

Flood Consequence Assessment – The Mole, Barry Docks

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Purpose

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Abbreviations

ABP	Associated British Ports
AEP	Annual Exceedance Probability
FRAW	Flood Risk Assessment Wales
JBA	JBA Consulting
NRW	Natural Resources Wales
PPW	Planning Policy Wales
TAN-15	Technical Advice Note 15

1 Introduction

1.1 Terms of Reference

JBA Consulting were commissioned by Associated British Ports (ABP) to undertake a Flood Consequence Assessment (FCA) to support a planning application for a proposed mixed use, residential, leisure and business site at the Mole, Barry Docks.

1.2 FCA Requirements

This FCA follows Welsh Government guidance on development and flood risk set out in Technical Advice Note 15: Development and Flood Risk (TAN-15). Where appropriate the following aspects of flood risk will be addressed in all planning applications over its expected lifetime in flood risk areas:

- The likely mechanisms of flooding
- The likely source of flooding
- The depths of flooding through the site
- The speed of inundation of the site
- The rate of rise of flood water through the site
- Velocities of floodwater across the site
- Overland flow routes
- The effect of access and egress and infrastructure, for example public sewer outfalls, combined sewer outflows, surface water sewers and effluent discharge pipes from wastewater treatment works
- The impacts of the development in terms of flood risk on neighbouring properties and elsewhere on the floodplain

2 Site Description

2.1 Site location

The proposed development site is located off Neptune Road in Barry, in the Vale of Glamorgan, as shown in Figure 2-1 (NGR ST115673). The site is approximately 3.1ha and Brownfield in nature. The site is located in an industrial area of Barry, within the docks, and currently houses the Barry Community Water Activity Centre. A residential development, and Neptune Road forms the western boundary of the site, with all other boundaries surrounded by Barry Dock.

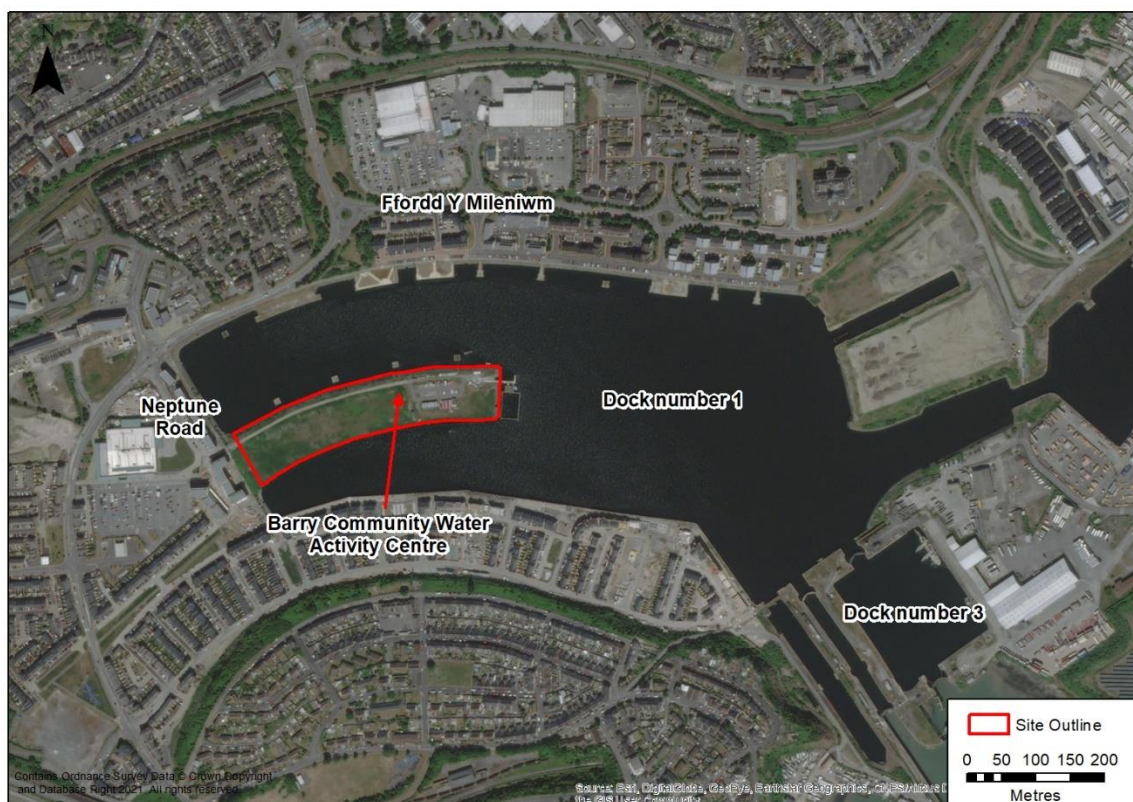


Figure 2-1 Site location

2.2 Site topography

Welsh Government's new 2021 1m Light Detection and Ranging (LiDAR) data has been used to analyse existing ground levels across the site. This data is not yet publicly available but was obtained via a data request directly to Welsh Government.

The site has a generally flat topography as shown in Figure 2-2. There is a slight slope from 9.25mAOD in the west of the site to 8.57mAOD in the east. From north to south the site is generally level, except for an existing access road along the northern boundary of the site which lies at 8.1mAOD, approximately 0.9m lower than the surrounding ground level.

Off site, ground levels generally rise from east to west from The Mole access point towards the Asda supermarket site nearby.

Figure 2-3 illustrates a topographic profile of Welsh Government's 1m DTM LiDAR dataset. The ground levels from Point A to The Mole access all lie at around 9.3m AOD. The point identified with a pink cross on Figure 2-2 corresponds with the pale blue hatched on Figure 2-3.



Figure 2-2 Site topography using Welsh Government's 2021 1m DTM LiDAR

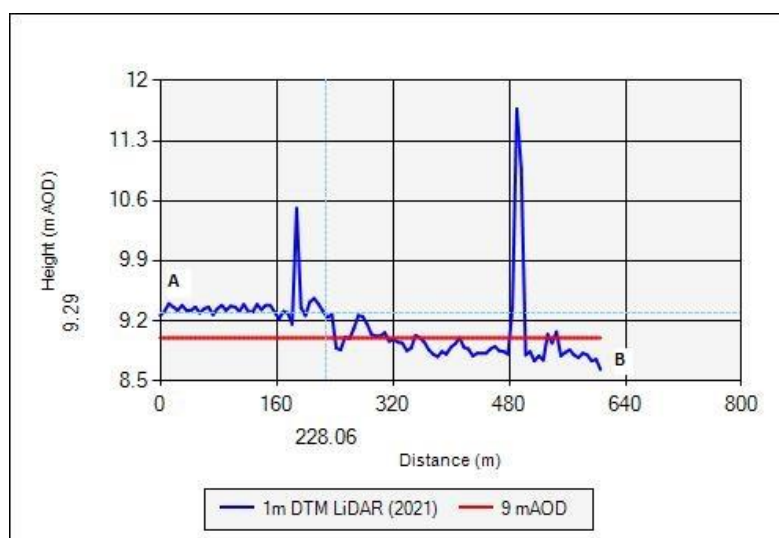


Figure 2-3 Topographic profile of The Mole and surrounding access areas

Peak Surveying Services produced a detailed topographic survey of the site in 2020 which can be found in Appendix A. This survey covers The Mole only, and not the adjacent access points.

An additional topographic survey, undertaken by Laser Surveys in January 2023, details updated levels for the existing access road (Neptune Road) to the proposed development site. This updated survey is contained in Appendix B. In recent years, the areas located adjacent to The Mole access have undergone extensive redevelopment which included significant ground raising. As this ground raising is a recent addition, it is not reflected in NRW's 2011 LiDAR Open-Source dataset or resultant flood mapping.

As indicated by both the topographic survey and new LiDAR data, at the existing access point of the proposed development, the road has been raised to 8.98mAOD. As the road turn and directs north, the level raises to 9.2mAOD.

2.3 Soils and Geology

The soils on site were assessed on the Cranfield Soilscales Viewer¹ and were shown to be freely draining slightly acid but base-rich soils. However, due to the industrial nature and setting of the site it is very likely that the soils on site are heavily compacted and constitute of made ground to significant depths. This means that the site is effectively impermeable.

The geology of the site was assessed using the BGS Geology of Britain Viewer². The bedrock geology was shown to be Blue Anchor Formation comprised of mudstone and other sedimentary bedrock. Superficial deposits at the site are comprised of clay, silt and sand.

2.4 Proposed development

Development proposals for the site are for a mixed use, residential, leisure, and business site, with the creation of a 400-berth marina with floating pontoons. The west of the proposed development site will comprise of 19 x 1-2 bed apartments and 45 x 3-4 bed townhouses with a maximum height of 4 storeys, with associated parking and access. Towards the east of the proposed site, proposals include an incubation workspace building comprising of offices, smart innovation spaces, breakout spaces and a café. Further to the east of the proposed development site lies a marine office building with facilities for visitors/members and a restaurant. The eastern vicinity will also host public open space and car parking. The proposed development plan and site levels are shown in Figure 2-4 and provided in full within Appendix C.

The Water Activity Centre in the eastern part of the site is likely to be re-located to East Quay, adjacent to Ffordd Y Milleniwm Road. The relocation of the Ocean Watersports Trust building would fall under a second phase of this proposed development and is subject to successfully obtaining a grant from Phase 3 of the UK Government Levelling Up Fund.

To support the development aspirations, ground raising at the site is required to mitigate the risk of flood. As shown in Drawing 20065 (05) 100 contain in Appendix C, all areas of built development (including, roads, parking and buildings) will be raised to an approximate level of 9.20mAOD and a **minimum level of 9.00mAOD**. Areas outside of the development plateau will be graded down to existing ground levels retained behind the dock walls, providing a perimeter footpath around the Mole.

The existing access road (Neptune Road) has already been raised to approximately 9.00mAOD, linking the site to high ground.

1 <http://www.landis.org.uk/soilscales/>

2 <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

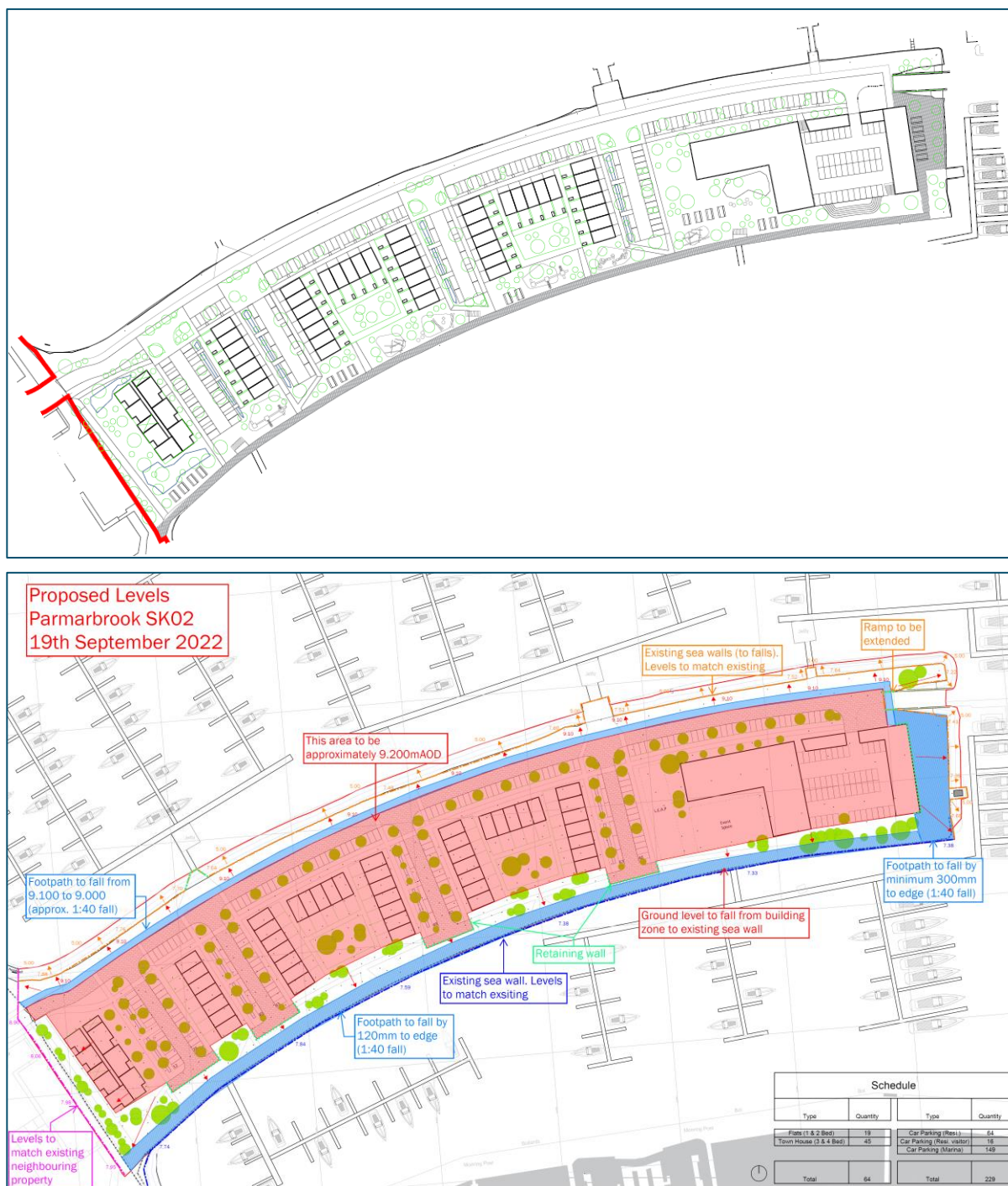


Figure 2-4 Proposed development (above: site layout, below: site levels)

3 Planning Policy

3.1 Planning context

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. These policies have the aim that all development in Wales is sustainable and improves the social, economic, environmental, and cultural wellbeing of Wales as set out in the Wellbeing of Future Generations Act 2015.

Technical Advice Note 15 (TAN-15), introduced by the Welsh Government in 2004, provides the technical guidance relating to development planning and flood risk in Wales. The initial requirements of TAN-15 are to identify the vulnerability classification(s) and the flood zones relevant to the proposed development, and to apply this information to the application of the justification tests.

An update for TAN-15 is expected to be implemented on 1st June 2023. Although the new TAN-15 is not a material consideration, Welsh Government and NRW advise that some consideration is given to the draft Flood Map for Planning (FMfP) as the best available information. Therefore, where a site is located in a FMfP flood risk zone it is recommended that an FCA is carried out.

As a result of the above, both the DAM and the FMfP are considered as part of this FCA, although only the current TAN15 has been applied to assessment.

3.2 Vulnerability classification

TAN-15 assigns one of three flood risk vulnerabilities to a development as shown in Table 3-1. TAN-15 states that the vulnerability attributed to a mixed-use proposal will be defined by the most vulnerable use. Therefore, the proposed development is classed under residential development and consequently is classified as **Highly Vulnerable**.

Table 3-1 Development categories defined by TAN 15

Development category	Types
Emergency services	Hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood.
Highly vulnerable development	All residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites.
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.

3.3 Development Advice Map classification

The Development Advice Map (DAM) created by the Welsh Government is used to trigger different planning actions based on a precautionary assessment of flood risk. Figure 3-1. shows that the site is located within DAM Zone C2, with areas to the west of the site located in Zone B.

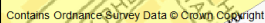


Figure 3-1 Development Advice Map

In October 2020, JBA Consulting submitted to NRW updated tidal flood modelling for a number of sites in the Barry Dock area, including the proposed development site. This established to the satisfaction of NRW new flood risk modelling for the area through the Flood Map Challenge process.

This new modelling showed the current DAM to be inaccurate, with none of the Mole site located within the 0.1% AEP flood extent that defines DAM Zone C2.

Following NRW approval of the updated modelling, the site can be re-classified to Zone A (areas with little to no flood risk). On receipt of this information NRW would usually update the DAM maps to show the change in zone. However, NRW are in the process of updating the DAM maps and during this process they state that:

"We will continue to accept, and review models submitted in support of a planning application consultation, which will be used to inform our technical flood risk advice. However, this information will not be incorporated into the Development Advice Map and there will be no change made to the flood zones."

Figure 3-2 shows how the DAM map would look if NRW updated the mapping as a result of the accepted new flood modelling. The map shows that the development site is no longer located in Zone C2 and is instead located in Zone A (as shown by no shading on the map).

A Flood Consequence Assessment (FCA) is not normally required for developments outside of Zone C. However, recognising the transitional status of the DAM, with a DAM update agreed but not yet implemented online, this FCA has been prepared to document the detailed site-specific appraisal of flood risk at the proposed development site.

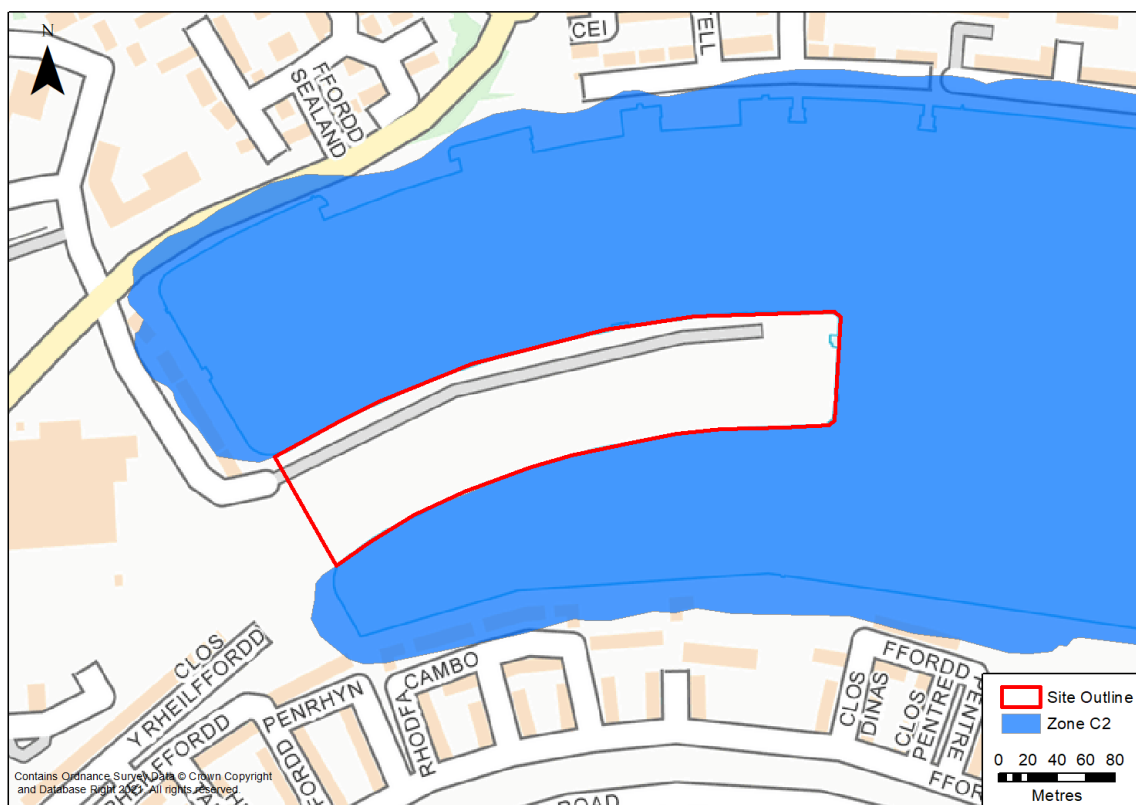


Figure 3-2 Changes to the DAM map as agreed by NRW

3.4 Flood Map for Planning Classifications

The Flood Map for Planning (FMfP) is used to trigger different planning actions based on a precautionary risk assessment of flood risk. Figure 3-3 shows the current FMfP flood risk from the Sea. There is no flood risk from rivers within the area.

The current FMfP shows that the periphery of the Mole is predicted to be located in Flood Zone 3. Flood Zone 3 represents areas with a greater than 1 in 200 (0.5%) chance of flooding in any given year, including climate change.

The central are of the site is predominantly located within Flood Zone 2 of the Flood Map for Planning for Sea. Flood Zone 2 represents areas with a 0.1% - 0.5% (1 in 100 to 1 in 200) chance of flooding from the sea in any given year, including the effects of climate change.

Highly Vulnerable Development is allowed in Flood Zone 2, subject to the application of the Justification Test and Acceptability Criteria.

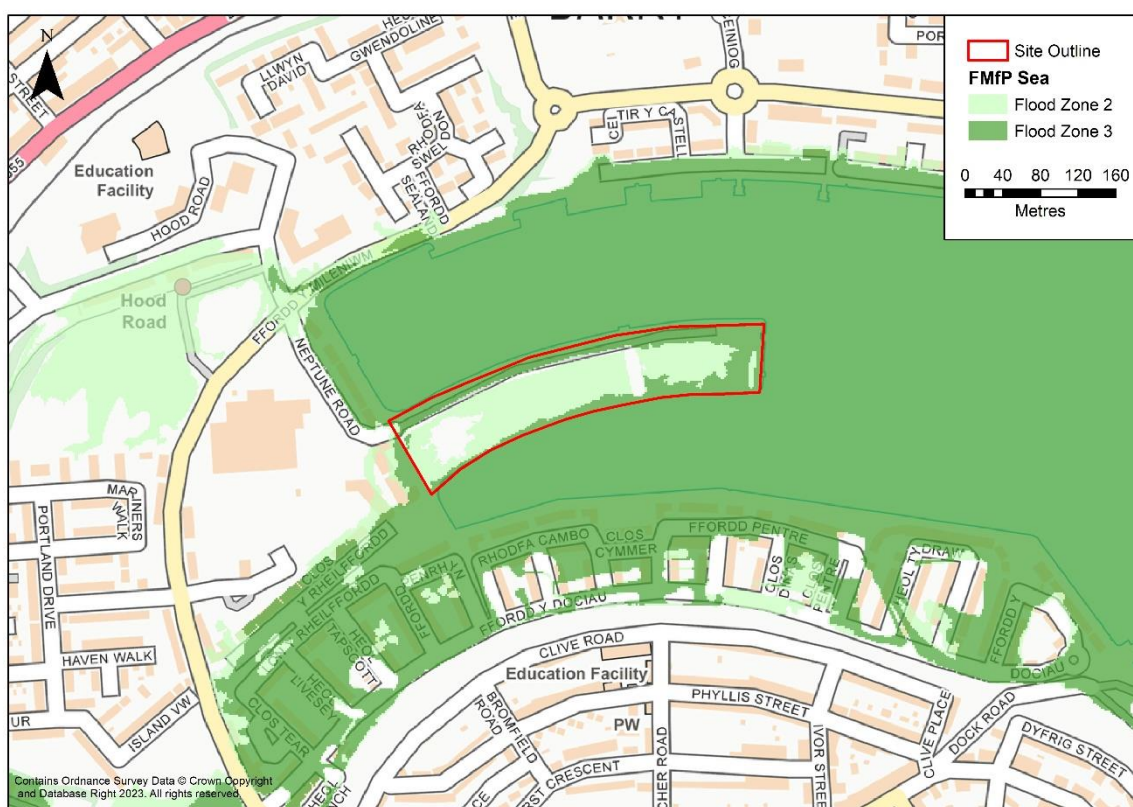


Figure 3-3 Flood Map for Planning - Sea

3.5 Vale of Glamorgan Local Development Plan (2017)

The Vale of Glamorgan Adopted Local Development Plan (LDP)³, adopted in 2017, sets out the council's vision and objectives for the development and use of land in the Vale of Glamorgan, together with the policies and proposals to implement until 2026.

The proposed development site is located within the Barry Waterfront development identified as a strategic site in the LDP as Policy MG3. The Barry Waterfront development aims to provide 1,700 homes in addition to retail and office space, community leisure and education facilities. The Mole development will eventually contribute towards this aim preparing the site for future residential developments.

3.6 Justification Test

The Justification Test is used to ensure that only development that is justified within flood risk areas is permitted. As it has been accepted that the site is located within DAM Flood Zone A, the Justification Test is not required. However, in accordance with the precautionary principals of TAN15, the Acceptability Criteria of TAN15 have been applied to this assessment.

³ Vale of Glamorgan Adopted Local Development Plan (2017)
<https://www.valeofglamorgan.gov.uk/Documents/Living/Planning/Policy/LDP/LDP-Adoption/Adopted-LDP-Written-Statement-June-2017-final-interactive-web-version.pdf>

4 Flood Risk Assessment

This section assesses the risk to the proposed development from all sources of flooding, the risk of increased flood risk to others, and how flood risks can be managed.

4.1 Review of Existing Flood Risk Data

The latest available information on flood risk at the site, published by NRW, is summarised in Table 4-1 below.

Table 4-1 Summary of flood risk to the site

Source of Flooding	Onsite Presence	Description
Flood Risk from Rivers	x	The site is at very low risk of flooding from rivers (Section 4.1)
Flood Risk from the sea	✓	The site is at low risk of flooding from the sea (Section 4.2)
Flood Risk from Surface Water and Small Watercourses	x	The site is at 'very low' risk from surface water flooding (Section 4.3).
Reservoirs	x	The site is not at risk from reservoir flooding.
Groundwater	x	The site is at very low risk of groundwater flooding (Section 4.5).
Canals	x	The site is not at risk of flooding from canals.
Sewers	x	The site is not considered to be at risk from sewer flooding.

4.2 Flood Risk from Rivers

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

4.3 Flood Risk from the Sea

The NRW FRAW map in Figure 4-1 shows that the site is mainly at very low risk of flooding from the sea. This means that there is less a 0.1% AEP chance of tidal flooding at the site. In the north eastern corner of the site, around the slip way, the chance of tidal flooding is considered to be low risk due to the lower ground levels in this area. Low risk is between a 0.5% and 0.1% AEP event. However, FRAW mapping does not account for the increasing risk of flooding from climate change and therefore further assessment is required to consider this potential source of flood risk.

Section 5 of this report documents the detailed tidal modelling work that has been undertaken to support this FCA which has been submitted and accepted by NRW.

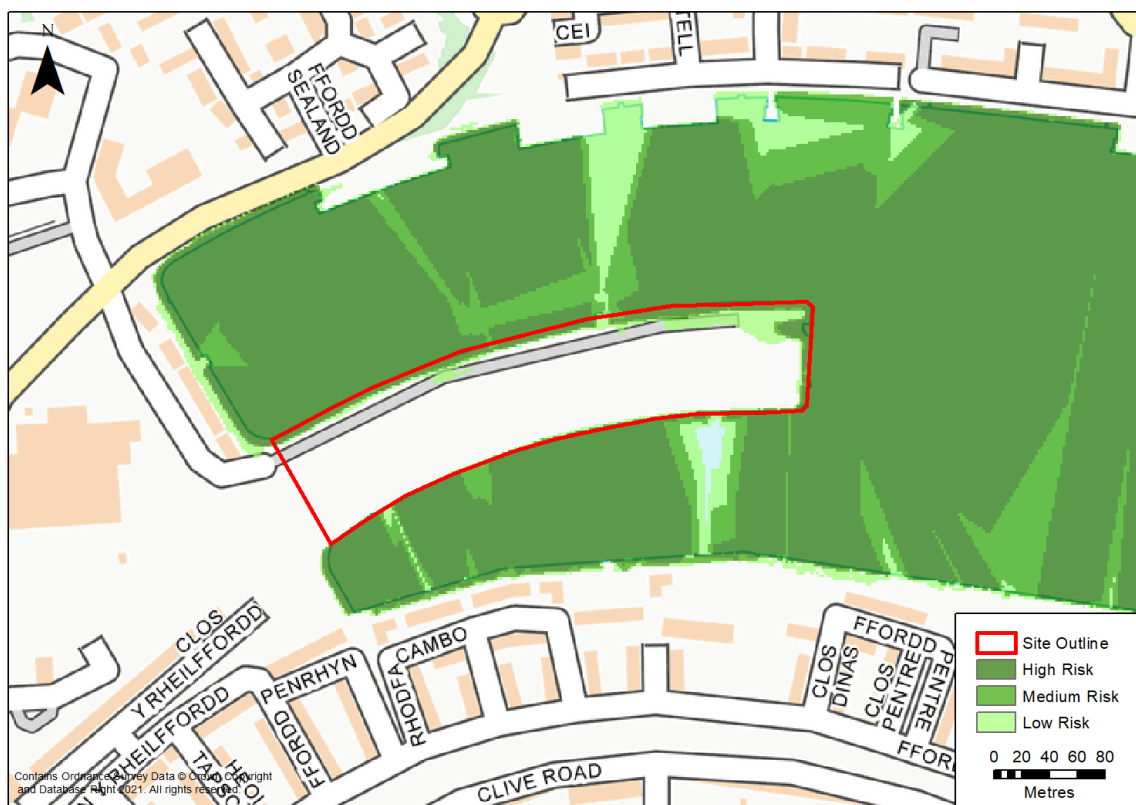


Figure 4-1 NRW FRAW map for tidal flooding

4.4 Surface water and small watercourse risk

The NRW FRAW map for surface water and small watercourses is shown in Figure 4-2. The site is largely at 'very low' risk from surface water and small watercourse flooding where there is a less than a 0.1% AEP chance of flooding in any given year. The northern and eastern boundaries of the site are shown to be at a low risk of surface water flooding. However, this is an artifact of the broadscale modelling approach, as surface water in these areas will rapidly drain to the dock. It is therefore concluded that the site is at very low risk of surface water and small watercourse flooding.

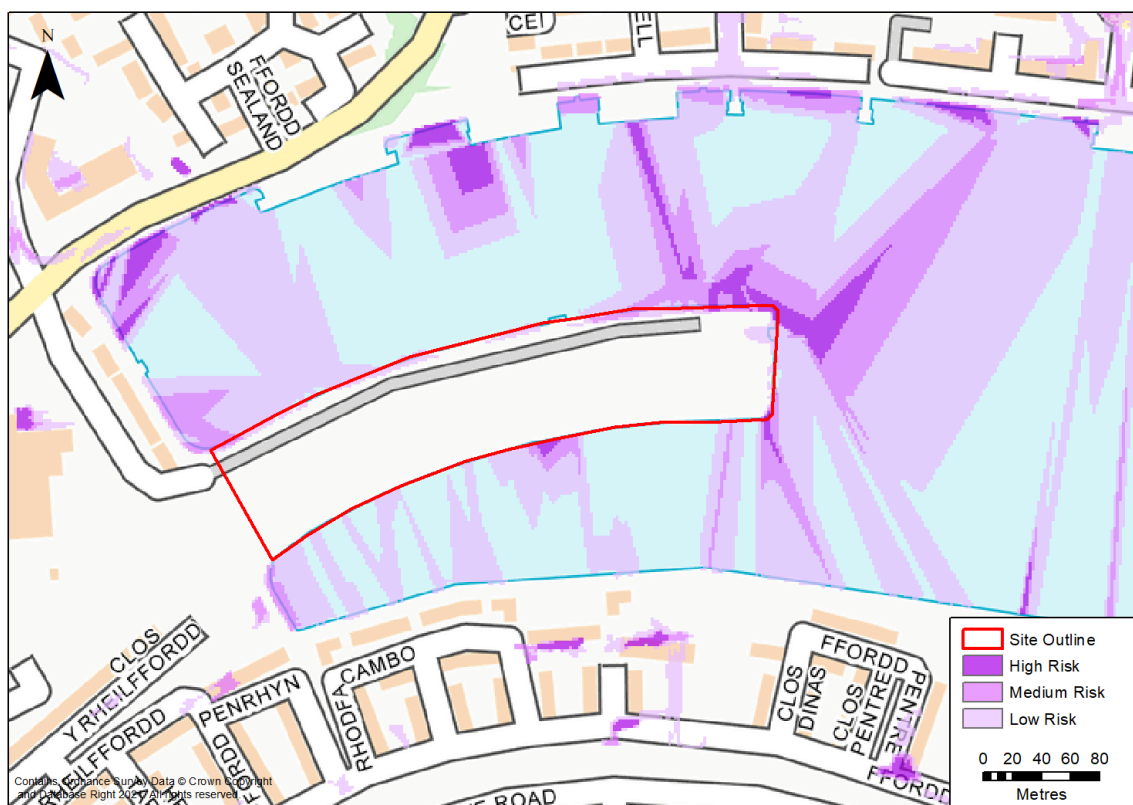


Figure 4-2 NRW FRAW map for surface water and small watercourse flooding

4.5 Risk of flooding from reservoirs

As the site is not located in close proximity to any watercourses the risk of reservoir flooding is considered to be very low.

4.6 Risk of flooding from groundwater

Groundwater flooding is caused by unusually high groundwater levels. It occurs as excess water emerging at the ground surface or within manmade structures such as basements. Groundwater flooding tends to be more persistent than surface water flooding, in some cases lasting for weeks or months, and can result in significant damage to property. The risk of groundwater flooding depends on the nature of the geological strata underlying the sites, as well as on local topography.

The Vale of Glamorgan Local Flood Risk Management Strategy⁴ states that the risk of groundwater flooding in the study area is considered to be between 50% to 75% chance of flooding. Barry has historically been affected by groundwater flooding. However, the risk of groundwater flooding in Barry is typically linked to areas of overlying limestone. This does not apply to the Mole site, which is built on significant made ground and will have a groundwater table directly linked with the water level of the Dock. Consequently, we conclude that the risk of groundwater flooding is very low for the Mole.

4 The Vale of Glamorgan. Local Flood Risk Management Strategy (2013) <https://www.valeofglamorgan.gov.uk/Documents/Living/Environment/Flood-and-coastal-erosion-risk/VoGC-LFRMS.pdf>

5 Detailed Assessment of Tidal Flood Risk

5.1 Barry Port Tidal Modelling

In 2013 JBA Consulting developed a 1D-2D ESTRY-TUFLOW tidal inundation model on behalf of NRW for the Cadoxton Flood Risk Study. Further amendments were made to the model in 2017 as to support production of the Cadoxton FAS Outline Business Case (OBC). This model has been licensed for use in this project and updated to align with the latest tidal change estimates. The focus of this work is to understand the tidal flood risk to Barry Port now and in the future.

The most recent model (2017 Cadoxton OBC) has been reviewed in order to understand if there are any limitations with the model schematisation and what, if any, updates were required. The review recommended the implementation of the following model improvements:

- The version of TUFLOW used to run the model was updated to the most recently available.
- The tidal boundary was updated to include new Extreme Sea Level data and follow current Coastal Flood Boundary (CFB) guidance⁵.
- The 2D Head-Time (HT) tidal boundary was amended to follow the line of seaward overtopping to better reflect the true site conditions and expected flood hydraulics.
- The 2D initial water level was set to 6.2mAOD which covered all of the dock water surface, this is the same level as the top of the tidal lock gates. The elevation of the dock floor had been raised to 5mAOD to help address model instabilities associated with having such a high initial depth of water (an issue for the Shallow Water Equation). However, a document produced by UK Dredging indicated that ABP aim for a constant water level in the dock of 3.9mAOD, a copy of this can be found in Appendix A of the Modelling Technical Note⁶. This suggests that both the 2D initial water level and dock floor elevation are too high.
- The representation of the lock gates has been amended following discussions with ABP on their performance during events when the seaward water level exceeds the impounded dock water level.
- The model has been reviewed to ensure the latest version of LiDAR is represented.
- New tidal boundary conditions were generated for the updated model. The Highest Astronomical Tide (HAT) curve for the Severn Estuary at Barry Docks was obtained from the Admiralty Tide software and was corrected to Ordnance Datum. The 2018 CFB sea level estimates were used to derive the design event still water sea level estimates at Barry using the chainage ID 426.

The flood modelling focused on two design events; 0.5% AEP and 0.1% AEP. Both events incorporated the influence of climate change using the latest guidance⁷ available at the time for the present day and three future epochs (2071, 2096 and 2121). Table 5-1 shows the peak still water sea level estimates applied to the model for each of the four epochs looking at the 0.5% and 0.1% AEP events.

⁵ Environment Agency (2018) 'Coastal Design Sea Levels - Coastal Flood Boundary Extreme Sea Levels (2018)'. LINK

⁶ JBA Consulting. DND-JBAU-XX-XX-FN-HM-0002 (December 2020)

⁷ Welsh Government (2017). Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities

Table 5-1 Extreme sea level estimates (mAOD) applied to the flood model

Event (AEP)	0.5%	0.1%
2021	7.46	7.79
2071	7.90	8.23
2096	8.22	8.55
2121	8.59	8.92

It should be noted that updated climate change guidance⁸ was published by Welsh Government in September 2021, following the completion of this modelling. The extreme sea levels applied to the model have been compared against the most recently released Coastal Flood Boundary dataset available⁹. Table 5-2 below illustrates the comparison between the estimates within the model, and those that would be calculated now.

Considering the most recently available data, the climate change estimates used in the 2021 flood model are comparable. Updated guidance indicates a 2cm increase in estimated sea levels for the present day compared to those estimates calculated in 2021. However, estimates within the new guidance are lower when considering 100 years of climate change. The 2023 estimates are 7cm lower than that currently used in the hydraulic modelling. As such, the current modelling provides a slightly conservative estimate to flood risk in the future.

Table 5-2 Extreme sea level estimates guidance comparison (mAOD)

Event (AEP)	0.5%	0.1%
Estimate Used in Modelling		
2021	7.46	7.79
2121	8.59	8.92
Updated Guidance Estimate		
2023	7.48	7.81
2123	8.52	8.85

⁸ Flood Consequences Assessments: Climate change allowances in Wales:
https://www.gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf

⁹ Coastal Design Sea Levels - Coastal Flood Boundary Extreme Sea Levels data set. Accessed:
<https://www.data.gov.uk/dataset/73834283-7dc4-488a-9583-a920072d9a9d/coastal-design-sea-levels-coastal-flood-boundary-extreme-sea-levels-2018>

5.2 Pre-development flood risk

5.2.1 0.5% AEP (2121) tidal event

During the 0.5% AEP plus climate change tidal event, the site remains largely flood free as shown in Figure 5-1. There are areas on the northern boundary of the site which experience flood depths to a maximum of 0.9m with 1m recorded in the north eastern part of the site on the slipway to the dock. Flooding along the southern boundary of the site experience depths of up to 0.28m. The flood level for this event is approximately 8.56mAOD.

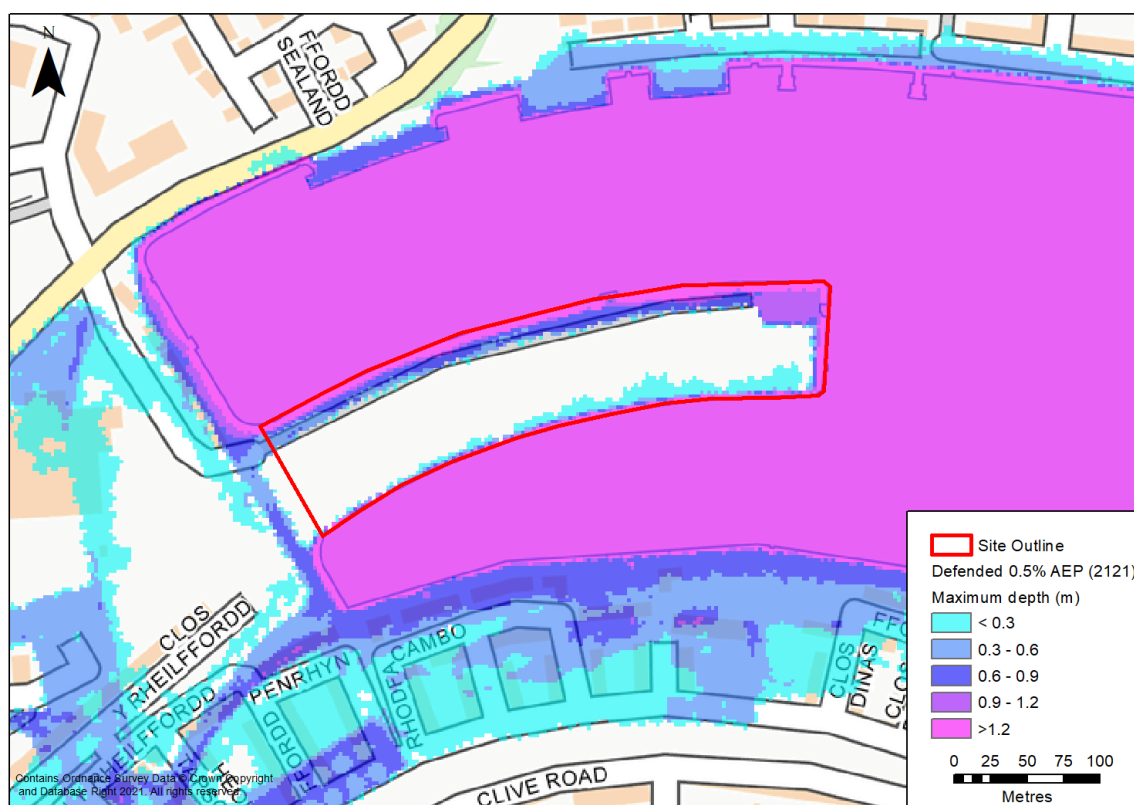


Figure 5-1 0.5% AEP (2121) tidal model - maximum depth

5.2.2 0.1% AEP (2121) tidal event

During the 0.1% AEP plus climate change tidal event, flood depths on the main area of site are generally below 0.4m as shown in Figure 5-2. Flood depths on the northern access road reach a maximum of 1.1m and 1.3m on the slipway to the north east of the site. The flood level for this event is approximately 8.9mAOD.

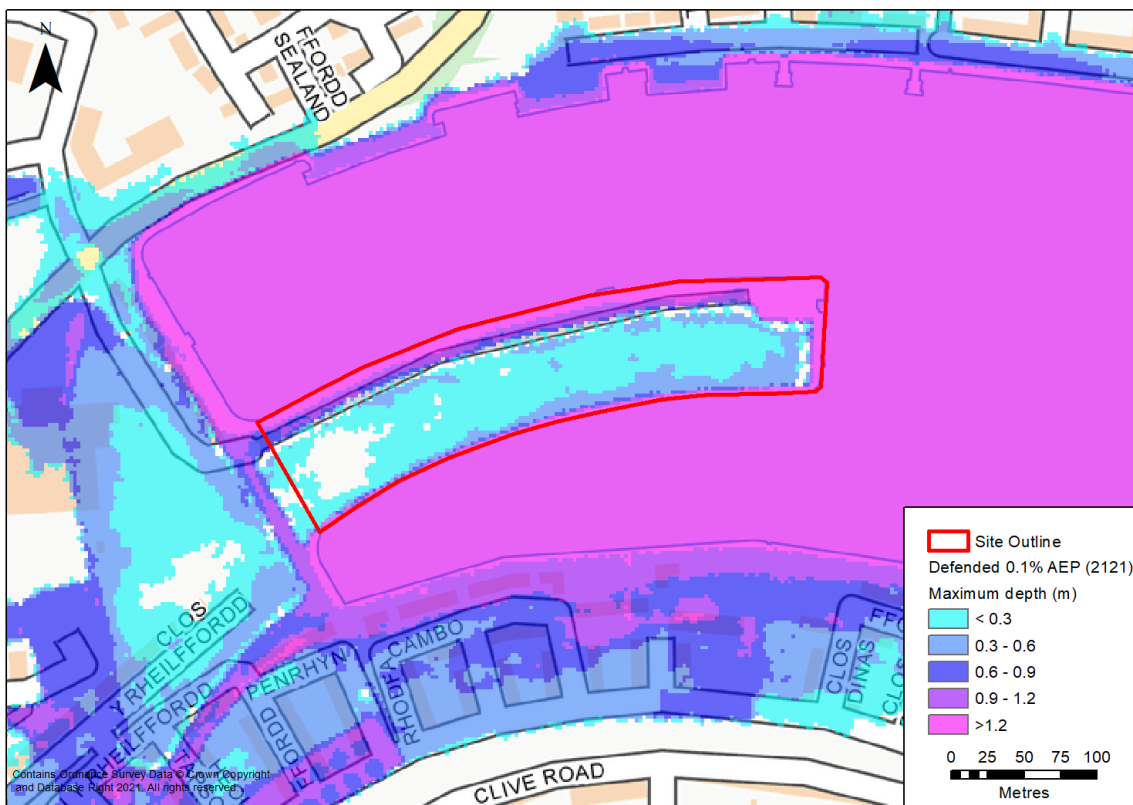


Figure 5-2 0.1% AEP (2121) tidal model - maximum depth

5.3 Post-development flood risk

Based on the pre-development detailed hydraulic modelling and assessment of ground levels, it is advised that the ground levels with the development plateau are raised to minimum level of 9.0mAOD. This minimum level has been selected to ensure that the site is flood free in the most extreme 0.1% AEP event for a lifetime of development of 100 years.

The proposed ground raising will not increase flood risk to others as it is not possible to increase flood risk by simple displacement of tidal flood water, given the effectively infinite volume of the sea.

Table 5-3 shows how the site will be flood free in the 0.5% and 0.1% AEP (2121) events following ground raising.

It should be noted that NRW's 2011 LiDAR has been used as the basis of the flood modelling. As outlined in Section 2.2, the level of Neptune Road that provides access to the site has recently been raised to a minimum level of 9.0mAOD. As such access to the Mole shall remain flood free under all TAN15 design events.

Table 5-3 Post-development flood levels

Current ground level	8.57 – 9.25 mAOD
0.5% AEP (2121) tidal flood level	8.56 mAOD
0.1% AEP (2121) tidal flood level	8.90 mAOD
Minimum level of development plateau	9.00 mAOD
0.5% AEP (2121) Freeboard	0.44m above flood water level
0.1% AEP (2121) Freeboard	0.10m above flood water level

6 Assessment of Acceptability Criteria

Although application of the Justification Test is not required for this site an assessment of the Acceptability Criteria, as set out in TAN-15, is required. These criteria must be satisfied in order for the proposed development to comply with TAN-15. Table 6-1 shows how the development meets each of the acceptability criteria.

Table 6-1 Acceptability Criteria for TAN-15

TAN-15 Acceptability Criteria	Comments	Assessment
Developer is required to demonstrate that the site is designed to be flood-free for the lifetime of development for a 1 in 200 (0.5% AEP) chance (tidal) flood event including an allowance for climate change in accordance with TAN-15 Table A1.14.	Ground levels within the development plateau will be raised to a minimum of 9.0mAOD. As such the all areas of built development will be flood free in the 0.5% AEP event, including an allowance for climate change.	✓
In respect of the residual risk to the development it should be designed so that in an extreme (1 in 1000 chance) [0.1% AEP] event there would be less than 600mm of water on access roads and within the property, the velocity of any water flowing across the development would be less than 0.4m/s.	Ground levels within the development plateau will be raised to a minimum of 9.0mAOD. As such the all areas of built development will be flood free in the 0.1% AEP event, including an allowance for climate change.	✓
No flooding elsewhere	Given the tidal nature of the flood risk it is not possible to increase flood risk by simple displacement of tidal flood water, given the effectively infinite volume of the sea. Furthermore, the proposals will not interfere with any flood flowpaths. It is therefore concluded that the proposed development will not increase flood risk to others.	✓
Flood defences must be shown by the developer to be structurally adequate particularly under extreme overtopping conditions (i.e. that flood with a 1 in 1000 chance of occurring in any given year).	Not applicable. The site is not currently offered protection by formal flood defences.	✓
The developer must ensure that future occupiers of the development are aware of the flooding risks and consequences.	Not applicable. The proposed residential dwellings are predicted to remain flood free.	✓
Effective flood warnings are provided at the site.	The site is partially covered by the Coast from Aberthaw to Severn Bridge NRW Flood Alert Area and the Coast at Swanbridge and Barry Flood Warning Area. Significant lead-time (+24hrs)	✓

	is typically provided for tidal flood risk.	
Escape/evacuation routes are shown by the developer to be operational under all conditions.	Flood free emergency vehicle access and pedestrian routes will be available under all conditions.	✓
The development is designed by the developer to allow the occupier of the facility for rapid movement of goods/possessions to areas away from flood waters.	Areas of built development will not be at risk of flooding; therefore, goods and possessions should not need to be moved away from any areas at risk of flooding.	✓
Development is designed to minimise structural damage during a flood event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of a flood.	During the 0.5% and 0.1% AEP (2121) events all areas of built development are predicted to be flood free.	✓

7 Conclusion and Recommendations

- JBA Consulting were commissioned by Associated British Ports (ABP) to undertake a Flood Consequence Assessment to support a planning application for proposed mixed use residential, leisure, and business site the Mole, Barry Docks.
- The site is approximately 3.1 ha in size and is accessed via Neptune Road at the west of the site.
- The development proposal is classified as highly vulnerable by TAN-15. A development lifetime of 100 years has been assumed for the proposal due to its residential inclusion.
- The site is located in DAM Zone C2 of the Development Advice Map. Flood Zone C2 is defined as areas of the floodplain without significant flood defence infrastructure. JBA submitted updated tidal modelling to NRW to challenge the Zone C2 categorisation. The modelling was accepted by NRW which removes the site from Zone C and reclassifies the site as Zone A, an area with little to no flood risk, although the Development Advice Map has not been updated at the present time.
- Topographical survey of the site shows that it is generally level with a slight slope from 8.9mAOD in the west to 8.6mAOD in the east. The only location lower than this is associated with the slipway.
- The site is at little to no risk of flooding from fluvial, reservoir, groundwater or surface water sources.
- Detailed tidal flood modelling has been undertaken to support this assessment. This shows that in the 0.1% AEP event, including allowance for climate change, the tidal flood levels will reach 8.9mAOD.
- To support the proposed development, all areas of built development (the development plateau) will be raised to a minimum ground level of **9.00mAOD** to mitigate the risks of tidal flooding over the lifetime of development. Ground raising of the access road (Neptune Road) has recently been completed, raising the access road above 9mAOD. These works mean that the development is not predicted to flood in any TAN15 design event.
- Given the tidal nature of the flood risk it is not possible to increase flood risk by simple displacement of tidal flood water, given the effectively infinite volume of the sea. It is therefore concluded that the proposed development will not increase flood risk to others.
- This FCA has demonstrated that all aspects of the acceptability criteria set out in TAN-15 have been satisfied. Consequently, we conclude that on the grounds of flood risk, the proposed development meets the requirement set out in TAN-15 and the aims of Planning Policy Wales.

A Topographic Survey of The Mole



LEGEND

- BOL ○ Bollard
- Bottom of Bank
- Concrete
- Fence
- Gate
- Invert Level
- Kerb Channel
- Kerb Dropped
- MH + Manhole Cover
- Post ○ Post
- 0.00 + Spot Level
- Top Of Bank
- Topographic Contour (1m Interval)
- Topographic Contour (5m Interval)
- Track
- Verge
- Wall Bottom
- Building

NOTES:
Site surveyed to Ordnance Survey OSNet™ GB
OSGB36(15) through Leica SmartNet.

CLIENT:
**PICK
EVERARD**

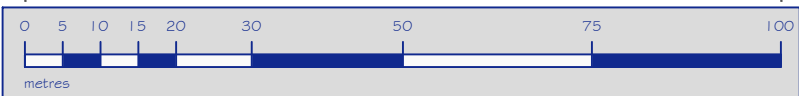
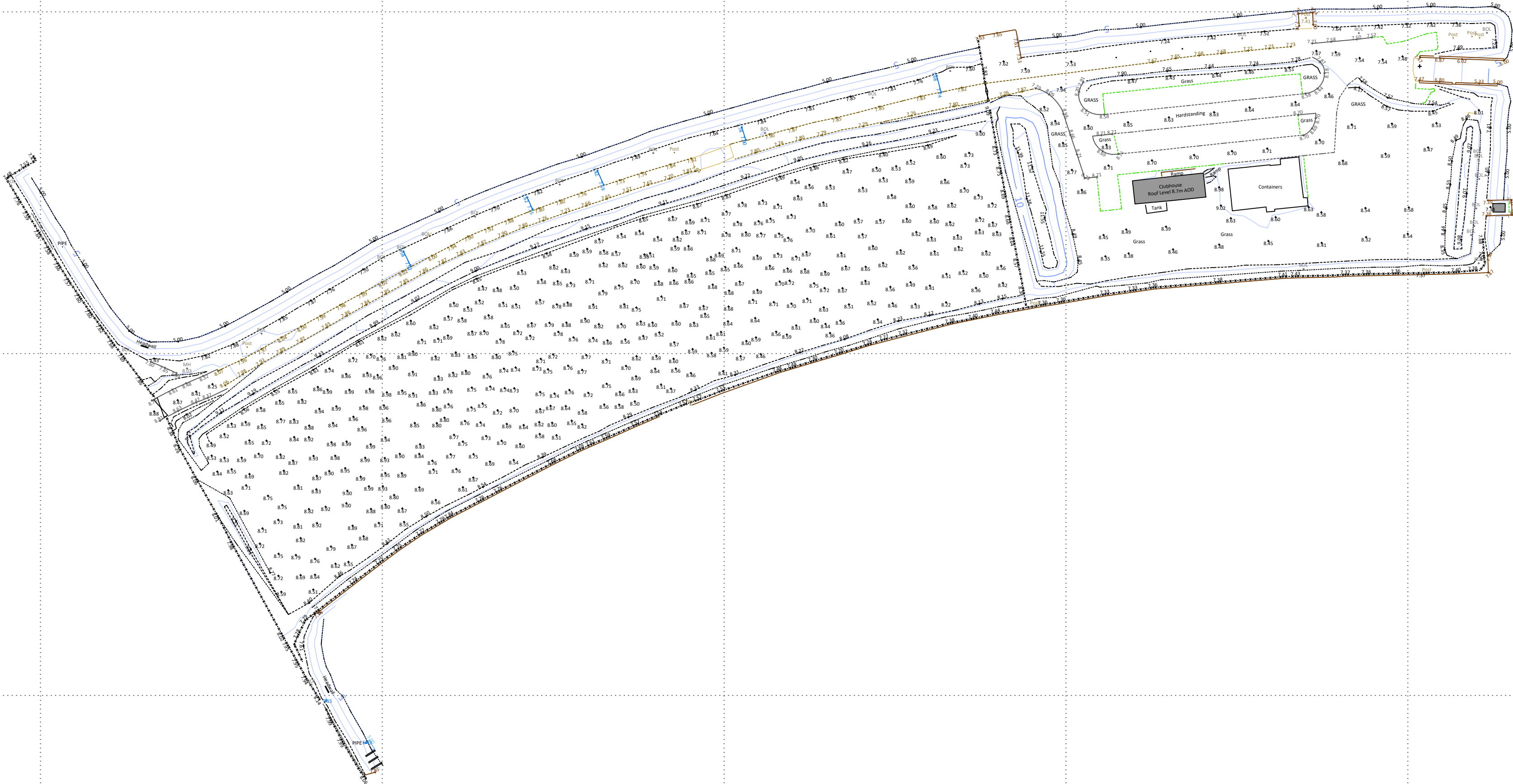
SITE:
**ASSOCIATED BRITISH PORTS
BARRY
THE MOLE**

PLAN:
**TOPOGRAPHIC SURVEY
6 FEBRUARY 2020**

Scale: 1:1000 @ A2 4 March 2020

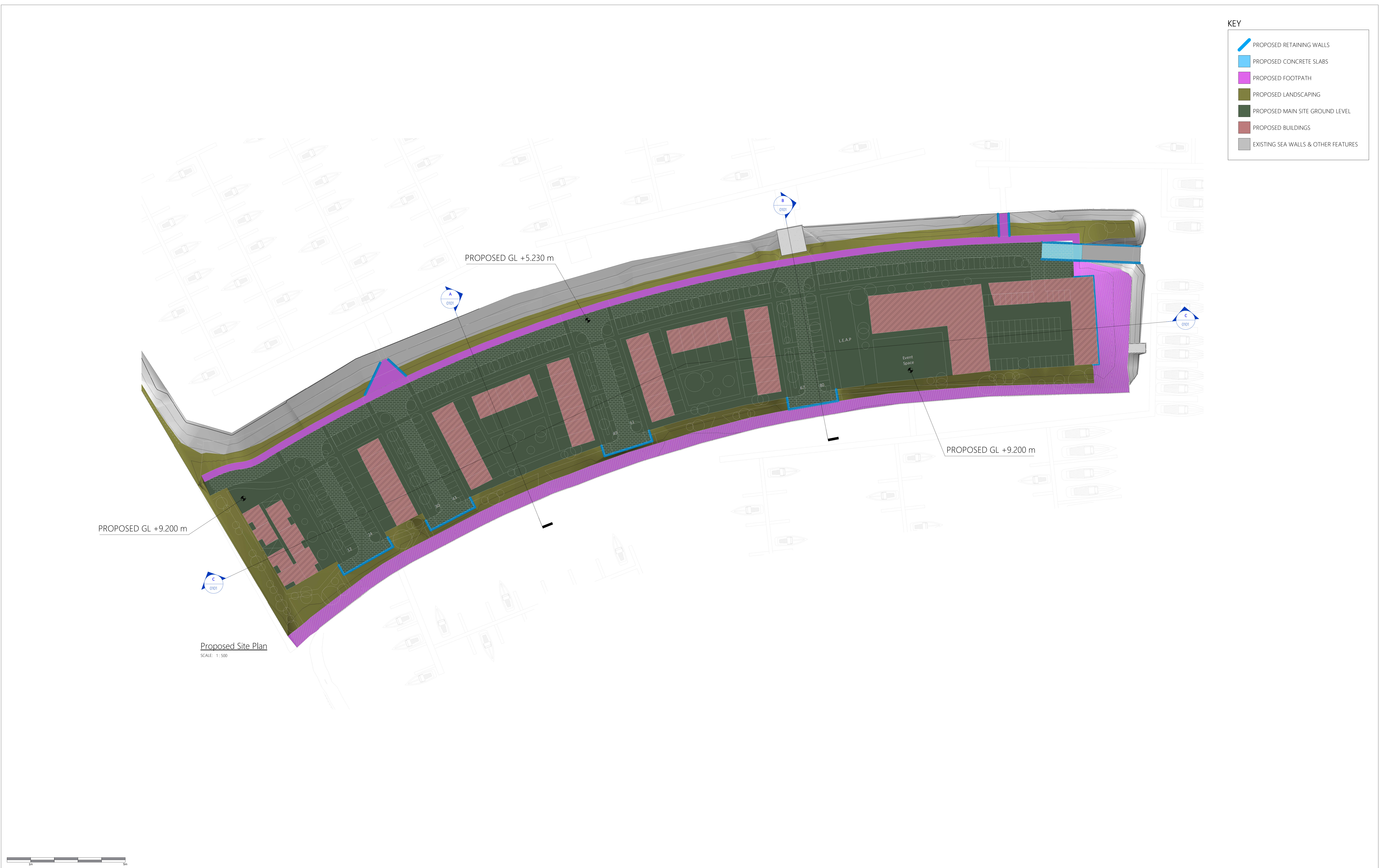
PSS - 085 - 008 - 001
Drawing No.

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B Topographic Survey of Surrounding Land

C Proposed Development Plan



GENERAL NOTES				SITE NOTES			
<div>1. This drawing is copyright © and the property of Parmarbrook. It shall not be copied in whole or in part, except under a written agreement. 2. Do not scale this drawing. All dimensions are to be established on site and any discrepancies are to be reported to the engineer immediately. 3. This drawing is to be read in conjunction with Parmarbrook's General Notes Drawing: PL 0001. 4. This Drawing is to be read in conjunction with all relevant Architect's and Services Engineer's drawings and specifications of engineering fill material. Details of required groundworks & specification is to be confirmed by geotechnical engineer prior to commencement of any work. 5. Details on this drawing are to be checked on site by the contractor and any discrepancies reported to the engineer so that adjustment can be made as necessary. 6. The contractor is responsible for establishing and checking the setting out of all girders, beams and columns. 7. The contractor must ensure and will be held responsible for the overall stability of the building/structure/recreation during all stages of the work. 8. All work by the contractor must be carried out in such a way to satisfy all the requirements under the Health and Safety at work act. 9. All work will be carried out in compliance with the requirements of the relevant statutory authorities and regulations.</div>				<div>1. This drawing is not for construction. Relevant approvals from local authorities are to be obtained for proposed works prior to any construction. 2. Raising the ground level may destabilise the existing sea walls. Assessment by specialist should be carried out in next stages of design to ascertain any strengthening works required. 3. Proposed ground/landscape areas are relatively steep & may require use of engineered ground solutions such as geogrid reinforcement. 4. The raising of ground is to be consistent with compacted layers of engineering fill material. Details of required groundworks & specification is to be confirmed by geotechnical engineer prior to commencement of any work. 5. The proposal (levels) are to accommodate the required height for flood risk, in addition to a maximum assumed long term settlement of 200mm. This is to be assessed & confirmed by a geotechnical specialist in the next stages of design.</div>			
Architect: Powell Dobson				Project: The Mole			
Designed: PRE-PLANNING STAGE				Title: SITE LAYOUT			
Designed: C.W		Drawn: P.B		Title:		<div>PARMAR BROOK</div> <div>4-8 Whites Grounds, London Bridge, SE1 3JA</div> <div>www.parmarbrook.com</div> <div>Tel: 0207 639 3999</div> <div>email: general@parmarbrook.com</div>	
Checked: C.W		Date: Aug 2022		Associated British Ports			
Project No: 2348		Scale: As indicated					
Drawing No:		Suitability: Rev:		Client:			
2348-PAR-XX-ZZ-DR-S-0100		P01		Associated British Ports			
PO1	2609-22	PRELIMINARY PRE-PLANNING		PB			
Rev:	Date:	Description:		By:			

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