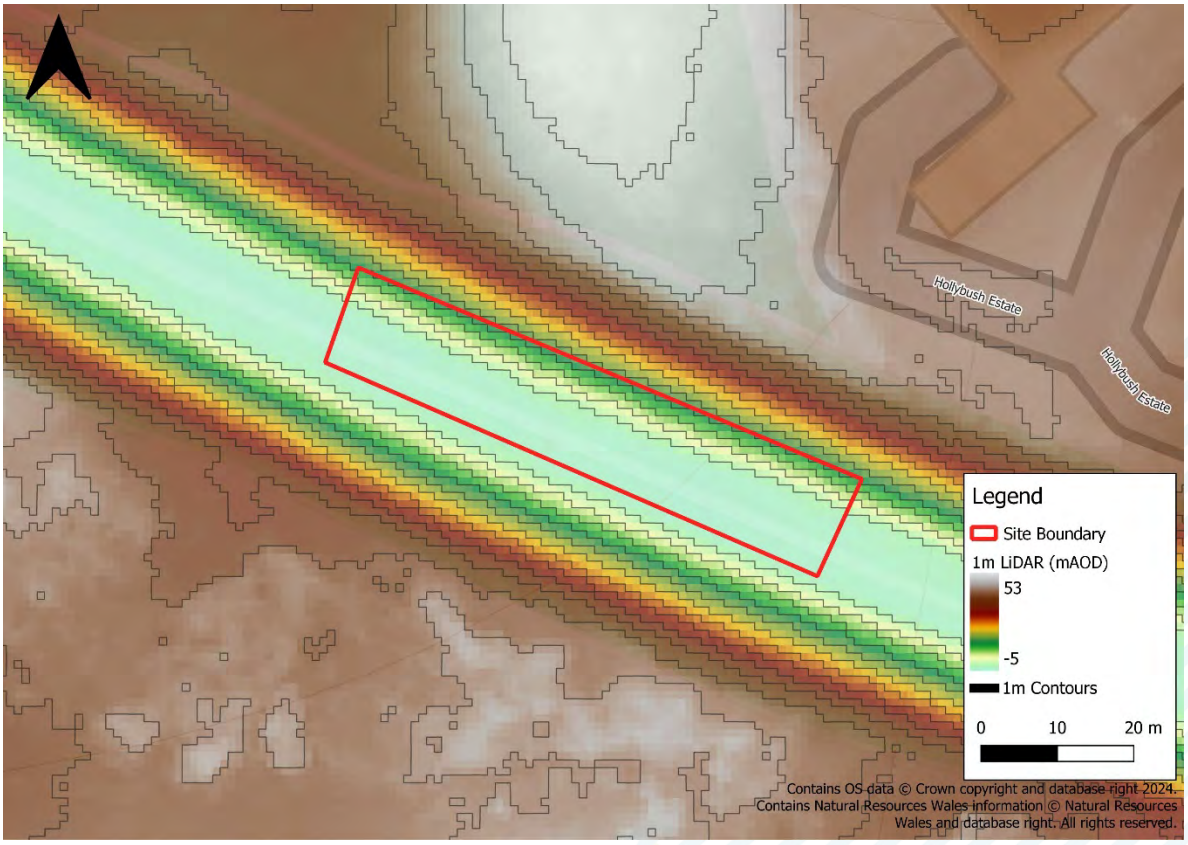

Figure 2-3 1m LiDAR Topography Overview.

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from Rivers. This means that there is a less than 0.1% AEP chance of fluvial flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the areas of the site are at **low risk** of flooding from the surface water and small watercourses as seen in Figure 3-1. This means that there is a between 0.1% (1 in 1000 year) and 1% (1 in 100 year) chance of flooding from this source in any given year. Despite having some risk of surface water flooding its thought that this can be managed at the site via an adequate drainage strategy.

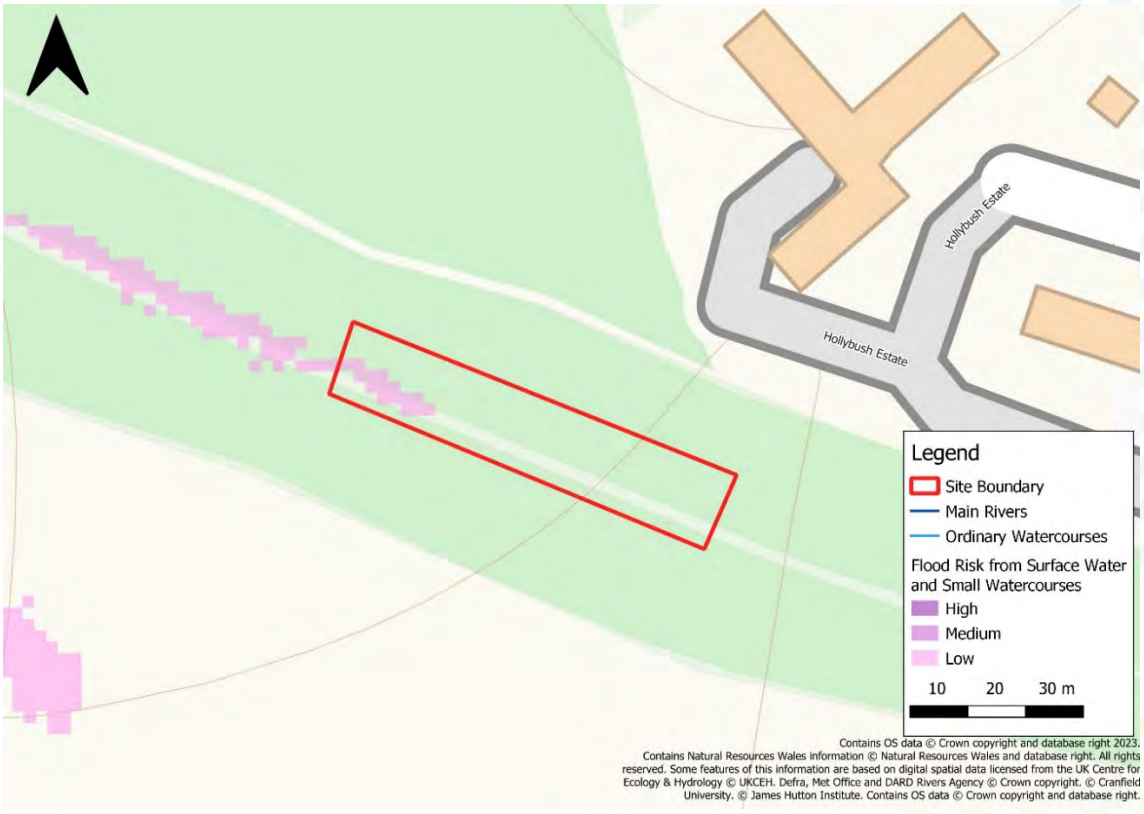

Figure 3-1 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The South East Wales Stage 1 – Strategic Flood Consequence Assessment includes JBAs Groundwater Flood map as part of the assessment and shows the proposed candidate site to be in an area of 'low' risk from groundwater emergence as shown in Figure 3-2.

Furthermore, there have been no recorded incidents of groundwater flooding in this area of Cardiff mentioned in the South East Wales Stage 1 Strategic Flood Consequence Assessment, furthermore, the Cardiff Local Flood Risk Management Strategy[1] also states that 'there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small. As such the groundwater flood risk at the site has been assessed as **very low**.

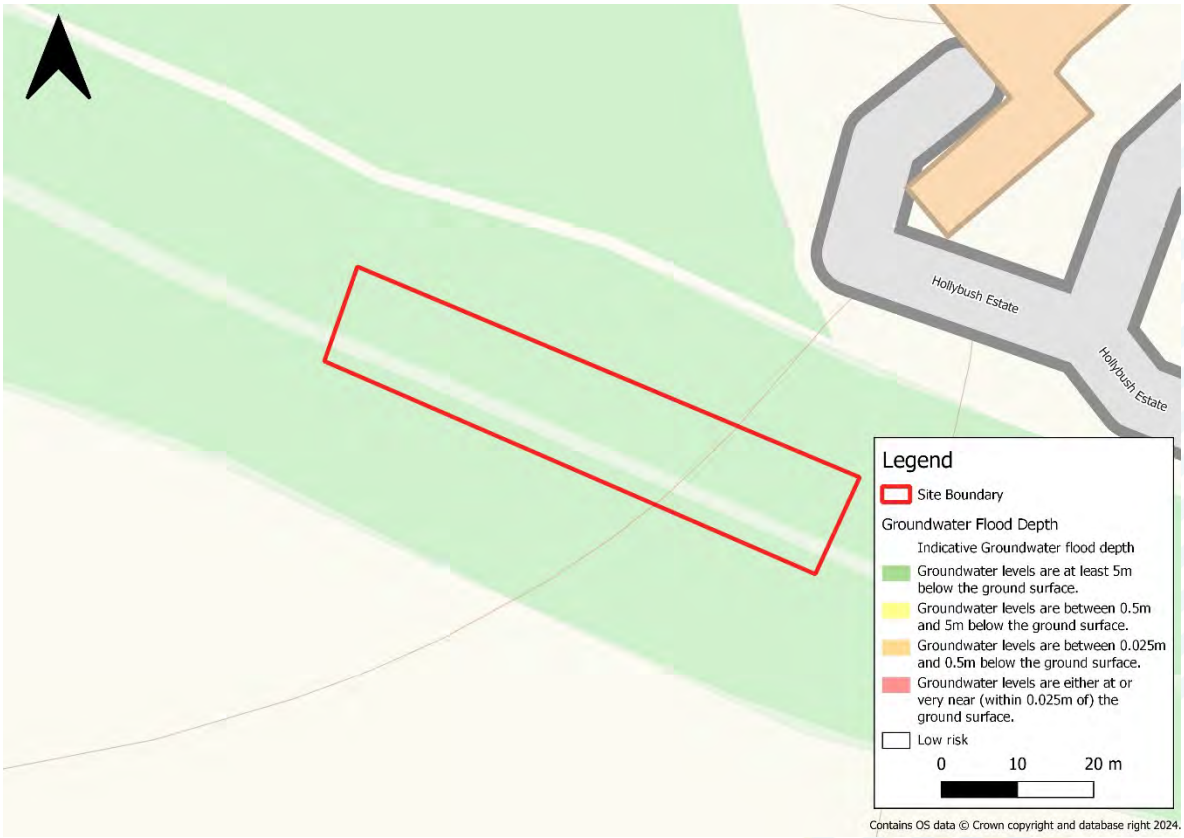

Figure 3-2 Groundwater Emergence Risk Map

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx>

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoir flooding. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

The South-East Wales Level-1 Strategic Flood Consequence Assessment (SFCA) has identified there to be a high number (59) of historic sewer flood incidents within the Whitchurch and Tongwynlais. The current location of existing sewers is unknown and further assessment of sewer flood risk would need to be considered at the site. However, given the sites location and former use its unlikely to have existing sewer infrastructure present at the site. Therefore, the site has been assessed to have a **low risk** of sewer flooding.

3.7 Summary of Flood Risk

The main flood risk source to the site is from surface water and small watercourses with most of the site are shown to be at low risk from this form of flooding. This is thought to be associated with the site location in a former railway cutting. This localised topographical depression facilitates the potential collection and ponding of surface water. The surface water risk could likely be managed, and the risk reduced. Table 3-1 below gives an overview of the flood risk at the site from all sources of flooding.

Table 3-1 Summary of flood risk

Source of Flooding	Risk
Rivers	Very Low
Sea	Very Low
Surface Water and Small Watercourses	Low
Groundwater	Low
Reservoir	Very Low
Sewer	Low

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it indicates as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year.		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.
TAN-15 Defended Zone	Areas where flood risk management infrastructure managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers and the Sea

The Flood Map for Planning – flood risk from rivers and the sea shows the site is located in Flood Zone 1. This represents a less than 0.1% (1 in 1000 years) chance of flooding from fluvial and tidal mechanisms in any given year. Figure 4-1 below clearly shows the proposed site located outside Flood Zones 2 and 3 for rivers and the sea.

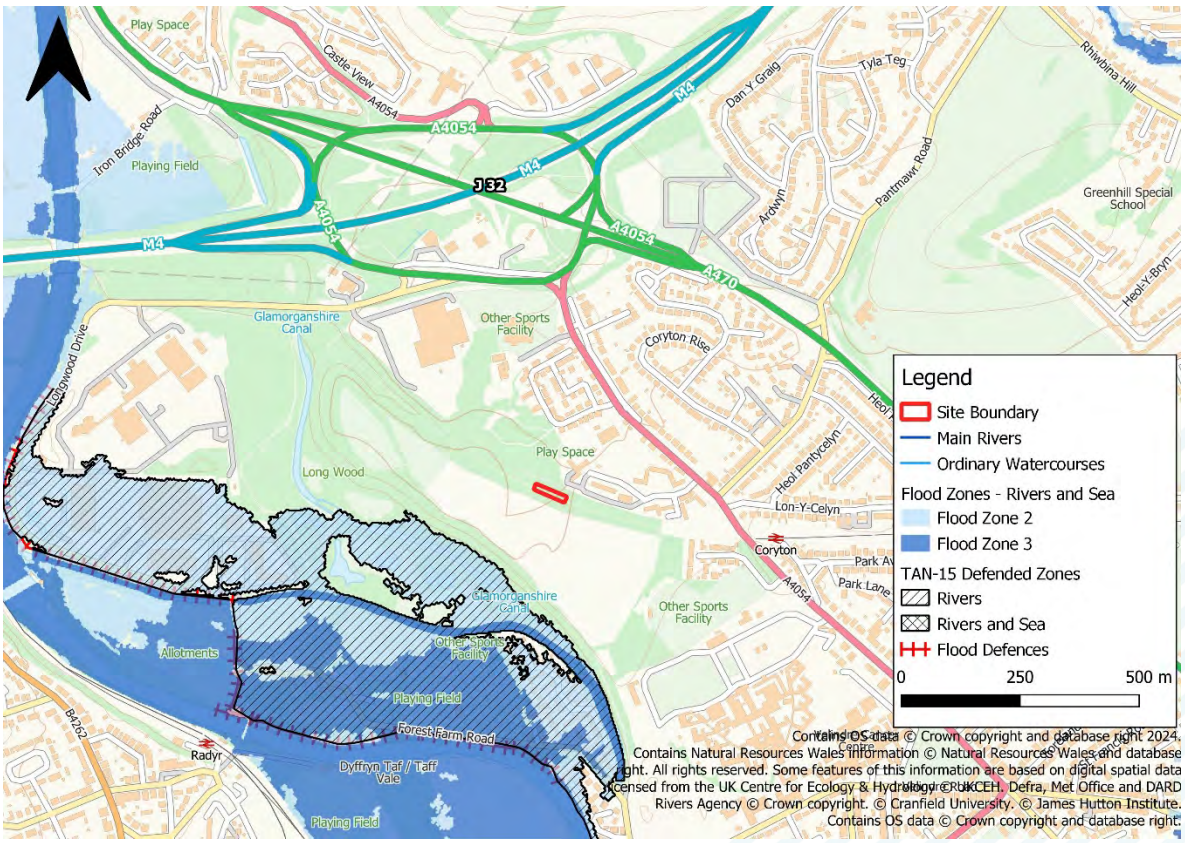

Figure 4-1 FMfP Rivers and the Sea

4.1.2 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows that portions of the site are located in Flood Zone 2, as shown in Figure 4-2 . The presence of areas of the site within this flood zone can be attributed to its location within a former railway cutting. This localised topographical depression facilitates the potential collection and ponding of surface water.

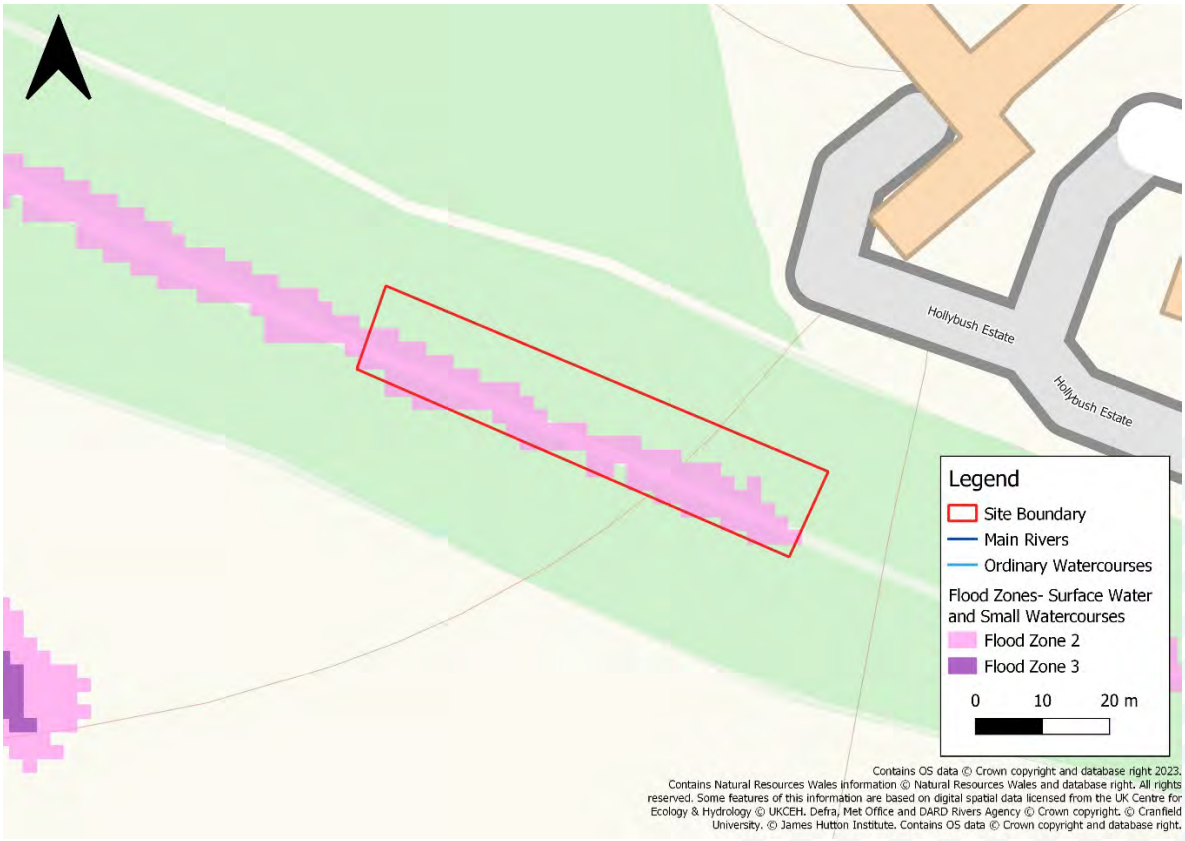

Figure 4-2 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for transport and utilities infrastructure it is classified as a less vulnerable development.

Table 4-2 Development vulnerability categories[3]

Development category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, and emergency depots. Buildings used to provide emergency shelter in times of flood
Less vulnerable development	General industrial, employment, commercial and retail development. **Transport and utilities infrastructure**. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New Development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice about four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood-risk areas.

Of most relevance to this appraisal are the definitions of new development.

The TAN-15 defines New development as: "development on any greenfield land; development of vacant or disused brownfield sites"

Furthermore, TAN-15 states that:

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new developments for the purposes of this guidance. New developments increase exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

For the time being and to the best of our knowledge, the proposed site will be classified as a 'New Development' for the TAN-15 and the application of the Justification Test.

4.4 Justification Test and Acceptability Criteria

As per Section 4.1, the proposed development is located within Flood Zone 1 of the FMfP –Rivers and Sea.

Tan-15 states that within Zone 1, all types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

Consequently, no FCA is required as a result of tidal or fluvial flood risk, and the site does not need to be considered against the Justification Test or Acceptability Criteria.

However, as some of the site is located within Flood Zone 2 of the Flood Map for Planning –Surface water and small watercourses, a Flood Consequences Assessment shall be required as a result of the risk from this source. The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding.

Therefore the FCA will be likely to be simple due to the risk. However, the FCA should include details on how the surface water risk will be managed including the use of SuDS.

Surface water and ordinary watercourse flood risk management are the responsibility of the Lead Local Flood Authority which may have site specific requirements for surface water management across the proposed development site.

The FCA should develop a full appreciation of:

- The risk and consequences of flooding on the development; and
- The risk and consequences of the development of flood risk elsewhere

5 Conclusion

Site Description

- JBA Consulting has been commissioned to prepare a Flood Risk Appraisal in support of a site at land south of the Hollybush estate in Whitchurch, Cardiff for a proposed new train station.
- The site is located on current greenfield land and is varying in topography due to the site being partially located in a former railway cutting.

Overview of flood risk

- The primary risk of flooding to the site is from surface water and small watercourses, however, this can be managed via an adequate drainage strategy.
- The site is at very low risk of flooding from fluvial, tidal, surface water and reservoir and groundwater sources.
- The site is at low risk of flooding from sewers.

Consultation draft of new TAN-15

- Under the current consultation draft of the revised TAN-15 the site would be classified as a 'New Development'.
- The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. However, it's been suggested that a site-specific FCA is undertaken to demonstrate how surface water flood risk is managed, including the use of SuDS

Conclusion

- It is concluded that on the grounds of flood risk, development proposals do currently comply with the aims and objectives of TAN-15 and Planning Policy Wales and that the production of an FCA will not be needed at the site.

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequences Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; Former Gas Works, Ferry Road. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The 9.95 hectare proposed development site is located on the western end of Ferry Road, Grangetown, Cardiff, as displayed in Figure 2-1. The site has been previously developed and is located at the former Ferry Road (British Gas Grangetown) Gas Works. The River Ely is located 15m to the south of the site, and, to the west, the site is bordered by the Vale of Glamorgan railway line, with Ferry Road located to the north of the site. The eastern boundary of the site is adjacent to the Cardiff Bay Retail Park to the north-east, and Grangemoor Park to the south-east.

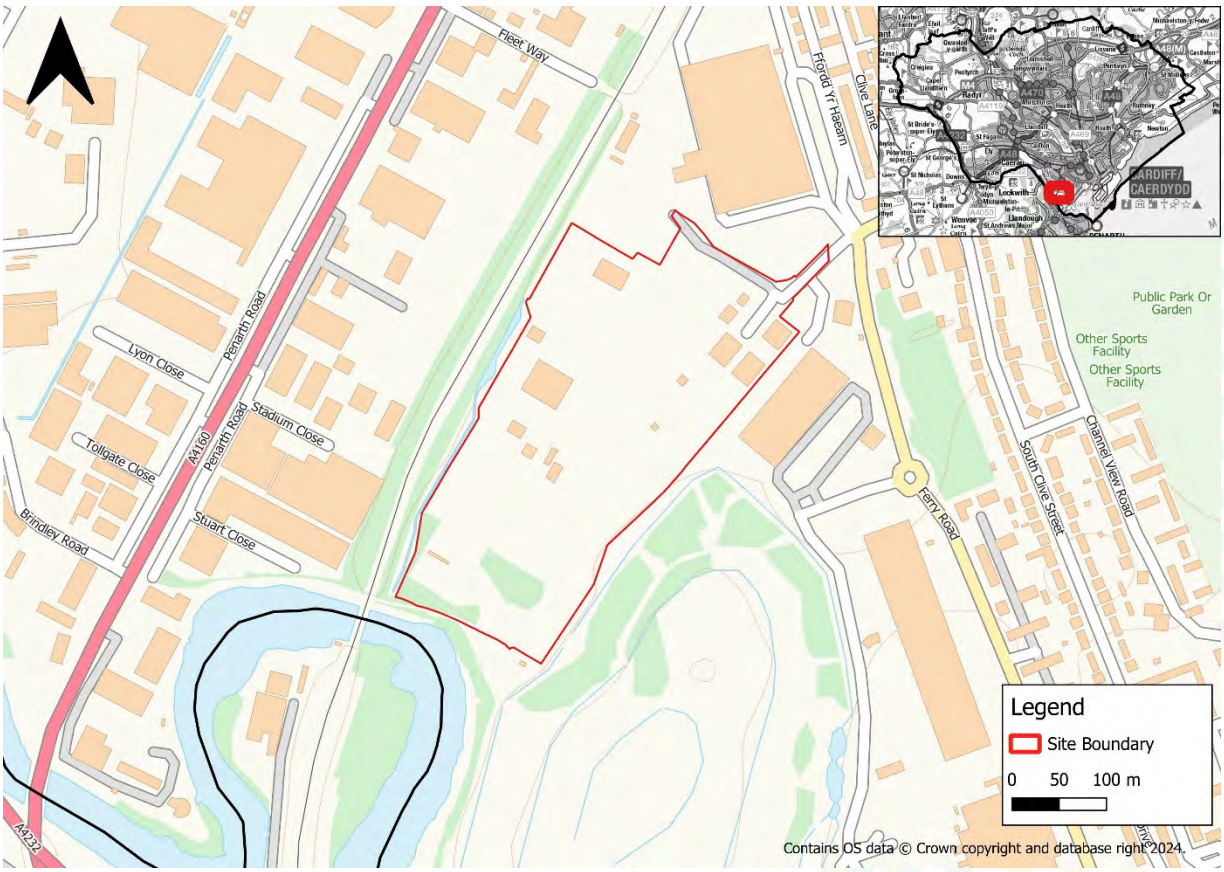

Figure 2-1 Site location.

The southern half of the site designated as a former landfill (Wales Gas Disposal Site), as displayed in Figure 2-2. Grangemoor Park, adjacent to the eastern boundary of the site, is also a former municipal landfill site.

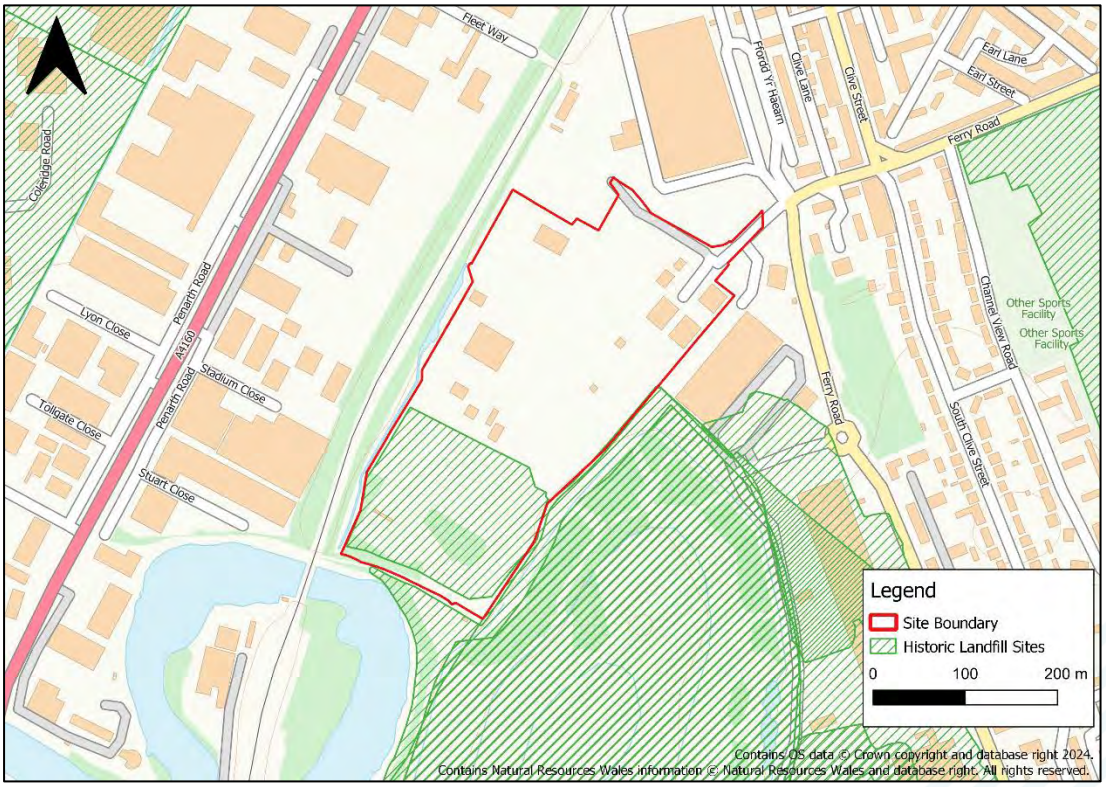

Figure 2-2 Extent of the Historic Landfill Sites (Wales Gas Disposal Site) within and in the vicinity of the site.

2.1 Development proposals

The proposed development at this site is for Residential use.

2.2 Watercourses and Flood Defences

Figure 2-2 displays the watercourses in close proximity to the site. The main watercourse in close proximity to the candidate site is the River Ely, located approximately 15m to the south of the site. The River Taff if located approximately 700m to the east of the site. The River Ely and The River Taff are designated NRW Main River.

There are two ordinary watercourses in close proximity to the site. One of these ordinary watercourses (drainage ditch) flows parallel to the western site boundary. The second ordinary watercourse (drainage ditch) flows parallel to the eastern site boundary within Grangemoor Park. Although not mapped on Ordnance Survey mapping, these watercourses are likely culverted underneath the footpath at the rear of the site, flowing into the River Ely.

There are no raised defences in close proximity to the site. However, the entire site is located in an area benefitting from tidal flood defences. The site benefits from the

presence of the Cardiff Bay Barrage, defending against tidal flooding. Additionally, the northern half of the site is located in an area benefitting from fluvial flood defences, with these river defences located on the River Taff.

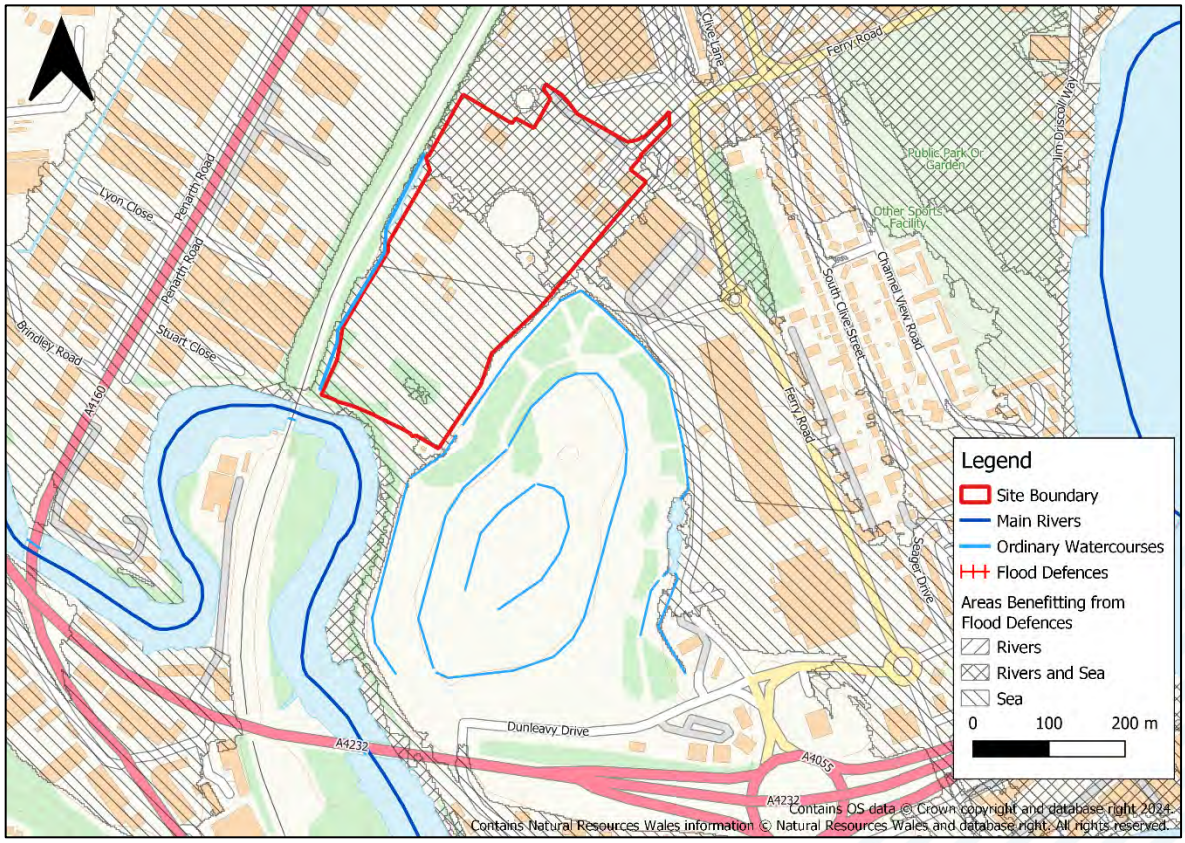

Figure 2-3 Main Rivers and Ordinary Watercourses in close proximity to the site.

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to assess the site topography.

As displayed in Figure 2-4, site elevations vary between 6.5 and 10.18mAOD. The site slopes from south to north. The highest elevations are located in the centre and the south of the site, where elevations are generally above 8.4mAOD. The north of the site is lower, with elevations in this part of the site generally between 7.0 and 7.9mAOD.

There are several isolated areas of raised ground and topographic depressions within the site, likely a remnant of the sites former usage as a gas works and landfill site.

Within the wider vicinity of the site, there are two areas of raised ground to the west and east of the site. The western site boundary is adjacent to a railway embankment for the Vale of Glamorgan railway line, with an average height of above 13.5mAOD. Grangemoor Park, adjacent to the eastern site boundary, rises approximately 20m higher than the maximum elevation within the site.

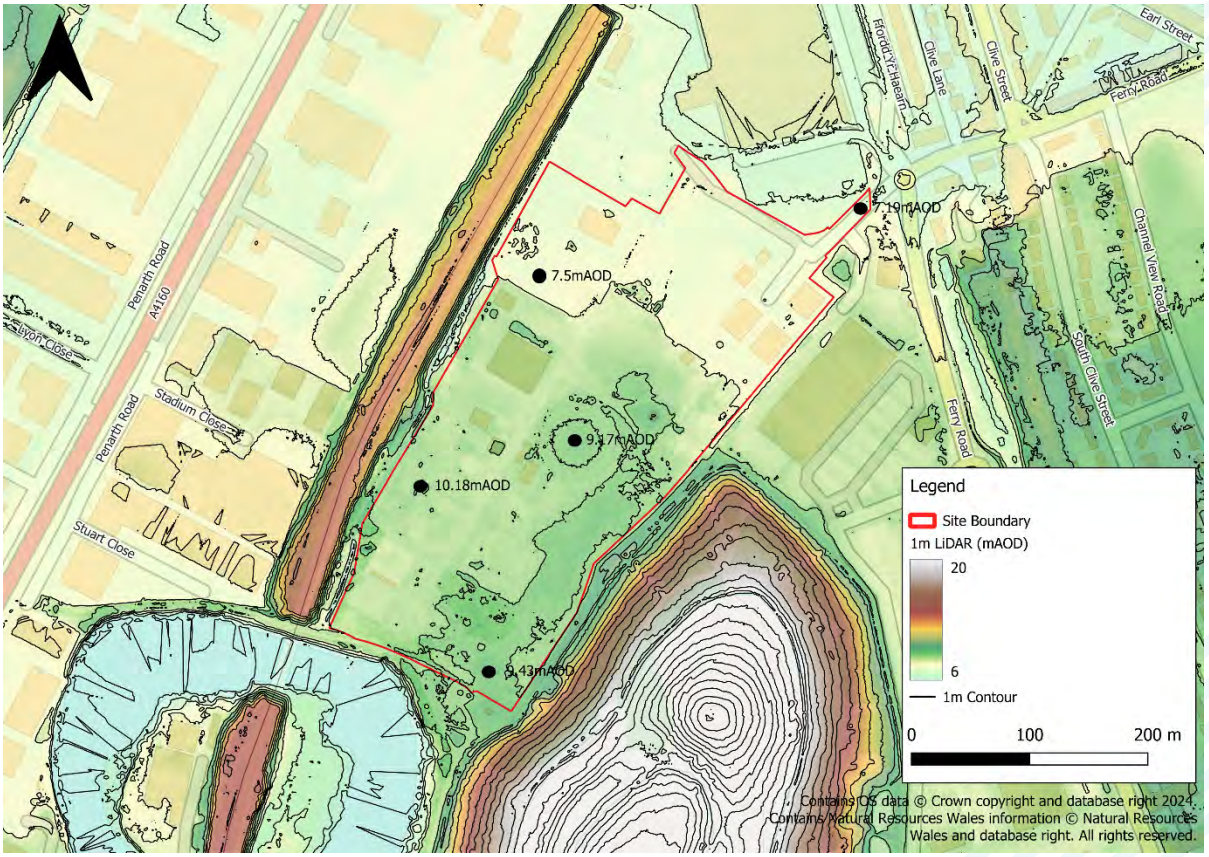

Figure 2-4 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

Detailed flood modelling has been used to assess the risk of fluvial flooding to the site. This has been detailed further below.

3.1.1 Model availability

The original Natural Resources Wales's (NRW's) Cardiff VDM hydraulic model was developed by Mott MacDonald in 2013. The original Motts model is referred to as version v2.2. Subsequently, the model was further updated by Mott MacDonald in 2016 to extend the model domain so that new climate change allowances (adopted into Flood Consequence Assessments (FCA) in December 2016) did not exceed the existing model extents. This version of the model is referred to as v2.3.

In 2019, JBA received the Cardiff VDM models (v2.2 and v2.3) from NRW and updated the River Ely hydrology using the Flood Estimation Handbook (FEH) Statistical method as QMED was based on local data. For flows above the 1% AEP event the ratio from ReFH2 was applied. Additionally, 13 new cross sections covering approximately 750 m of the River Ely downstream of the A48 road bridge were added to the model based on survey data collected in 2019. This model was reviewed and accepted by NRW as part of the Lansdowne Hospital Development FCA in 2020 (Cardiff Council planning reference: 21/02054/MJR) and has subsequently supported several other successful FCA's across Cardiff.

No assessment of the residual risk including breach has been included as part of this assessment. However, it may be required as part of a site-specific Flood Consequence Assessment (FCA).

As such, the JBA flood modelling of Cardiff is considered to represent best available information to support this assessment.

3.1.2 1% AEP plus climate change event

Figure 3-1 shows that the site is predicted to be flood free during the 1% AEP plus climate change event. During this event, floodwater is generally confined within the banks of the River Ely.

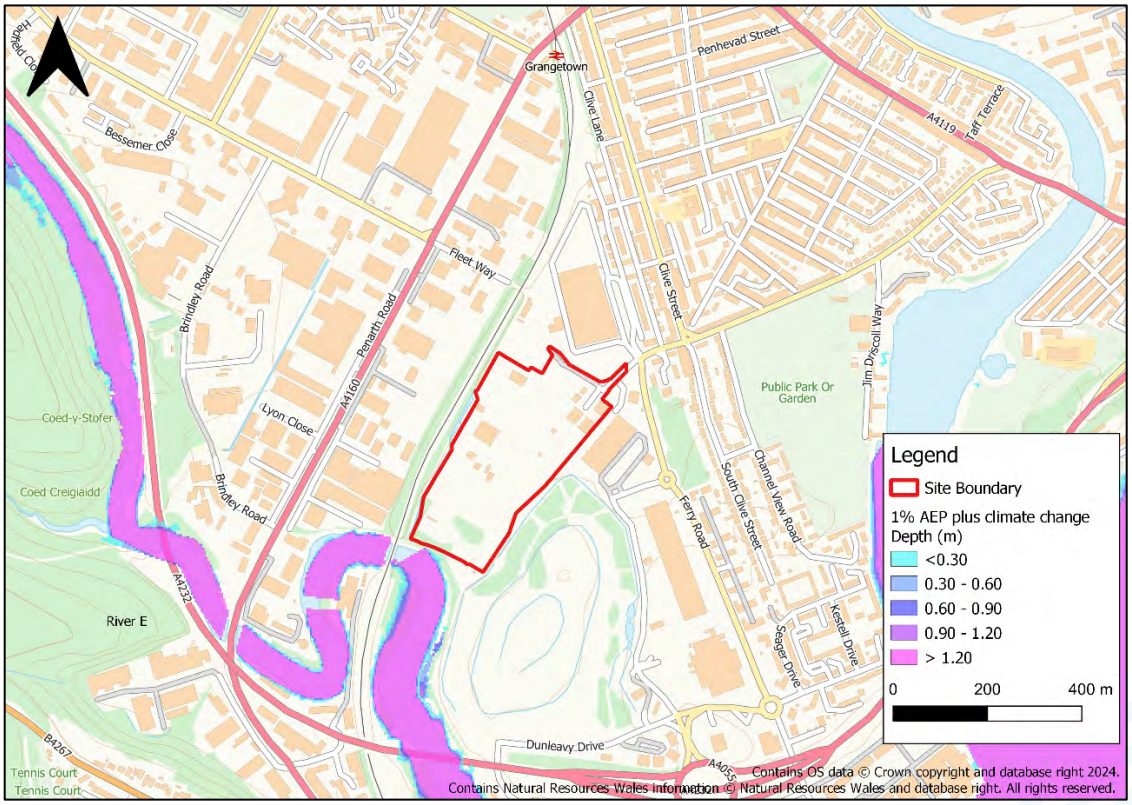

Figure 3-1 1% AEP plus climate change event: flood depths

3.1.3 0.1% AEP plus climate change event

During the 0.1% AEP plus climate change event, there flooding is predicted to the north of the site. The source of this flooding is the breach of flood defences on the River Taff, with the River Ely – to the south of the site – largely remaining in bank. The flood depths, velocities and flood levels within the site during this event are summarised in Table 3-1 below.

Where flooding occurs within the site, flood depths vary between 0.1 and 0.98m (Figure 3-3). Flood depths are highest in the northernmost part of the site on Ferry Road, corresponding with the areas of lower elevations within the site (as discussed in Section 2.3.). The south of the site remains flood free during this event.

Table 3-1 0.1% AEP plus climate change event: flood model results summary

Flood Event	Flood Depths (m)	Maximum Flood Level (mAOD)	Flood Velocities (m/s)
0.1% AEP plus climate change event	0.00 – 1.32	8.43	0.00 – 0.98

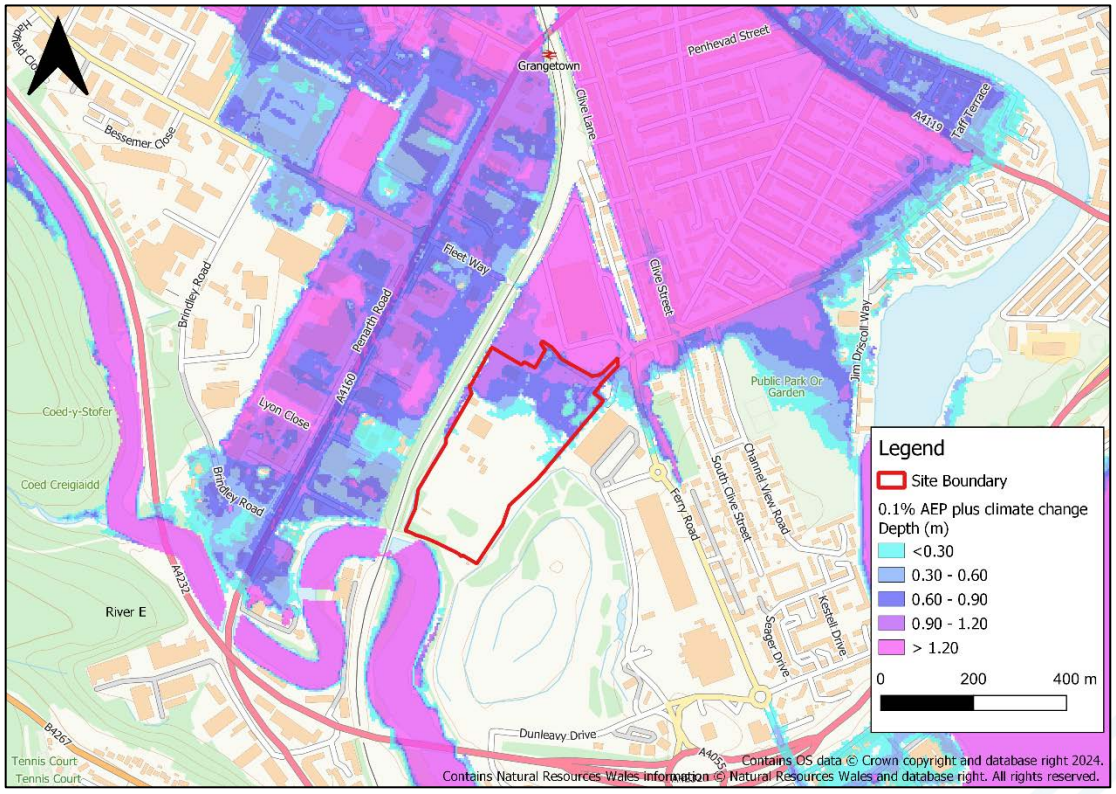

Figure 3-2 0.1% AEP plus climate change modelled depths

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at **low risk of flooding** from the sea, as displayed in Figure 3-3. This means that there is between a 0.5% and 0.1% AEP chance of tidal flooding at the site.

However, as discussed in Section 3.1.2, the site is located in an area benefitting from the presence of the Cardiff Bay Barrage, which is understood to provide robust protection from flooding from the sea now and in the future.

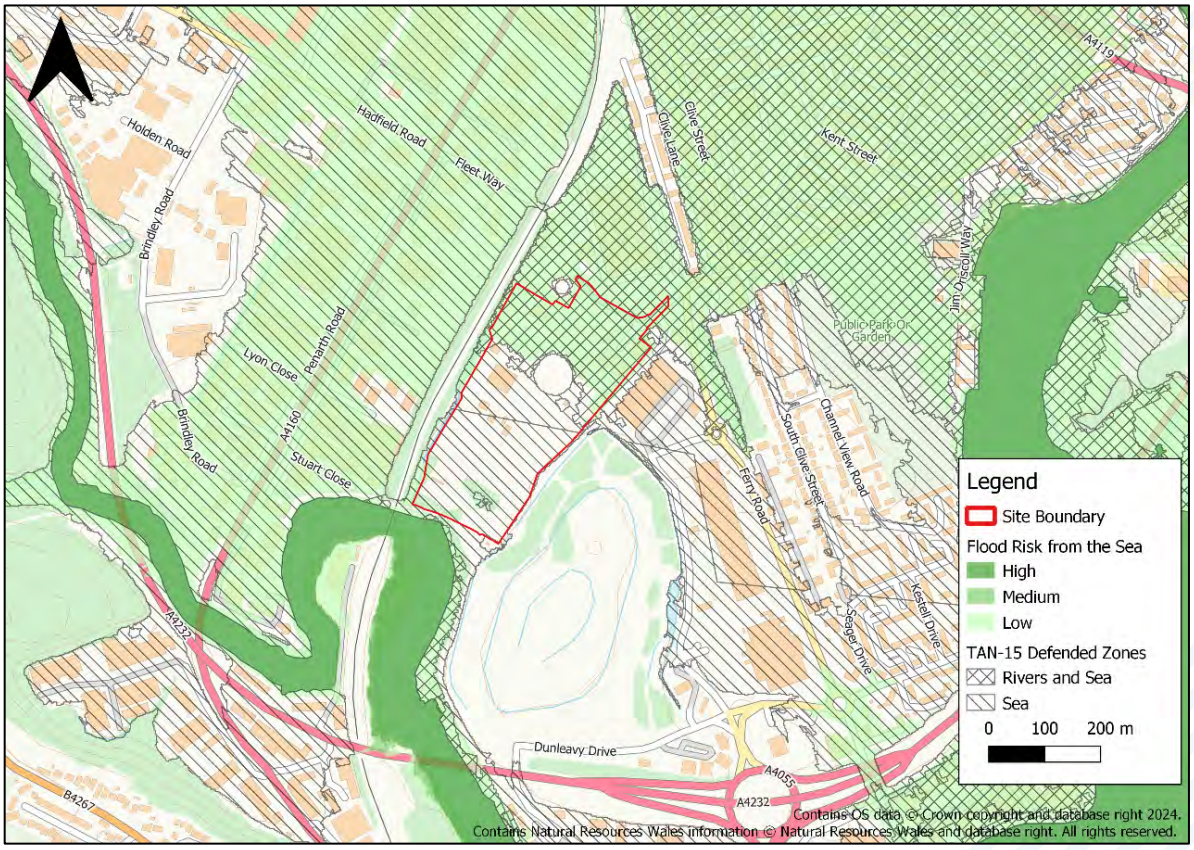

Figure 3-3 Flood Risk Assessment Wales – flood risk from the sea.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW FRAW mapping shows that the majority of the site is at **very low risk** of flooding from the surface water and small watercourses, as displayed in Figure 3-4. Very low risk means that there is a less than 0.1% AEP chance of surface water and small watercourse flooding at the site.

There are some isolated areas distributed across the site which are at a **medium** and **high risk of flooding**.

Medium risk of flooding means there is between 0.1% and 1% AEP chance of flooding from surface water and small watercourses.

High risk means there is a greater than 1% AEP chance of flooding from this source.

The areas of the site at a high and medium risk of flooding are concentrated within isolated existing topographic depressions within the site, or parallel to the existing ordinary watercourses adjacent to the western and eastern site boundaries.

As this surface water flood risk is relatively minor, this surface water flood risk within the site can likely be managed through surface water drainage and sustainable drainage systems (SuDS) within the site.

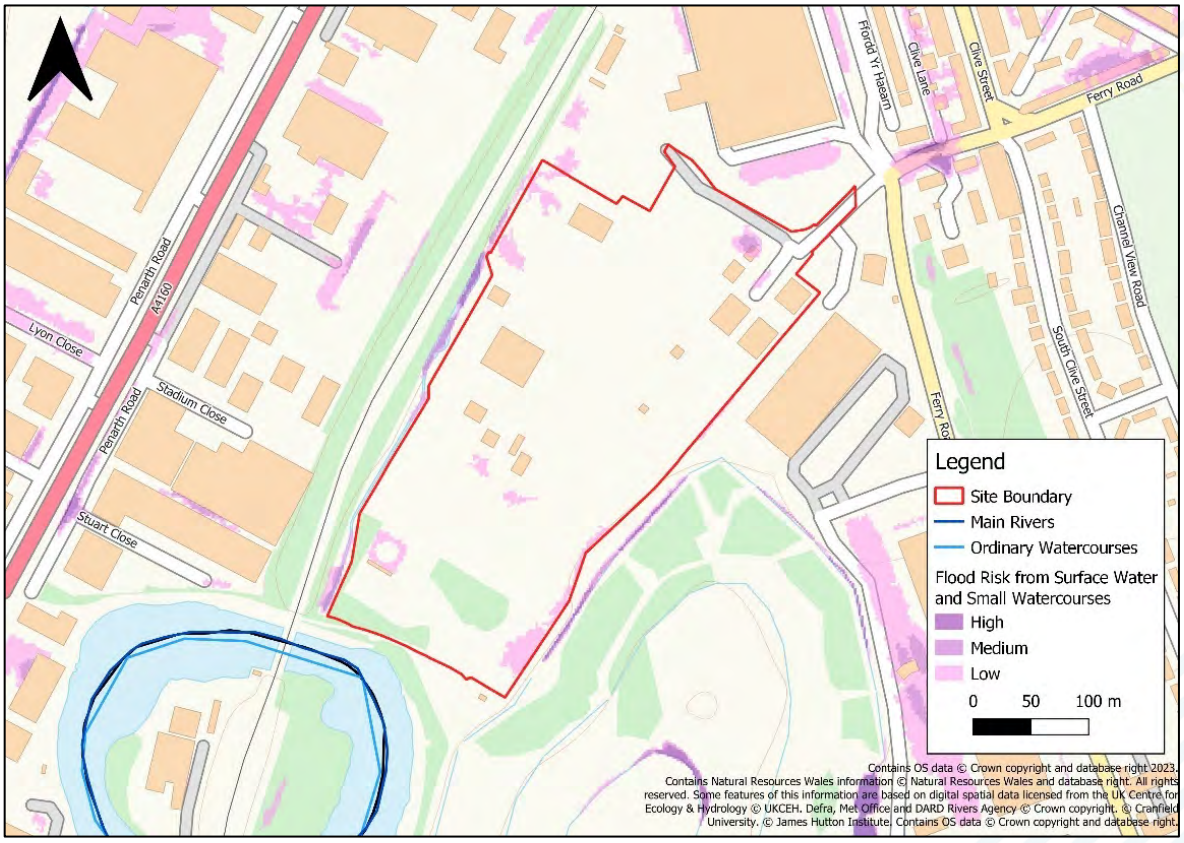

Figure 3-4 FRAW- Surface Water and Small Watercourses

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months, and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

JBA has developed a range of Groundwater Flood Map products nationally. The 5m resolution JBA Groundwater Map has been used within the report. The modelling involves simulating groundwater levels for various return periods (including 1.33% year, 1%, and 0.5% AEP). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 1% AEP model outputs.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, which would represent an extreme scenario. The maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often

necessary for groundwater to have nowhere to go without ponding and flooding an area first.

According to the JBA groundwater flood mapping, the site is at a low risk of ground water emergence. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

The Cardiff Local Flood Risk Management Strategy[1] also states that 'there is little documented evidence of groundwater flooding in Cardiff and therefore the risk of flooding from this source is considered to be small.'

Therefore, it is concluded there is a **low risk** of flooding to the site from groundwater.

3.5 Flood Risk from Reservoirs

According to the NRW FRAW mapping, the site is at risk of flooding from reservoirs, as displayed in Figure 3-6. The north, west, and centre of the site is at risk of flooding from the Pontsticill (Taf Fechan) reservoir approximately 40km to the north. Additionally, the north of the site is at risk from the Beacons, Cantref and Llwyn-On reservoirs located approximately 48km, 44km and 40km away respectively. All of these reservoirs are managed by Dŵr Cymru Welsh Water.

However, it is worth noting that reservoir flooding is extremely unlikely to occur as all large reservoirs must be inspected and supervised by reservoir panel engineers under the Reservoirs Act 1975.

Section 5.3 of TAN-15 states that "*reservoirs are maintained to very high standards in Wales and therefore the location of homes and businesses in reservoir inundation areas should not raise alarm. This information is presented to ensure open and constructive dialogue between planning authorities and reservoir operators or owners should development plans have implications for the risk categorisation of the reservoir*".

Given the sites location in central Cardiff, it is unlikely that the risk categorisation of the reservoir would be re-categorised as a result of the proposals.

Therefore, the risk of flooding from reservoir failure has been assessed to be **low**.

[1] Cardiff Council (2014) Local Flood Risk Management Strategy. Available at: <https://www.cardiff.gov.uk/ENG/Your-Council/Strategies-plans-and-policies/Local-flood-risk-management-strategy/Pages/default.aspx>

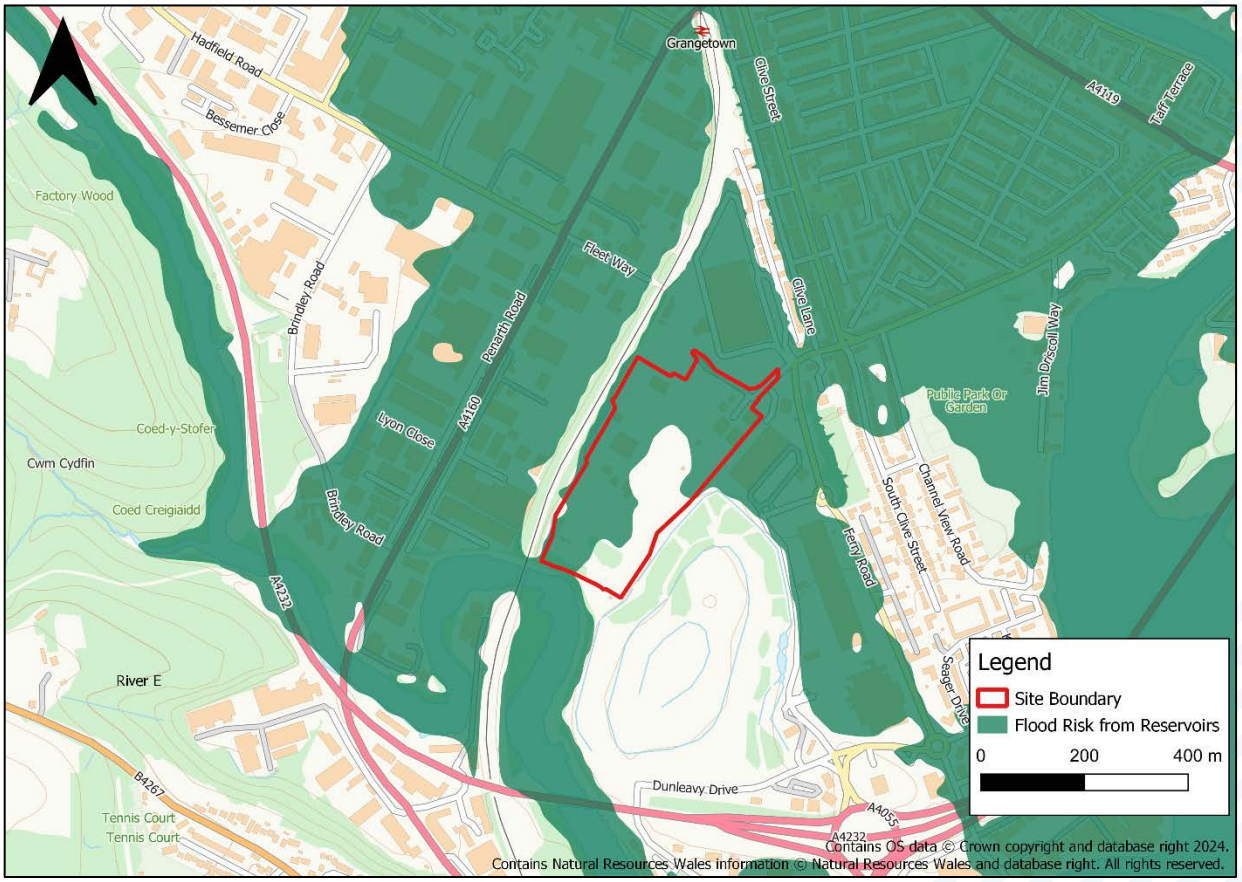

Figure 3-5 Flood Risk Assessment Wales (FRAW) Flood Risk from Reservoirs mapping.

3.6 Flood Risk from Sewers

The South-East Wales Level-1 Strategic Flood Consequence Assessment (SFCA) has identified there to be a low number (3) of historic sewer flood incidents within the Grangetown electoral ward, in which this candidate site is located. The current location of existing sewers is unknown and further assessment of sewer flood risk would need to be undertaken as part of the Flood Consequence assessment for this site to fully assess the risk posed by sewer flooding at the site. With the current location of the existing sewers not known, the risk posed by sewer flooding is currently assessed to be **low**.

3.7 Summary of Flood Risk

Table **3**-**2** below summarises the flood risk to the site.

Table 3-2: Summary of Flood Risk to the site.

Source of Flooding	Description
Flood Risk from Rivers	The site is at risk of flooding during the 0.1% AEP plus climate change event. Therefore, the site is at a **medium risk** of river flooding.
Flood Risk from the Sea	Low Risk
Surface Water and Small Watercourses	Low – Very Low
Groundwater	Low
Reservoirs	Low
Sewers	Low

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it provides an indication as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development, and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood Map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 4-1 summarises the flood zones and their definitions.

Table 4-1 TAN-15 Definition of FMfP flood zones[2]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change.	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 1:100 (plus climate change and freeboard).	Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard).	Not applicable.

4.1.1 FMfP: Flood Risk from Rivers

The Flood Map for Planning – flood risk from rivers shows the north of the site is located within Flood Zones 2 and 3, as displayed in Figure 4-1.

2 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN-15-development-flooding-and-coastal-erosion-jan-2023.pdf

The site is also located within a Defended Zone for flooding from rivers, benefitting from the presence of flood defences on the River Taff, which provides a 0.5% AEP standard of protection.

The FMfP rivers layer for this site is informed by the detailed flood model discussed in Section 3.1.

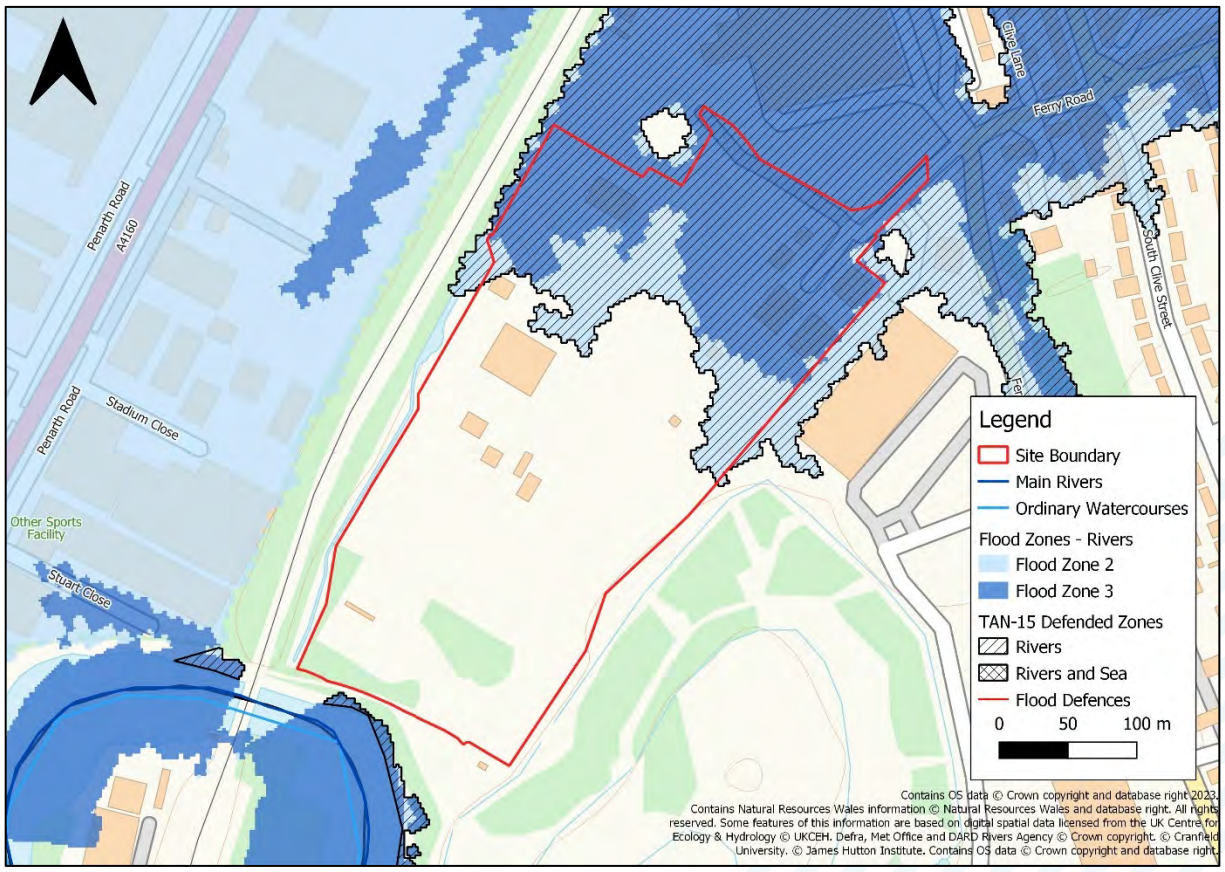

Figure 4-1 Flood Map for Planning- Rivers

4.1.2 FMfP: Flood Risk from the Sea

The Flood Map for Planning – flood risk from the sea indicates the majority of the site is located within Flood Zones 2 and 3, with the exception of two small areas of raised ground in the centre of the site as seen in Figure 4-2.

However, the parts of the site located within Flood Zones 2 and 3 are also located within a Defended Zone for risk of flooding from the sea. The site benefits from the presence of the Cardiff Bay Barrage, which is understood to provide robust protection from flooding from the sea now and in the future.

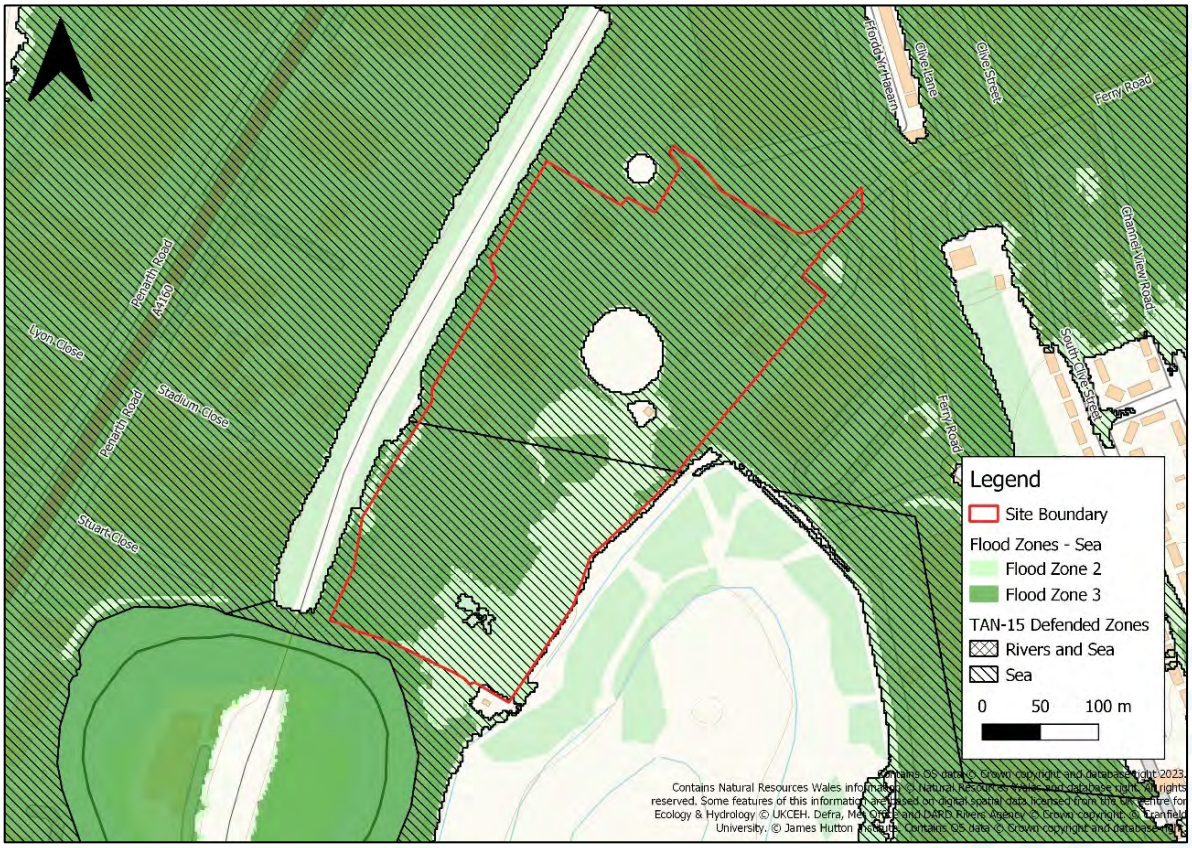

Figure 4-2 FMfP - Flood Risk from the Sea

4.1.3 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows that the majority of the site is located within Flood Zone 1, as displayed in Figure 4-3. Isolated areas of the site are located within Flood Zones 2 and 3 for risk of flooding from Surface Water and Small Watercourses. This surface water and small watercourse flood risk is either concentrated in isolated existing topographic depressions within the site or related to the existing ordinary watercourses adjacent to the western and eastern site boundaries.

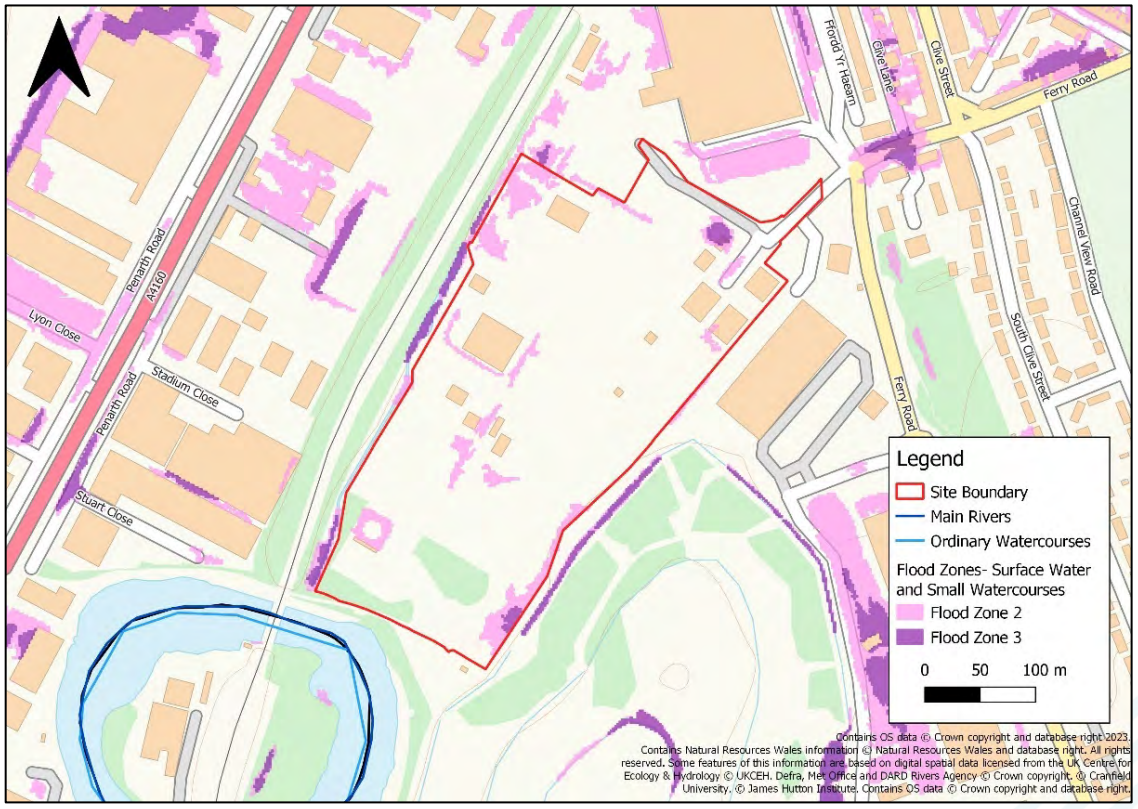

Figure 4-3 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 4-2 below. As the proposed use for the site is for residential development it is classified as highly vulnerable development.

Table 4-2 Development vulnerability categories[3]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

3 TAN-15, Figure 2

4.3 New development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice in relation to four types of development. These are New Development, Redevelopment, Change of use or conversions, and Extensions. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood risk areas.

Of most relevant to this appraisal is the definition of redevelopment.

The TAN-15 defines redevelopment as: *"Replacing an existing in-use building(s) (fully or partly) with a new building(s)."*

Furthermore, TAN-15 states that:

Proposals for redevelopment, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient then the expectation is that planning permission will not be granted (TAN-15 para 4.5).

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new development for the purposes of this guidance. New developments increase exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

Where buildings in flood risk areas are currently in use, there may be circumstances where redevelopment, changes of use or conversion proposals can bring clear benefits to the area and the building. These should be balanced and weighed against the flood risk considerations (TAN-15 para 10.4).

The current consultation draft of the revised TAN-15 appears to support changes of use if these changes are able to further increase the resilience of a building. For the time being and to the best of our knowledge, the proposed site will be classified as 're-development' for the purposes of the TAN-15 and the application of the Justification Test.

4.4 Justification Test

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test', dependent on the flood zone and type of development.

The justification requirements for 'new development' are more onerous than 'redevelopment', and a clear distinction is drawn been the two forms of development.

The requirements of the Justification Test are summarised in Table 4-3 and the proposed development has been assessed against the requirements of the Justification Test with the results summarised in Section 5.1.

Table 4-3 Justification Test[4]

<table>
<tr><th>Zone 1</th><th>Defended Zones</th><th>Zone 2 (rivers and sea)</th><th>Zone 3 (rivers and sea)</th><th>Redevelopment, change of use and conversions in any Flood Zone</th></tr>
<tr><td rowspan="4">All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.</td><td>Development will be justified in the TAN 15 Defended Zones if:</td><td>Development will be justified in Zone 2 if:</td><td>Development will be justified in Zone 3 if:</td><td>Redevelopment will be justified in any Flood Zone if:</td></tr>
<tr><td rowspan="2">Where there is an agreed Community Adaptation and Resilience Plan in place supporting developments forming part of a strategic regeneration. scheme or[5]</td><td>It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;
and</td><td>There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;
and</td><td rowspan="2">The scheme results in a development that is resilient to flooding</td></tr>
<tr><td>Its location meets the definition of previously developed land;
and</td><td>Its location meets the definition of previously developed land;
and</td></tr>
<tr><td colspan="4">The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.</td></tr>
</table>

4 TAN-15, Section 10

[5] This has not been included within the current draft of TAN-15 however it is our understanding that this section should include this.

4.5 Acceptability criteria

If the planning authority is satisfied that the proposed development is justified in a flood risk area, it must next consider if the risks and consequences of flooding can be managed safely. This can be demonstrated through the 'acceptability criteria'. There are three principal aspects to the acceptability criteria:

Flood frequency requirements. The frequency at which flooding is regarded to be acceptable, depending on the primary source of flooding (Table 4-4).

Tolerable conditions. The flood conditions that are regarded to be acceptable during an extreme flood event, depending on the type of development (Table 4-5).

Avoidance of third-party impacts. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere.

Table 4-4 Flood frequency requirements[6]

Vulnerability categories		Flood event types	
		Rivers	Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC	0.1% +CC
	All other types	1% +CC	0.5% +CC
Less vulnerable development Water compatible development (limited to those built elements of development that may be occupied by people)		1% +CC	0.5% +CC

Table 4-5 Tolerable conditions in extreme flood event[7]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

6 Technical Advice Note 15: Development, flooding and coastal erosion, January 2023, Consultation Version, Figure 5
7 TAN-15, Figure 6

4.6 Summary of policy position

Based on the NRW's FMfP, the proposed development site is located in a Defended Zone for risk of flooding from rivers and sea. The site is classed as a highly vulnerable re-development scheme.

The site is subject to the Justification Test for re-development in a Defended Zone. To pass the Justification Test, the site needs to meet the acceptability criteria.

Although the site satisfies the first requirement of the acceptability criteria (flood free during the 1% AEP plus climate change fluvial event), the site does not satisfy the second requirement (tolerable conditions during the extreme flood event) as flood depths are greater than 600mm during the 0.1% AEP plus climate change fluvial - event. The proposed development is unlikely to pass the acceptability criteria, and therefore Justification Test, without suitable avoidance and mitigation measures.

A sequential approach to site design should be considered, placing all highly vulnerable development to the south of the site which remains flood free during the most extreme fluvial flood event (0.1% AEP plus climate change). However, demonstrating safe access and egress to the site if this sequential approach is followed is likely to be challenging. The current access route to the north of the site does not pass the acceptability criteria.

Other mitigation options, such as ground raising, could be considered so the site would meet the acceptability of flood consequences criteria. This should be supported using detailed modelling, demonstrating no increase in flooding to third party land.

A site-specific Flood Consequences Assessment (FCA) should be undertaken. This should demonstrate how the chosen avoidance and mitigation measures for the site satisfies the requirements of the acceptability criteria, and therefore Justification Test, as stated in TAN-15 and as part of the aims and objectives of Planning Policy Wales (PPW).

5 Conclusion

Site Description

- JBA Consulting have been commissioned to prepare a Flood Risk Appraisal in support of a site Cardiff Council wish to develop at the Former Gas Works, Ferry Road for residential use.
- The site is located to the west of Cardiff in Grangetown. The topography of the site is predominantly flat, and the River Ely is 15m south of the site.
- There are some existing buildings located to the north of the site, and the rest of the site is vacant brownfield land.

Overview of flood risk

- The main flood risk source to the site is river flooding. The site is located in an area benefitting from fluvial flood defences. However, during the 0.1% AEP plus climate change flood event, flood defences on the River Taff overtop, with significant depths predicted to the north of the site during this event.
- Whilst the site is shown to be at risk from tidal flooding, it is assumed that this risk is managed by the presence of the Cardiff Bay Barrage and hence its position within an area benefitting from tidal defences.
- The majority of the site is at a low risk of flooding from surface water and small watercourses, although there are some isolated areas across the site at a medium to high risk. As this flood risk is relatively minor, this flood risk within the site can likely be managed through surface water drainage and sustainable drainage systems (SuDS) within the site.
- The site is at low or very low risk of flooding from reservoirs, sewers and groundwater sources.

Consultation draft of new TAN-15

- Cardiff Council have classed the site as a 're-development' scheme. Development proposals for the site are for highly vulnerable (residential) development. Therefore, the Justification Test for a 're-development' should be used.
- The site is subject to the Justification Test for re-development in a Defended Zone. To pass the Justification Test, the site needs to meet the acceptability criteria.
- Although the site satisfies the first requirement of the acceptability criteria (flood free during the 1% AEP plus climate change flood), the site does not satisfy the second requirement (tolerable conditions during the extreme flood event) as flood depths are greater than 600mm during the 0.1% AEP plus climate change event. The proposed development is unlikely to pass the acceptability criteria, and therefore Justification Test, without suitable avoidance and mitigation measures.
- Demonstrating safe access and egress to this site is likely to be challenging

Conclusion

- It is concluded that on the ground of flood risk without suitable avoidance and mitigation measures, development proposals do not comply with the aims and objectives of TAN-15 and Planning Policy Wales.

- A site-specific Flood Consequences Assessment (FCA) should be undertaken. This should demonstrate how the chosen avoidance and mitigation measures for the site satisfies the requirements of the acceptability criteria, and therefore Justification Test, as stated in TAN-15 and as part of the aims and objectives of Planning Policy Wales (PPW).

1 Introduction

JBA Consulting has been commissioned by Cardiff Council to prepare an independent Flood Risk Appraisal as part of a Stage 2 Strategic Flood Consequence Assessment (SFCA), for a site considered for allocation in its replacement Local Development Plan; The Manor, Druidstone Road. This Flood Risk Appraisal will be used to understand the appropriateness of development at the site in accordance with Welsh Government policy, as set out in Technical Advice Note 15 (TAN-15): Development flooding and coastal erosion (January 2023) and includes a review of NRW flood mapping and detailed flood modelling.

2 Site Description

The proposed development site is located at The Manor, Druidstone Road, Old St. Mellons, Cardiff, CF3 6XD, as shown in Figure 2-1. The site is in electoral ward Pontprennau and Old St. Mellons and is currently a housing complex.

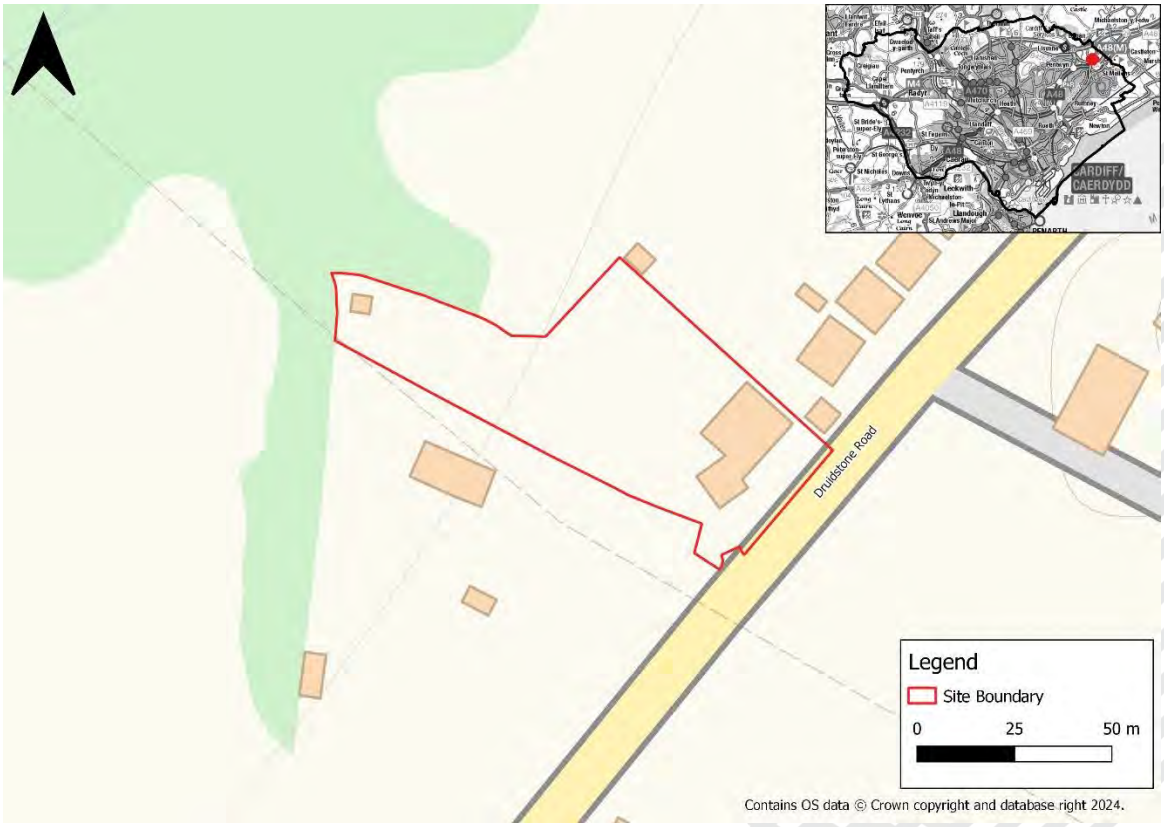

Figure 2-1 Site Location

2.1 Development Proposals

The proposed development at this site is for a residential development.

2.2 Watercourses and Flood Defences

The main watercourse in close proximity to the proposed development is an unnamed watercourse, located approximately 100m to the north of the site. The watercourse is a tributary off the Rhymney River, which is an NRW Main River and benefits from flood defences in close proximity to the site, located to the west of Began Road north of the site.

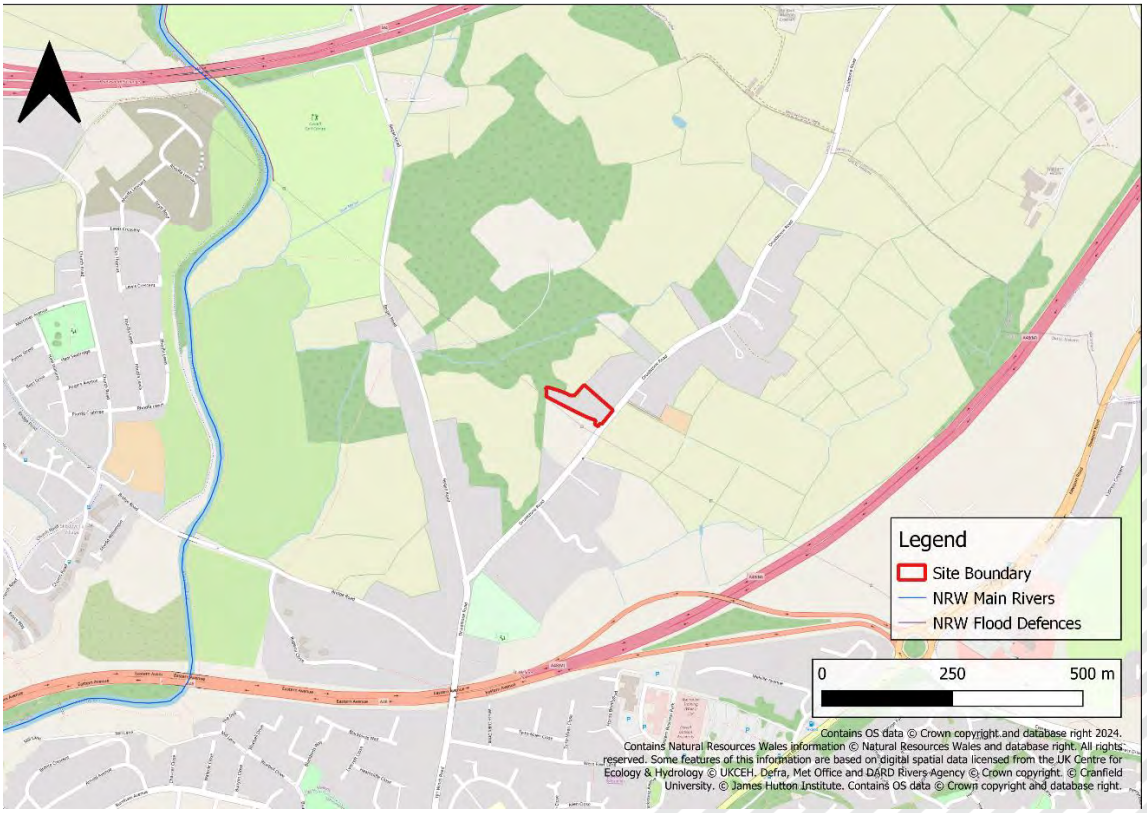

Figure 2-2 NRW Watercourses

2.3 Topography

The Natural Resources Wales (NRW) Open Source 1m Light Detection and Ranging (LiDAR) data has been used to illustrate the site topography, as shown in

Figure **2**-**2**. The LiDAR data shows that the elevation across the site slopes downwards from south to north. The maximum elevation is 46.93m AOD in the south of the site, where the existing development is situated. The minimum elevation is 36.25m AOD in the north of the site. This gives a difference in elevation across the site of 10.68m AOD. The topography in the surrounding area is similar to that of the site, with the area to the south of the site at a greater elevation to that of the north. Approximately 200m to the south of the site, the elevation begins to decrease.

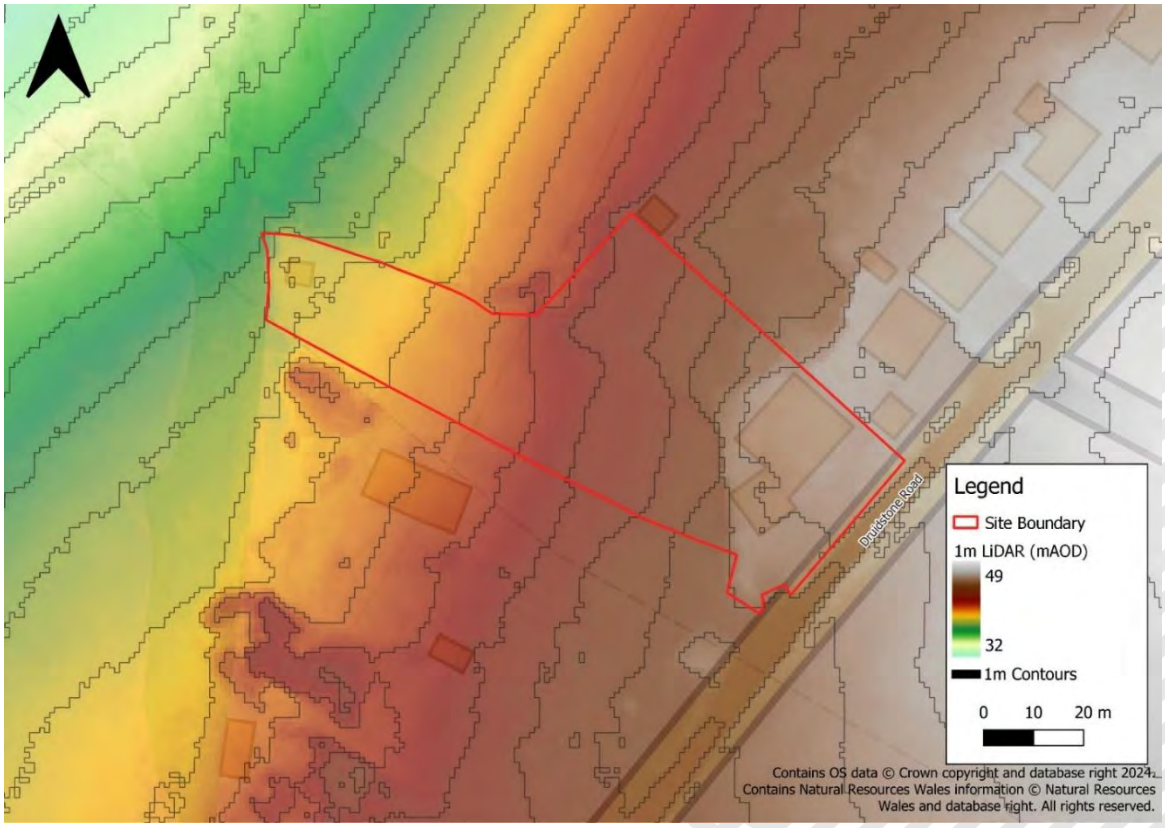

Figure 2-2 1m LiDAR Topography

3 Assessment of Flood Risk

The following section provides an assessment of flood risk to the proposed development site from all sources.

3.1 Flood Risk from Rivers

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from fluvial sources. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.2 Flood Risk from the Sea

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from the sea. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.3 Flood Risk from Surface Water and Small Watercourses

The NRW Flood Risk Assessment Wales (FRAW) mapping shows that the site is at very low risk of flooding from surface water and small watercourses. This means that there is a less than 0.1% AEP chance of tidal flooding at the site. No figure is provided as **very low risk** is shown as a transparent layer on the FRAW mapping.

3.4 Flood Risk from Groundwater

Groundwater flooding is caused by unusually high groundwater levels, and it occurs as excess water emerges at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, sometimes lasting for weeks or months, and can damage property. This risk of groundwater flooding depends on the nature of the site's geological strata and the local topography.

The Cardiff City Council Flood Risk Management Plan states that 'low lying areas are particularly susceptible' but groundwater 'has not been a common issue in Cardiff since the Cardiff Bay Barrage was built'. Therefore, it is concluded there is **low risk** of flooding to the site. Figure 4-1 indicates that the site is at low risk of groundwater flooding.

Figure 4-1 Groundwater Flood Risk Map

3.5 Flood Risk from Reservoirs

The NRW FRAW mapping shows that the site is at very low risk of flooding from reservoirs. No figure is provided as **very low risk** is shown as a clear layer on the FRAW mapping.

3.6 Flood Risk from Sewers

Cardiff Flood Risk Review – Appendix D1 from the South-East Wales Stage 1 SFCA indicates that Pontprennau and Old St Mellons has been subject to two sewer flooding incidents. Therefore, it is concluded that there is a **medium to low risk** of sewer flooding.

3.7 Summary of Flood Risk

The proposed development is considered to be at very low risk of flooding for all sources of flooding except flooding from sewers, which is assigned a low to medium risk. A summary of flood risk from all sources is given in Table 3-1**Error! Reference source not found.** below.

Table 3-1 Summary of Flood Risk

Source of Flooding	Risk
Rivers	Very Low
Sea	Very Low
Surface Water and Small Watercourses	Very Low
Groundwater	Low
Reservoir Failure	Very Low
Sewer	Low to Medium

4 Consultation draft of new TAN-15

The following chapter provides a summarised overview of the requirements set out in the consultation draft of the revised TAN-15, published January 2023. Whilst this policy has not been finalised or enacted it provides an indication as to whether development of the site could occur in the future under the new TAN-15 when implemented.

4.1 Flood Map for Planning

The initial requirement of TAN-15 is to identify the flood zones and vulnerability classification relevant to the proposed development, and to apply this information to the application of the Justification Tests. TAN-15 is supported by the Flood map for Planning (FMfP).

The FMfP defines flood zones based on the central estimates of climate change, assuming a 100-year lifetime of the development. Table 3-1 summarises the flood zones and their definitions.

Table 3-1 TAN-15 Definition of FMfP flood zones[1]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year		
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.	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change.	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change.	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change	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, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard)	Areas where flood risk management infrastructure, managed and maintained by Risk Management Authorities, provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard)	Not applicable

1 Figure 1, TAN-15 January 2023. https://www.gov.wales/sites/default/files/consultations/2023-01/TAN15-development-flooding-and-coastal-erosion-jan-2023.pdf

4.1.1 FMfP: Flood Risk from Rivers and Sea

The Flood Map for Planning – flood risk from rivers and the sea shows that the site is located in Flood Zone 1, as shown in Figure 3-1. The map is provided at a larger scale to show the distance of the site to the nearest areas of flood risk from these sources.

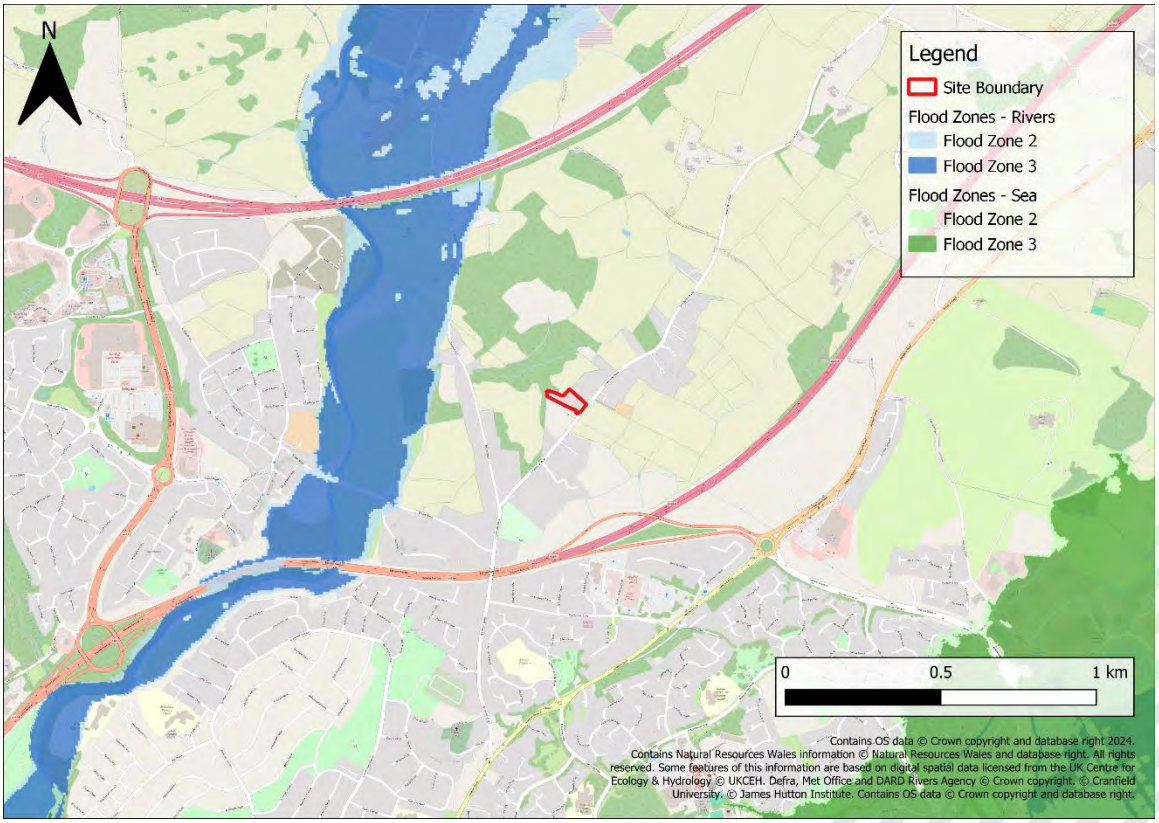

Figure 3-1 Flood Map for Planning- Rivers and Sea

4.1.2 FMfP: Flood Risk from Surface Water and Small Watercourses

The Flood Map for Planning – Flood Risk from Surface Water and Small Watercourses shows the site is located in Flood Zone 1, as shown in Figure 3-2.

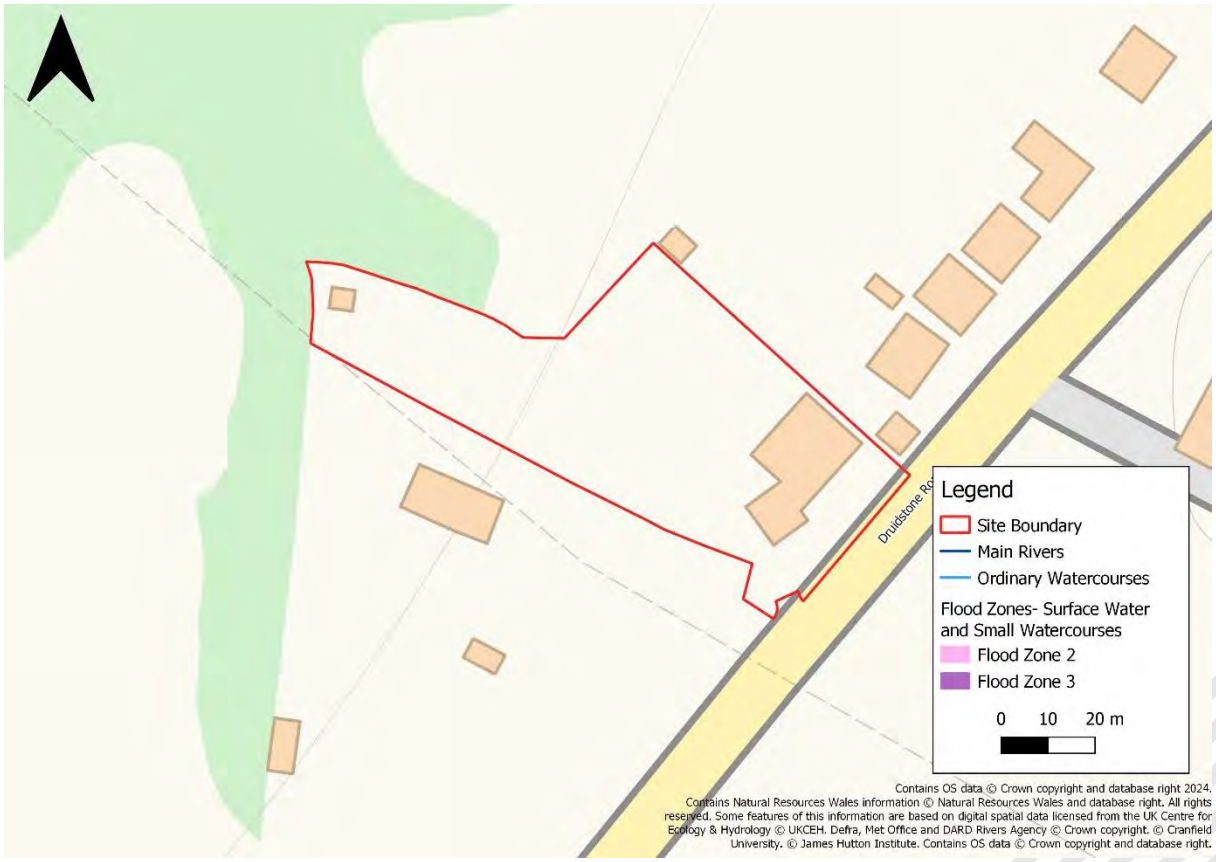

Figure 3-2 Flood Map for Planning- Surface Water and Small Watercourses

4.2 Vulnerability to Flooding

Under TAN-15, one of three flood risk vulnerability classifications can be assigned to a development, as shown in Table 3-2 below. As the proposed use for the site is for residential development, it is classified as a highly vulnerable development.

Table 3-2 Development vulnerability categories[2]

Development category	Types
Highly vulnerable development	**All residential premises** (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

2 TAN-15, Figure 2

4.3 New development and Redevelopment

Recognising that the ability to avoid or minimise risk when undertaking development varies according to the type of development proposed, TAN-15 provides differing advice in relation to four types of development. These are **New Development, Redevelopment, Change of use or conversions, and Extensions**. These new definitions have been introduced to include an element of flexibility for appropriate regeneration and redevelopment proposals within flood risk areas.

TAN-15 defines Redevelopment as: "development that proposes to replace a building with an existing use (in full or in Part) with a new building".

The proposed development site is brownfield, comprising the existing housing complex. Consequently, any proposals for the site shall be classed as 'redevelopment'.

Furthermore, TAN-15 states that:

Proposals for redevelopment, changes of use, conversions and extensions may be considered differently to new development. Where a development already exists and the use of the land or building is established, further development can present an opportunity to increase the resilience of the building. If buildings cannot be made more resilient then the expectation is that planning permission will not be granted (TAN-15 para 4.5).

Schemes to develop greenfield sites and proposals to develop vacant or unused sites should be considered new development for the purposes of this guidance. New developments increase exposure of people, property and infrastructure to flood risk and are likely to adversely impact on flood storage capacity in areas at risk of flooding (TAN-15 para 10.3).

Where buildings in flood risk areas are currently in use, there may be circumstances where redevelopment, changes of use or conversion proposals can bring clear benefits to the area and the building. These should be balanced and weighed against the flood risk considerations (TAN-15 para 10.4).

The current consultation draft of the revised TAN-15 appears to support redevelopment opportunities if they are able to further increase the resilience of a building. For the time being and to the best of our knowledge, the proposed site will be classified as 'redevelopment for the purposes of the TAN-15 and the application of the Justification Test.

4.4 Justification Test and Acceptability Criteria

TAN-15 sets out the requirement for an FCA based on the sites location within the flood zones identified within the Flood Map for Planning. A Flood Consequences Assessment is only required as a consequence of a site being located within Flood Zones 2 and 3.

As per Section 4.1, the proposed development is located within Flood Zone 1 of the FMfP –Rivers and Sea.

TAN-15 states that within Zone 1, all types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

Consequently, no FCA is required as a result of tidal or fluvial flood risk, and the site does not need to be considered against the Justification Test or Acceptability Criteria.

The Justification Test and Acceptability Criteria are not applicable for sites at risk from surface water and small watercourse flooding. However, where surface water flood risk is present, a Flood Consequence Assessment (FCA) would be required to demonstrate that the surface water flood risk has been adequately managed. As outlined in Section 3.3 the proposed development is at very low risk of surface water and small watercourse flooding.

An FCA is not considered necessary for the proposed development of the site.

5 Conclusion

Site Description

- JBA Consulting have been commissioned to prepare a Flood Risk Appraisal in support of a candidate site for the Cardiff Council replacement LDP. The site is located at the Manor in Old St. Mellons and is proposed for residential use. The topography of the site slopes in a south-to-north direction, resulting in an elevation difference across the site of 10.68m AOD.

Overview of flood risk

- The site is at very low risk of flooding from tidal, fluvial, surface water and small watercourses and reservoir sources and is at low risk of flooding from groundwater.
- The site is at medium to low risk of flooding from sewers.

Consultation draft of new TAN-15

- The current consultation draft of the revised TAN-15 appears to support changes of use and redevelopment if these changes are able to further increase the resilience of a building.
- TAN-15 only requires a Flood Consequences Assessment where a site is located within Flood Zones 2 and 3 on the Flood Map for Planning.
- As the site is in Flood Zone 1 for all sources of flooding, the site does not need to be considered against the Justification Test or Acceptability Criteria.
- An FCA is not considered necessary for the proposed development of the site.

Conclusion

- It is concluded that on the grounds of flood risk, the development proposals comply with the aims and objectives of TAN-15 and Planning Policy Wales.