ARUP

File Note

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Prepared by	Jim Newbold
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4 Pierhead Street Capital Waterside Cardiff CF10 4QP United Kingdom
t +44 29 2047 3727 d +44 29 2026 6589
arup.com

1. Introduction

Ove Arup and Partners have been appointed by WEPCo to provide engineering design services for the new Cardiff and Vale College next to Cardiff Airport, South Wales, being developed under the Welsh Government's MIMWEP Framework. As part of this commission, Arup have developed a surface water drainage strategy for the site.

The proposed development covers an area greater than 100m^2 and therefore the proposed surface water drainage strategy must consider Sustainable Drainage Systems (SuDS) and is subject to approval by the SuDS Approval Body (SAB). The SAB for this scheme is Vale of Glamorgan (VoG). A pre-SAB application was submitted in November 2023, and formal SAB pre-application comments were received in February 2024.

2. Existing Site

The existing site is currently a greenfield area comprising grassed fields and hedgerows. The site is bounded by Port Road to the east, an unnamed airport road to the south and to the west, a road spur that terminates at a large turning head. To the north is greenfield, which is under the same client ownership however the red line boundary has been drawn to condense the development, reserving land to the north for future development.

2.1 Site Topography

The site falls in two general directions with the high point located in the north east portion of the site, just north of the band of dense vegetation running south east to north west through the centre of the site. The topographical survey spot levels show the high point at approximately 63.53mAOD. The natural contours are shown in Figure 1.

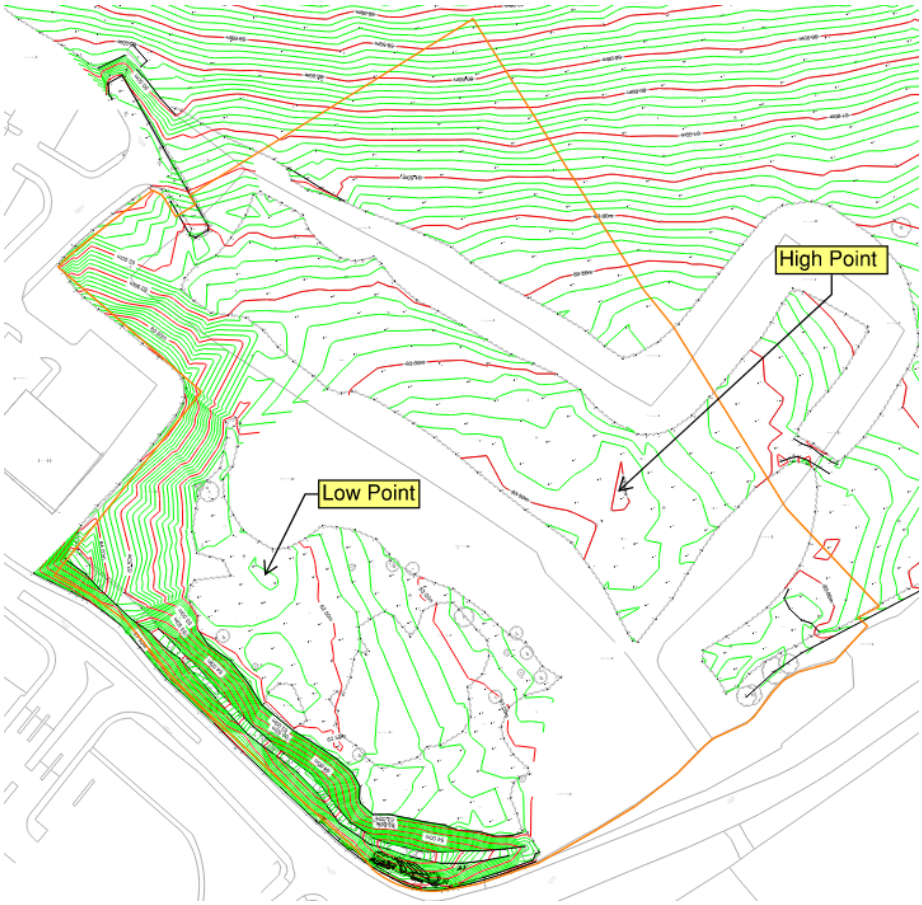


Figure 1: Site Topographical Contours

From the high point to the south, the gradient slopes down at 1:50 in a south-west direction to a low point on the western side of the site at approximately 62.3mAOD. This low point coincides with the surface water flood risk area identified on the NRW maps in Figure 5. There is a small landscape bund within the site, running along the southern boundary separating the site from the public highway to the south. The west area of the site topography slopes down from the industrial unit on the site boundary at approximately 1:9.5 gradient until the earthworks meets the natural ground levels within the site at approximately 62.4mAOD.

North of the high point, the site slopes down in a northern direction at 1:50. Beyond the site boundary the slope continues to the corner of the larger field into a wooded area. It should be noted that areas of the site were not surveyed due to dense vegetation.

2.2 Existing Drainage

Refer to Figure 2 for an extract from the DCWW record drawings showing the existing drainage assets in and around the site.

Figure 2: DCWW Record Information

As per Figure 2, record information shows there is a foul rising main that runs north-east to south-west along Port Road, east of the site. A foul rising main also runs north-west to south-east along the unnamed road to the south, slightly encroaching within the southern corner of the site before joining the Port Road main at the roundabout before continuing south. It is anticipated that the ultimate sewerage treatment works is Porthkerry. There is a 150mm diameter gravity foul sewer running south-east to north-west in the unnamed road south of the site. The upstream end starts just north-west of the roundabout.

There is a 300mm highway drain running alongside the foul sewer which is shown by the non-intrusive survey to increase to 375mm at the north-western roundabout. The non-intrusive survey showed a 300mm diameter highway drain to be present in the unnamed road to the west of the site, running south-west to north-east. It is assumed that this drain connects to the private surface water network running in the opposite direction to the north-west of the highway, however the non-intrusive survey was unable to confirm this.

It should be noted that there is a 150mm diameter foul drain that appears to run north-east beyond the turning head and into the development plot to the north. The non-intrusive survey carried out in September 2023 was unable to detect the route of this drainage within the site boundary and slit trenches were unable to detect the route within the boundary. If this sewer were to continue in the

direction implied on the paper records, it may clash with the proposed soakaway attenuation cell. The shape/location of the attenuation cell has been chosen to reduce this risk however the risk could not be eliminated due to the spatial requirements of the attenuation and the limited available area for attenuation further south within the site.

3. Flooding Consideration

The TAN15 and NRW Flood Maps have been assessed for the site and can be seen in Appendix A. The site is within Zone A as identified by the Welsh Government (WG) in the TAN15 Development Advice Map (DAM), therefore the area is considered to be at little or no risk of fluvial or tidal/coastal flooding. Figure 3 shows the site boundary overlayed on the DAM.

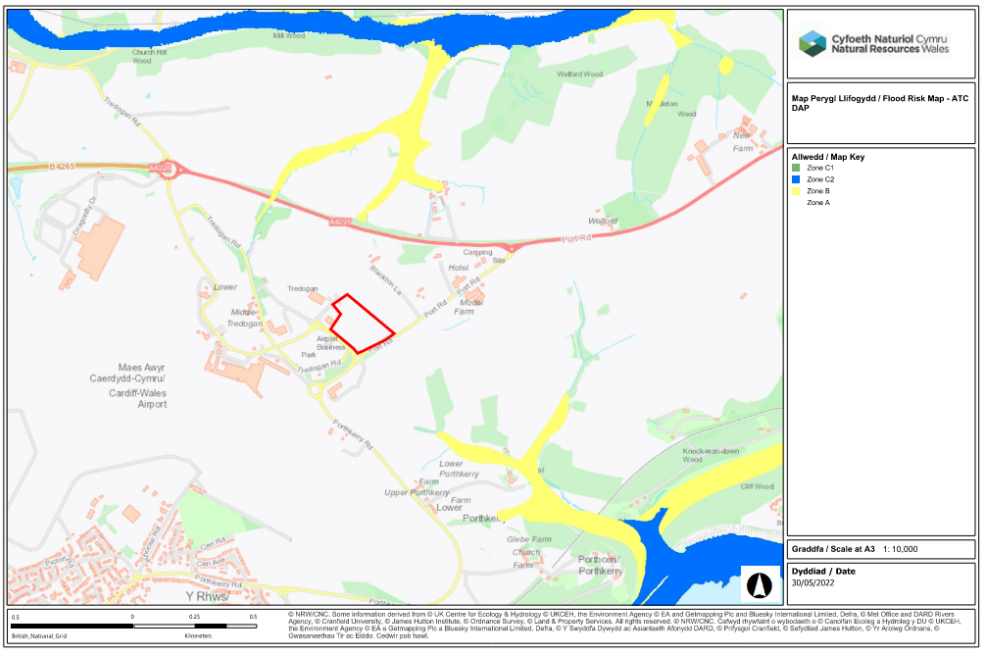


Figure 3: ATC TAN15 Development Advice Map

Welsh Government developed the Flood Map for Planning to support the revised TAN15 which is scheduled to be implemented in 2024. The Flood Map for Planning shows the impact that climate change is anticipated to have on the flood zones in the next 100 years. Whilst the Flood Map for Planning has no official status until the revised TAN15 is implemented, it is the best information available on flood risk and therefore has been used to assess the risk of flooding on the proposed development.

3.1 Tidal & Fluvial Flood Risk

The NRW Flood Map for Planning does not identify any areas of the site as being located in the tidal or fluvial flood zones, as shown in Figure 4.

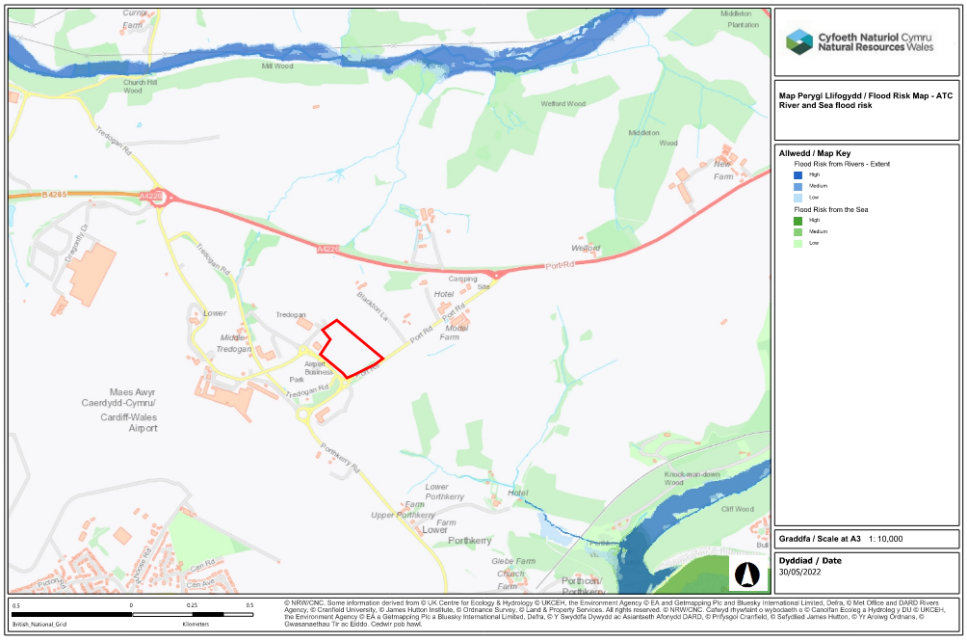


Figure 4: ATC NRW Flood Map for Planning (Rivers and Seas)

3.2 Surface Water Flood Risk

The majority of the site has no surface water flood risk identified, however there is a small discrete patch of the site recorded as being within Flood Zones 2 and 3, near to the western boundary. This is shown on the extracts of the NRW Flood Map for Planning given in Figures 5 and 6.

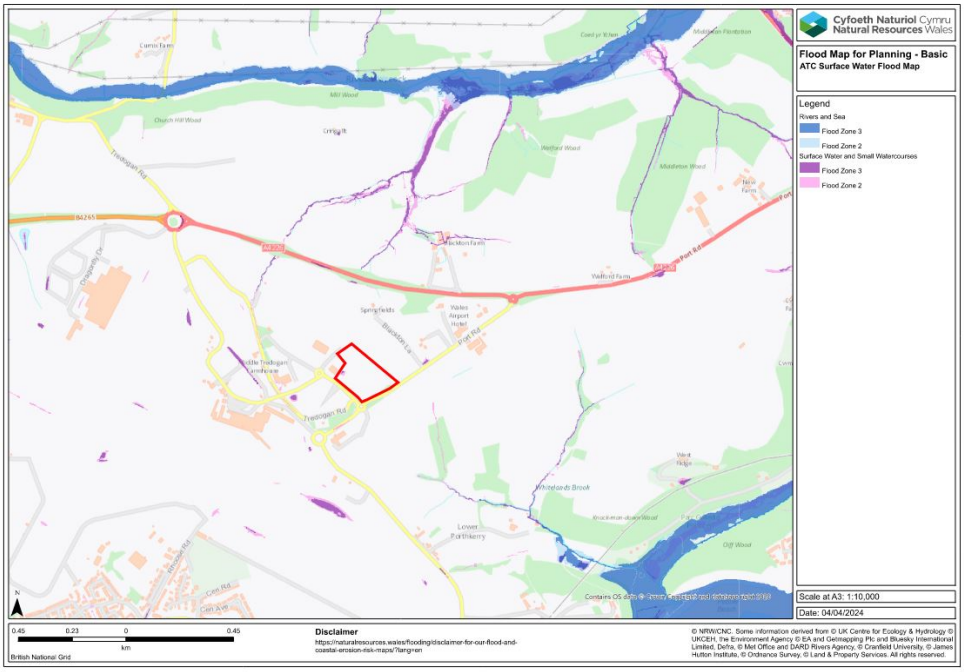


Figure 5: ATC NRW Flood Map for Planning (Surface Water)

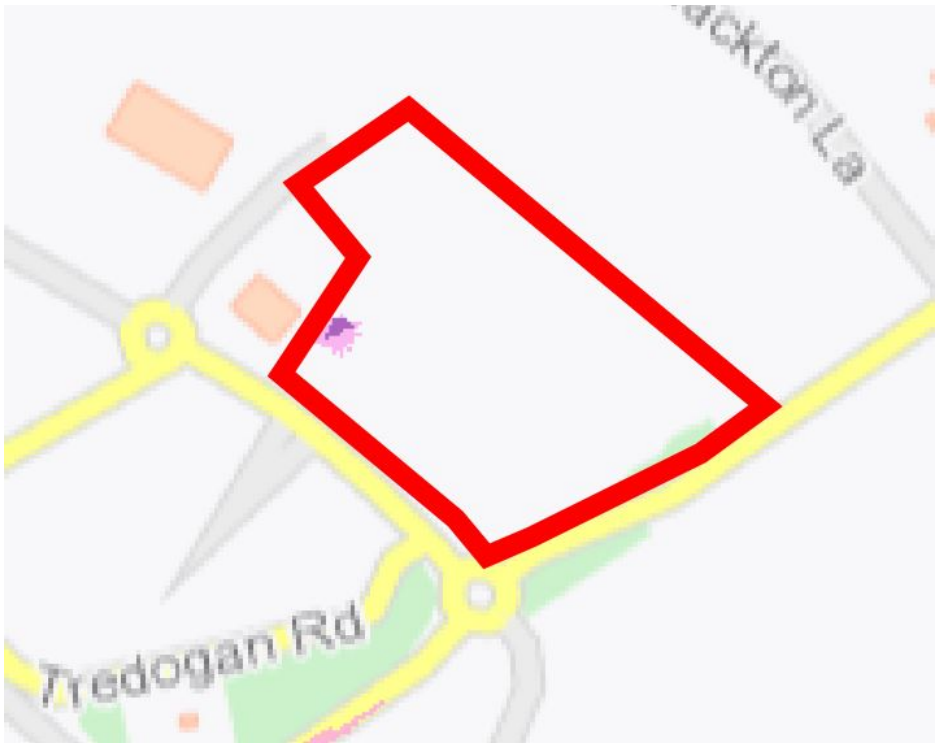


Figure 6: ATC NRW Flood Map for Planning (Surface Water) - Zoomed

The small area of flooding coincides with a local depression identified in the topographical survey and is likely to be the result of rainfall ponding in the low area during extreme storm events. The development proposals include a fully designed SuDS drainage system and therefore surface water flooding during such events will be managed as part of the proposed storm drainage provision.

4. Proposed Surface Water Drainage Strategy

As the development is over 100m^2 in area, it is subject to Schedule 3 of the Flood and Water Management Act and subsequently the storm drainage design is subject to approval by the SuDS Approval Body (SAB). As the development sits within the boundary of Vale of Glamorgan (VoG) Council, VoG are the SAB for the development.

A pre-SAB application was submitted in November 2023, and formal SAB pre-application comments were received in February 2024. The SAB raised comments and requested further information to be submitted for full SAB approval, however offered no objection in principle to the proposed drainage scheme.

A schematic illustrating the proposed surface water drainage strategy can be seen in Appendix B. The SuDS Manual hierarchy of discharge has been used to determine the appropriate storm water disposal form.

Runoff from part of the roof area will be collected and stored in a rainwater harvesting tank which will treat runoff and subsequently pump it back to the building for reuse. As only a portion of the surface water flows can be reused within the building, it is required to consider infiltration of flows to ground as for the discharge of the remaining flows, in line with the hierarchy.

Soakaway tests were carried out in September 2023 suggested that infiltration was a potentially viable strategy for the site, meaning that it must be considered as the primary discharge solution in accordance with the drainage hierarchy. If the soakaway tests showed non-viable infiltration rates for the site, further options on the discharge hierarchy would include outfall to a watercourse or sewer. However, due to the site being located 350-450m from the nearest watercourse, whilst the topography would not allow gravity connection to a nearby sewer, these options were considered less desirable.

Therefore, the general strategy taken forward is to infiltrate surface water flows to ground within the site, either at source via permeable paving and raingardens, or by transmitting to a soakaway cell in the north of the site. Attenuation storage is provided via the attenuation cell and permeable subbase beneath the car park, accommodating storm flows up to the 1:100 year storm event, with a 40% allowance for climate change. Overland flow paths have been considered if this return period is exceeded or in the case of a blockage, and the existing flow directions have been retained.

These attenuation features have been sized based on the average infiltration rates measured in the Ground Investigation in September 2023, however a second round of Ground Investigation in February 2024 generally indicated lower infiltration rates. The new results have been discussed with the SAB and an approach has been discussed and agreed to schedule a further round of testing, aimed at measuring the soakaway performance at a further depth and clarify if this is a viable solution.

If improved infiltration rates are achieved in the deeper strata then the soakaway depths will be adjusted accordingly and assessed to ascertain if this remains a viable solution. If improved rates are not achieved or the solution is not viable, then discussions will be held with the SAB regarding the alternative discharge strategies discussed above. Possible alternative solutions include attenuating flows and providing a gravity drainage connection to a water course some distance from site, or connecting into the existing highway drainage network, this is likely to require a pumped solution.

It is necessary to suitably treat all flows for pollutants before discharging from site. As mentioned previously, part of the roof is proposed to drain to a rainwater harvesting tank, which will treat and subsequently pump the flows to the northern workshop of the building where they are to be reused. It is proposed to treat the flows from the remaining roof areas using either ground-level raingarden features located around the perimeter of the building or proprietary vortex separators. Flows from the external hardstanding areas are proposed to be treated via a range of different measures including raingardens, permeable paving, proprietary vortex separators and a swale.

Since the SAB pre-application was submitted, the roof drainage strategy has been modified for the western building block, with syphonic downpipes being used to convey the roof flows to below ground internally within the building rather than externally. This meant that changes were required to be made to the treatment strategy for part of the western block roof, with more of the roof area

being routed to a below-ground proprietary treatment device, rather than utilising raingardens around the perimeter. This change to the strategy was discussed with the SAB retrospectively, who offered no objection to the changes, given that the treatment strategy is only changing for part of the western block roof.

Soft landscaping, raingardens and a swale are proposed across the site to provide pleasant spaces to learn and create amenity space for the College users. The layout of the site has been designed by the Landscape Architect, with a consideration for the best use of space for its intended purpose. Seating and external pedestrian space will be situated adjacent to the raingardens and other ground-level green landscaping features to maximise the impact of the amenity benefits provided for the end user.

The planting within the raingardens and other green landscaping will be designed by the Landscape Architect and in coordination with the Ecologist on the scheme, aiming to provide a variety of native flora and fauna.

5. Proposed Foul Drainage Strategy

The proposed development will generate foul flows and therefore require a foul drainage connection. The approximate foul peak flow has been estimated as 12.5l/s based on 2715 occupants per day, including an allowance for future expansion on the site. This assumes sprinkler tanks, pool etc are drained down out of hours, to avoid increasing the peak flows further.

In the pre-planning application response, DCWW advised that a Hydraulic Modelling Assessment (HMA) will be required. They confirmed that there is capacity in the sewage treatment works at Porthkerry however it is unknown if the networks surrounding the site have capacity. The results of the HMA will inform any upgrade works required and will provide a connection point from the site to the network. DCWW are currently undertaking the assessment and expect the final results to be delivered in June 2024. The assessment will inform an acceptable location of connection to the DCWW sewer.

Although no connection point has been offered yet, due to the shallow sloping gradients and the long lengths to drain, it is likely that a pumped solution will be required. Allowance in the masterplan has been made for a package pumping station. A pumping manufacturer has not yet been contacted as the length of rising main or allowable flow rate is not yet known, this will need to be undertaken once the HMA has confirmed these details. A foul drainage network has been designed for the site and is illustrated on the schematic in Appendix B.

6. Conclusion

A surface water drainage strategy for the site has been developed which considers the flood risk and the principles of sustainable drainage.

The flood risk maps show no risk of fluvial or tidal flooding on the site. The existing maps do however show that the existing site has a small discrete area of surface water flood risk. The development proposals include a fully designed SuDS drainage system and therefore surface water flooding during such events will be managed as part of the proposed storm drainage provision.

Following the hierarchy of discharge, it is proposed to harvest a portion of rainwater for reuse within the building where possible, and then infiltrate all storm water up to the 1:100 plus 40% climate change to the ground. Initial average infiltration test results appeared favourable, however more recent infiltration testing showed lower permeability values. Further testing is currently being arranged to investigate if higher permeability can be achieved deeper into the strata and to assess whether this remains a viable solution. If improved rates are not achieved or the solution not found to be viable, possible alternative solutions include attenuating flows and providing a gravity drainage connection to a water course some distance from site, or connecting into the existing highway drainage network, this is likely to require a pumped solution.

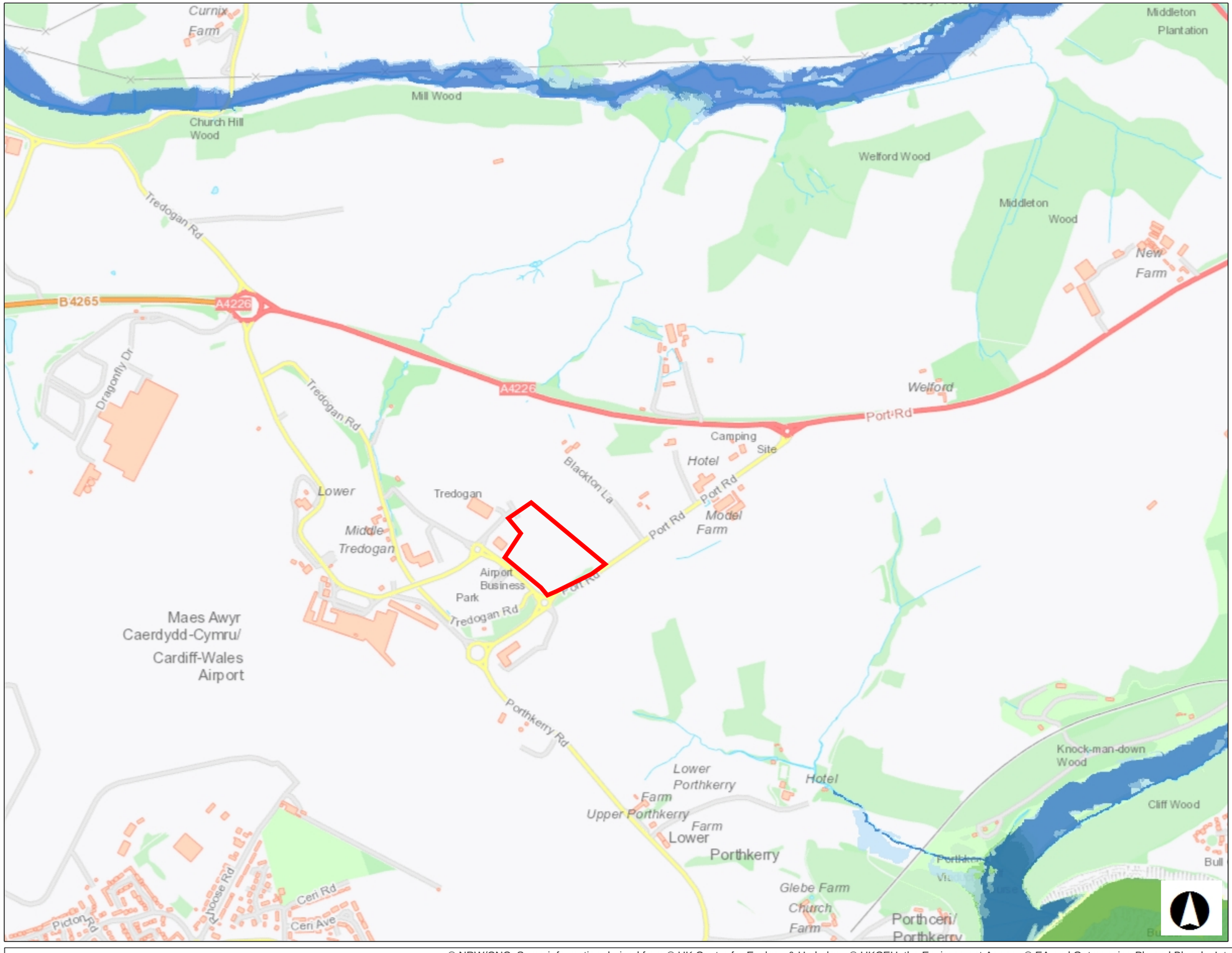
Storm water will be treated through raingardens, permeable paving, a vortex separator and a swale to ensure it is suitable quality before discharging to the ground.

A SAB pre-application has been submitted to VoG who have offered no objection in principle, although communication with the SAB is ongoing and will continue as more information is gained regarding the permeability of the existing ground to infiltrate drainage flows. The surface water drainage design will be agreed with the SAB through a full SAB application following detailed design.

DCWW are currently undertaking an HMA to ascertain an acceptable location of connection to the DCWW sewer and advise if any upgrade works are required. The outcome is expected to be received in June 2024.

Appendix A

Flood Mapping



Cyfoeth Naturiol Cymru
Natural Resources Wales

Map Perygl Llifogydd / Flood Risk Map - ATC River and Sea flood risk

Allwedd / Map Key

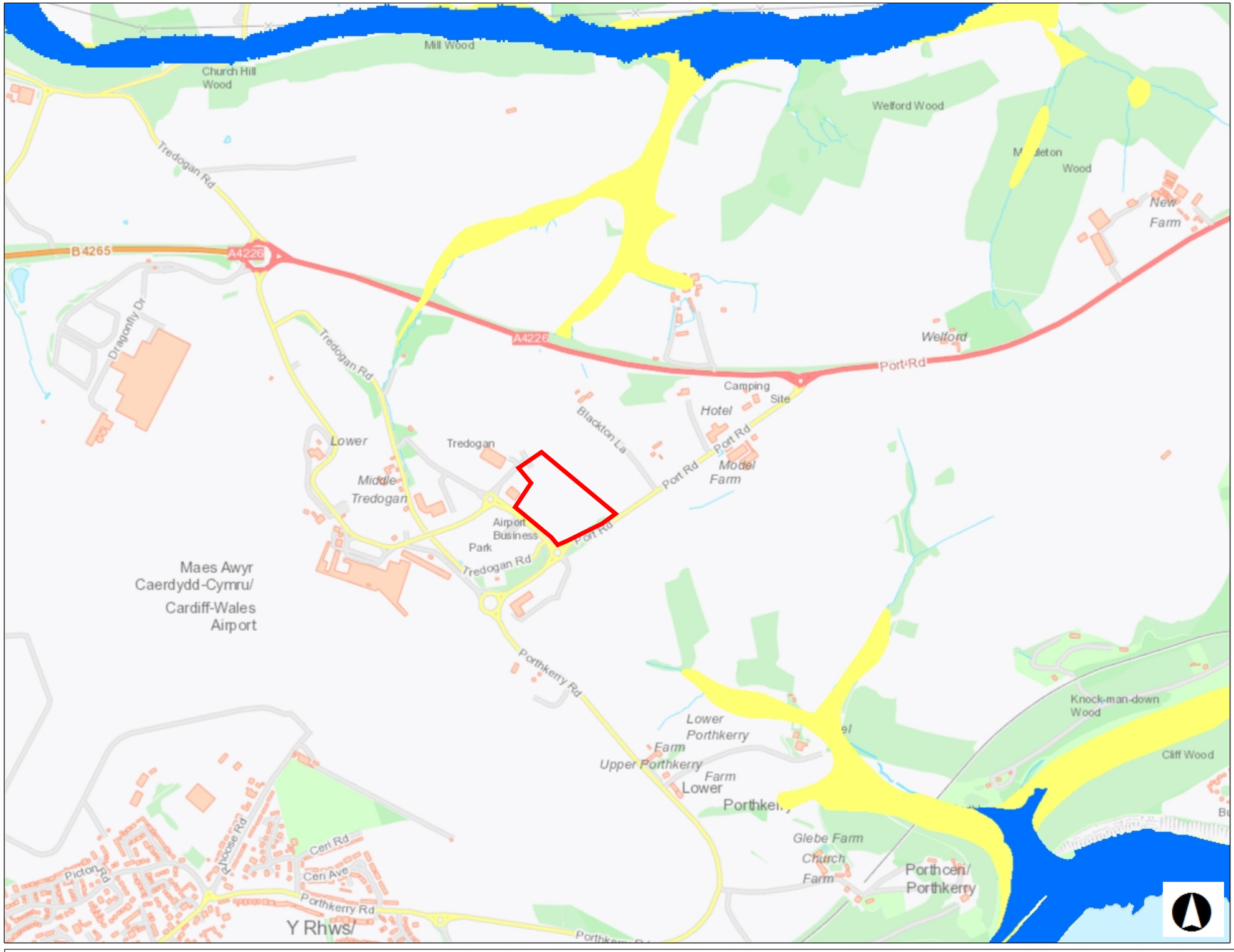
Flood Risk from Rivers - Extent
- High
- Medium
- Low

Flood Risk from the Sea
- High
- Medium
- Low

Graddfa / Scale at A3 1: 10,000

Dyddiad / Date
30/05/2022

0.5 0 0.25 0.5
British_National_Grid Kilometers



Cyfoeth Naturiol Cymru
Natural Resources Wales

Map Perygl Llifogydd / Flood Risk Map - ATC DAP

Allwedd / Map Key

- Zone C1
- Zone C2
- Zone B
- Zone A

Graddfa / Scale at A3 1: 10,000

Dyddiad / Date
30/05/2022

0.5 0 0.25 0.5
British_National_Grid Kilometers

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Map for Planning - Basic

ATC Surface Water Flood Map

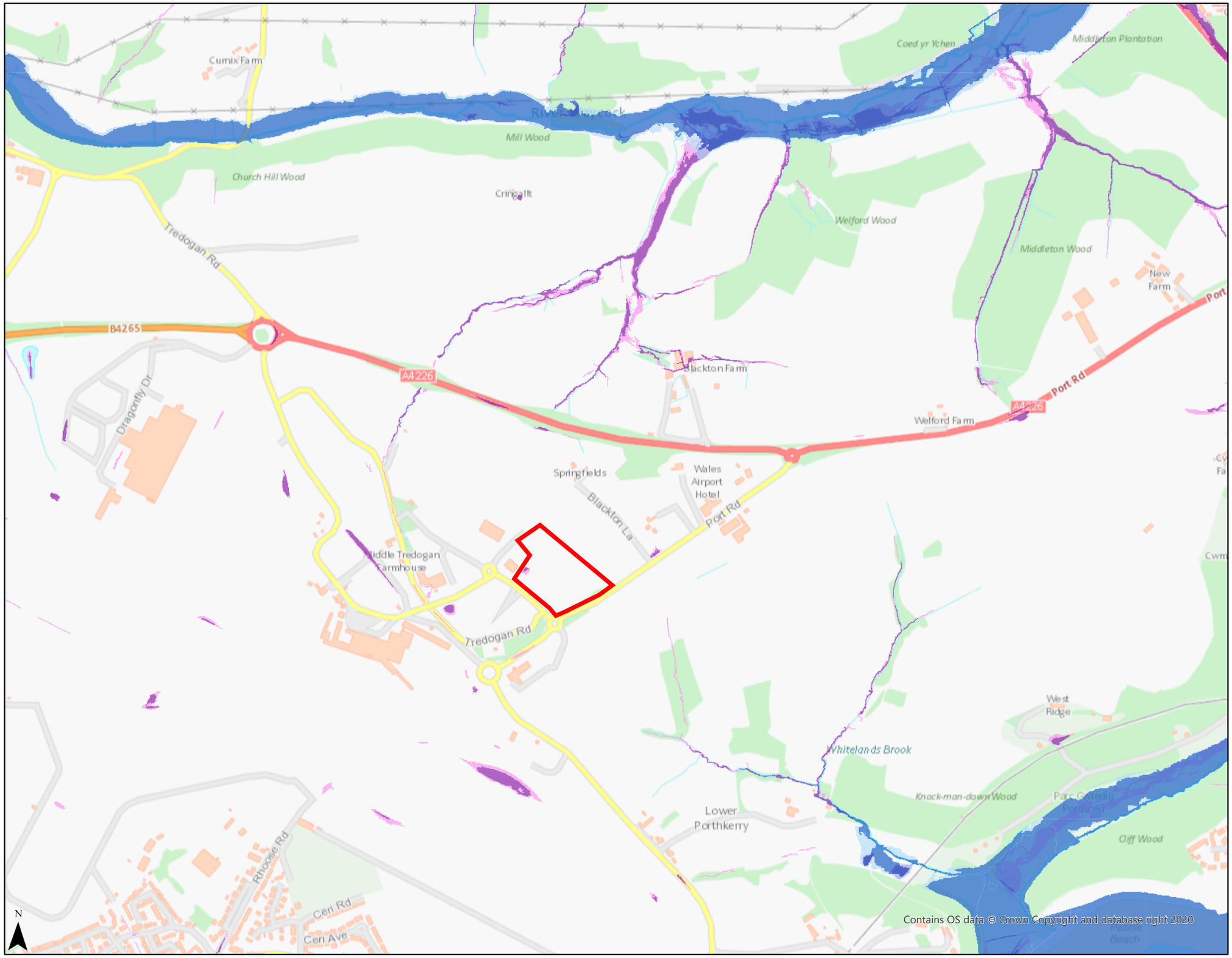
Legend

Rivers and Sea

- Flood Zone 3
- Flood Zone 2

Surface Water and Small Watercourses

- Flood Zone 3
- Flood Zone 2



Scale at A3: 1:10,000

Date: 04/04/2024

0.45 0.23 0 0.45

km

British National Grid

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https://naturalresources.wales/flooding/disclaimer-for-our-flood-and-coastal-erosion-risk-maps/?lang=en