



# Grange Road, Cwmbran

## Flood Consequence Assessment

*For Archtech Partnership LLP*

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## Appendix A – Existing and Proposed Development

## 1. INTRODUCTION

This Flood Consequence Assessment (FCA) has been prepared by Hydrock Consultants Limited (Hydrock) to support a planning application for proposed industrial development on pre-developed land off Grange Road, Cwmbran.

This report addresses the requirements of the Welsh Government Technical Advice Note 15 (TAN15)<sup>1</sup>, through:

- Assessing whether the site is likely to be affected by flooding, with consideration to the effects of climate change.
- Assessing whether the proposed development is appropriate in the suggested location in accordance with national and local planning policy.
- Presenting any flood risk mitigation measures necessary to ensure that the proposed development and future occupants will be safe, whilst ensuring flood risk is not increased (or where possible reduced) elsewhere.

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<sup>1</sup> Welsh Government (2004) Technical Advice Note 15: Development and Flood Risk (TAN15).

## 2. SITE INFORMATION

### 2.1 Site Description and Location

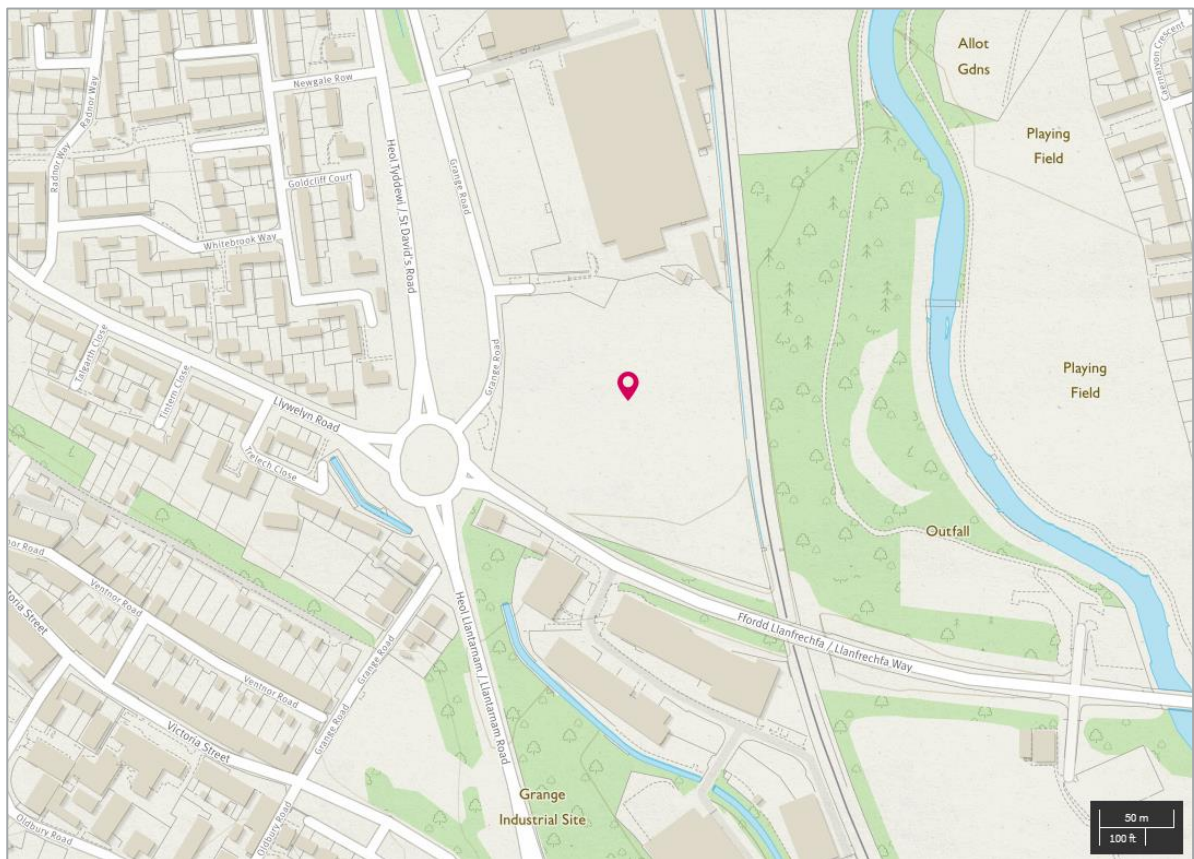
The site is located in the town of Cwmbran and is bounded by Llanfrechfa Way to the south, Grange Road to the west, a railway to the east and land currently occupied by Crane Process Flow Technologies Ltd to the north. Figure 1 shows the site location and Table 1 shows the detailed location reference.

The site is approximately 2.85ha and is classed as 'previously developed' land. From review of satellite / street-view imagery, the ground surfacing appears to be building rubble and ruderal vegetation with stock-piled material in the north-east corner.

Table 1. Site Referencing Information

|                   |                                       |
|-------------------|---------------------------------------|
| Site Address      | Grange Road, Cwmbran, Gwent, NP44 3XX |
| Grid Reference    | ST 29814 94852                        |
| Easting, Northing | 329814, 194852                        |

Figure 1. Site Location



## 2.2 Proposed Development

The proposal is for a new factory facility to serve an expansion to Crane Process Flow Technologies Ltd development to the north. The ground floor is allocated as industrial space, with an office on first and second floors. The development masterplan is included in Appendix A.

## 2.3 Hydrological Setting

The Afon Lwyd runs in a southerly direction in the small woodland approximately 140m east of the site. A tributary of this watercourse, the Cwmbrian Brook, runs through the industrial estate to the south of the site and Llanfrechfa Way. This watercourse sources in Church Wood in Thornhill, and is culverted for approximately 1km upstream of the site, between Cwmbrian Drive and Llantamam Road. The nearest reach of open channel to the site is approximately 60m to the south-west. OS mapping also shows a small drainage ditch running parallel to the railway along the eastern site boundary.

## 2.4 Site Levels

Appendix A includes a topographical survey completed by TPS in November 2014. This shows the ground is relatively flat, with a slight fall towards the south-east corner. Highest ground levels are along the western boundary at around 51.00m AOD. The south-east corner is at around 48.90m AOD, but south of this is a steep embankment up to Llanfrechfa Way.

### 3. ASSESSMENT OF FLOOD RISK

#### 3.1 Development Design and Climate Change Context

In accordance with TAN15, development should be flood free in the 1 in 100 Annual Exceedance Probability (AEP) fluvial flood or 1 in 200 AEP tidal flood accounting for climate change over the development lifetime (also known as the design flood). For industrial development, flood depths should also not exceed 1000mm within the property or across the access / egress route in the 1 in 1000 AEP fluvial or tidal event.

The effects of climate change over the estimated development lifetime is to be considered to ensure the development design is suitably safe from flooding into the future. The accepted lifetime for industrial developments is generally considered as 60-75 years. The following areas to be considered are:

- Increased peak river flows (fluvial flooding) – The Afon Lwyd catchment is within the Severn river basin district. The latest Natural Resources Wales (NRW) guidance<sup>2</sup> advises applying a 25% increase in peak flows, based on a central factor / estimate (50<sup>th</sup> statistical percentile) for the 2080s and beyond, as well as considering 70% increase in peak flows based on the upper end estimate (90<sup>th</sup> percentile) depending on the scale and nature of the development.
- Sea level rise (tidal / coastal flooding) – Table 2 shows the estimated sea level rise allowances up to 2116 as listed in the latest NRW guidance<sup>2</sup>.
- Increased peak rainfall intensity (surface water flooding) – influences proposed development drainage strategy. This is to be taken as 30% in accordance with TAN15<sup>3</sup>.

Table 2 Sea Level Rise Allowances

| Period                | 2009-2025 | 2026-2055 | 2056-2085 | 2086-2116 | Cumulative rise to 2116 |
|-----------------------|-----------|-----------|-----------|-----------|-------------------------|
| Annual change (mm/yr) | 3.5       | 8.0       | 11.5      | 14.5      |                         |
| Total increase        | 59.5 mm   | 240mm     | 345mm     | 449.5mm   | 1094mm                  |

#### 3.2 Tidal / Coastal Flooding

Based on the location and elevation of the site above sea level, tidal / coastal flooding is concluded to pose a ‘negligible’ risk.

#### 3.3 Fluvial Flooding

##### 3.3.1 NRW Flood Maps

The NRW long term flood risk maps<sup>4</sup> show that there have been no recorded historic fluvial flood events at the site, with the flood extent of the Afon Lwyd not extending as far as the railway line adjacent to

<sup>2</sup> NRW (2016) Flood Consequence Assessments: Climate Change Allowances (available at: <http://gov.wales/topics/planning/policy/policyclarificationletters/2016/cl-03-16-climate-change-allowances-for-planning-purposes/?lang=en>)

<sup>3</sup> Welsh Government (2004) Technical Advice Note 15: Development and Flood Risk (TAN15), Section 2.5, Pg 2

<sup>4</sup> NRW Long term flood risk maps, Available at: <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en>

the site (see Figure 2). However, Figure 3 shows the majority of the site is predicted to be in Flood Zone 2 (the 1 in 1000 (0.1%) Annual Exceedance Probability (AEP) fluvial flood), and the north of the site in Flood Zone 3 (the 1 in 100 (1%) AEP fluvial flood).

Figure 2. Historical Flood Map

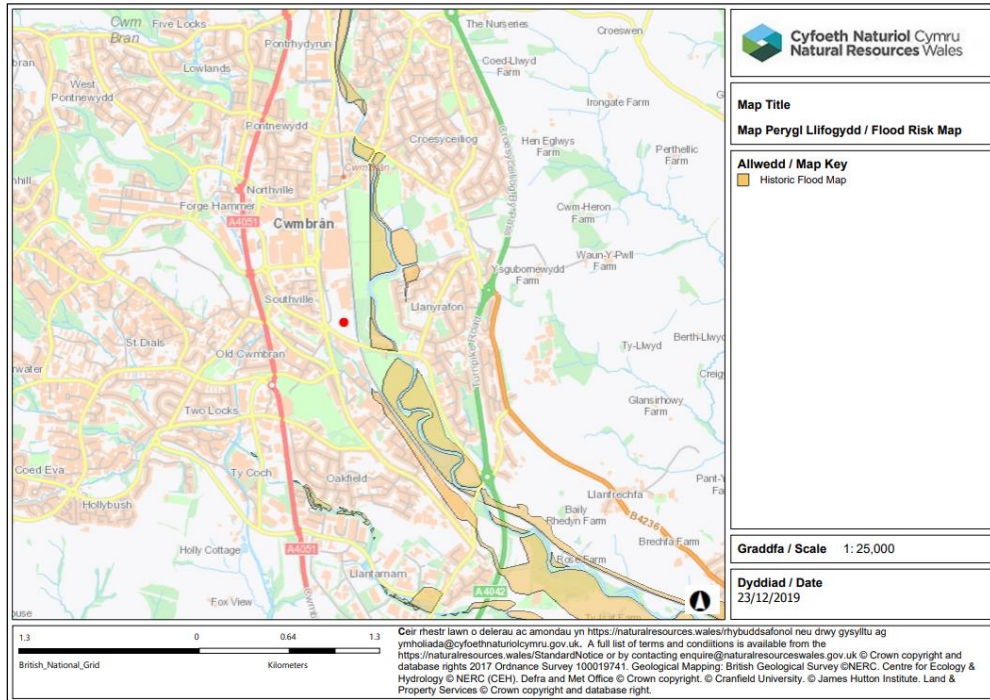
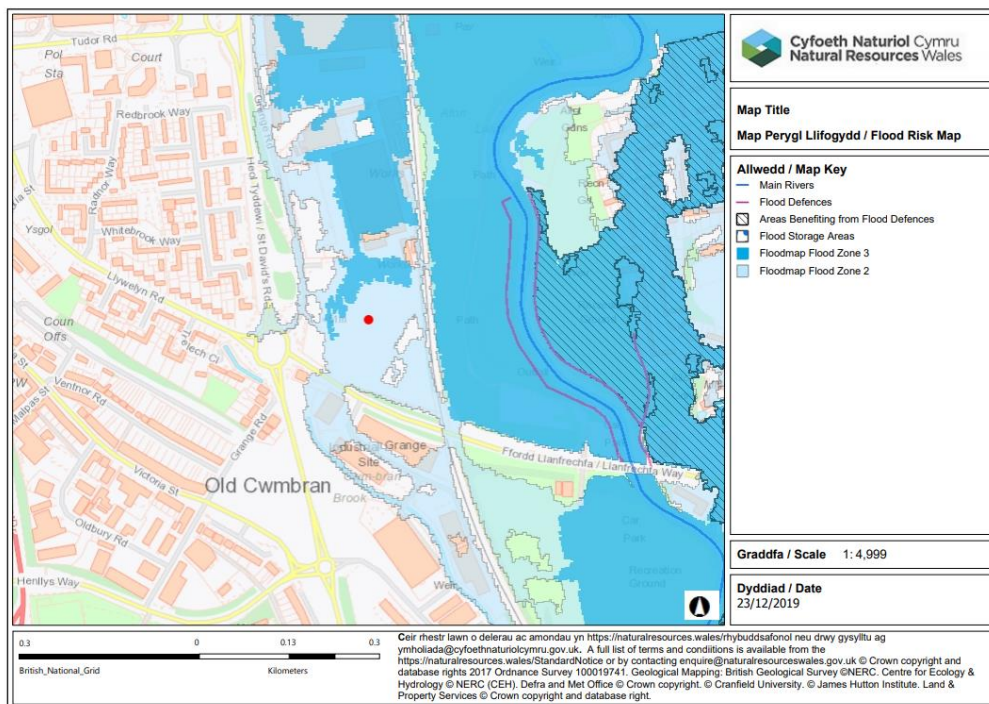


Figure 3. Flood Zone Map





### 3.3.2 Detailed Assessment

Hydrock obtained the Afon Lywd Integrated Catchment Model (2018) from the NRW in order to get a better understanding of the fluvial flood levels and depths in the critical flood events.

The model grid was updated to include the topographical survey levels which gives a more accurate representation of ground levels across the site than the LiDAR data. It was also observed that the ground levels along the railway embankment adjacent to the site are not correctly represented, with the embankment suddenly increasing from around 1.5m in height to 4m in areas (with trees expected to be skewing the ground level data). Therefore, a patch was included along the railway embankment where the inaccurate LiDAR levels were observed and ground levels were specified based on embankment levels to the north and south (see Figure 4). These model updates are being submitted to the NRW for their review, with a hydraulic modelling report if required.

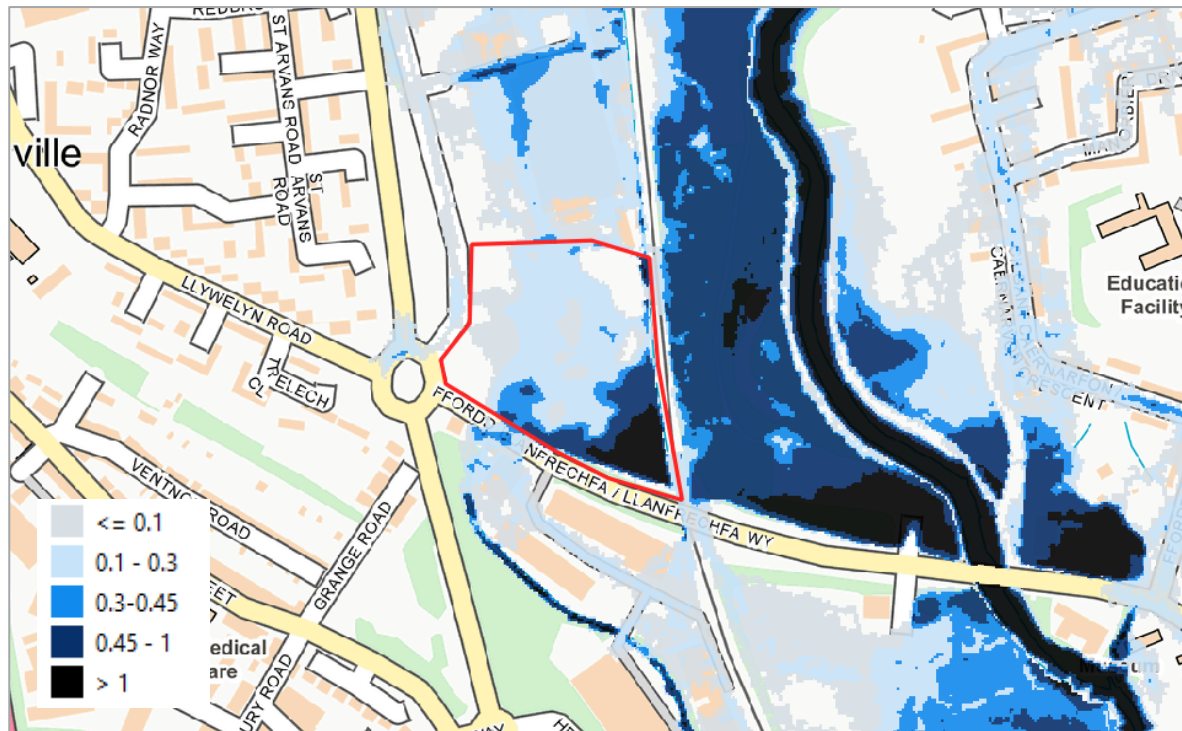
Figure 4. Railway Embankment Correction



The model was re-run for the 1 in 1000 year event following these updates and the resulting flood depth map is shown in Figure 5. The depths across the majority of the site are below 0.3m, but flood depths reach up to 1.4m in the south-eastern corner where the land levels are lowest. The flood depths at the site access reach a maximum of 0.4m.

The model shows that the flooding which occurs at the site is as a result of the Blaen Bran (a tributary of the Afon Lwyd) exceeding the capacity of a watercourse culvert below Cwmbran Drive (A4051) approximately 1.7km north of the site. Flows are shown to be channelled southwards along Cwmbran Drive and through Northville, eventually entering the north of the site at the location of the existing access. Flows continue through to the south of the site and overtop the railway embankment and south-western boundary, re-joining the main floodplain of the Afon Lwyd.

Figure 5. Flood Depth (m) in the 1 in 1000 year event - Baseline



From review of this data, the flood risk to the site from fluvial flooding is concluded to be 'high' and the mitigation of this risk is a major design consideration. This is discussed in further detail in Section 4.

### 3.4 Surface Water

Surface water flooding occurs as the result of an inability of intense / prolonged rainfall to infiltrate to ground. This can happen when the maximum soil infiltration rate or storage capacity is exceeded, or in urban areas as a result of man-made impermeable surfaces. Such flows either drain into existing land drainage features or follow the general topography which can concentrate flows and lead to localised ponding / flooding.

The NRW surface water flood mapping shows the low-lying ground in the south-east of the site is at a 'high' risk of surface water flooding, where flooding would be expected every 1 in 30 years or greater, not accounting for any culverts or drainage systems (see Figure 6). There is also a flow pathway indicated in the 1 in 1000 year 'low risk' storm event entering the site from the north and travelling around the eastern and western site extents, leaving the centre of the site flood free, i.e. 'very low' risk.

The proposed measures for mitigating fluvial flooding (discussed in Section 4) will address the indicative surface water flood risk at the site in the 1 in 1000 year event, directing flow paths away from buildings. The surface water drainage network will also be designed to safely manage surface water generated within the site for the 1 in 100 year plus climate change storm.

Figure 6 Natural Resources Wales Surface Water Flooding



### 3.5 Sewer Flooding

Various strategic flood risk reports were reviewed in order to understand the likelihood of sewer flooding at the site. This included the Section 19 Flood Investigation Report<sup>5</sup>, Preliminary Flood Risk Assessment<sup>6</sup> and Local Flood Risk Management Strategy<sup>7</sup>. There was no specific mention of sewer flooding by location in these reports. However, a previous site-specific FRA report prepared for the site in 2017<sup>8</sup> stated that discussions were held with Dwr Cymru/Welsh Water who confirmed there have been no recorded incidents of sewer flooding associated with the sewers which cross the site. Furthermore, there are no surface water flow pathways entering the site for events less than the 1 in 1000 year storm, and so the risk to the site from any surcharged sewers upslope is concluded to be 'low'.

### 3.6 Groundwater Flooding

The British Geological Survey (BGS) Geology of Britain viewer<sup>9</sup> indicates the site is underlain by the solid bedrock 'Raglan Mudstone Formation' which comprises mudstone and sandstone. Superficial 'alluvium' deposits are also expected to be present overlying the bedrock associated with historic river deposition. A ground investigation report<sup>10</sup> undertaken for the previous planning application in 2015 reported made

<sup>5</sup> Torfaen County Borough Council, 2014, Flood and Water Management Act 2010 Section 19 Flood Investigation Report – Cwmbran

<sup>6</sup> Torfaen County Borough Council, 2011, Preliminary Flood Risk Assessment (PFRA)

<sup>7</sup> Torfaen County Borough Council (2012) Local Flood Risk Management Strategy

<sup>8</sup> Arcadis (2017) Flood Consequences Assessment - Stage 1 (ref: 5001-UA008859-BMR-03)

<sup>9</sup> Available on the BGS website at: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>

<sup>10</sup> Geotechnics (2015) Ground Investigation (ref: PC145831)

ground to depths between 0.80 and 1.60m, clayey silt (alluvium) to depths between 1.40 and 2.00m, sandy gravelly silt (alluvium) to depths between 4.70 and 5.65m with Raglan Mudstone below. Seepages of shallow perched groundwater were encountered in some of the trial pits within the made ground at up to 0.1m below ground level (m bgl), but long-term monitoring confirmed the main groundwater table was encountered in the alluvium around 1.00 to 1.50m bgl.

The groundwater table in the alluvium will be hydraulically linked to the river levels in the Afon Lwyd to the east of the site. The flood model shows that fluvial flood waters from the Braen Bran have already reached the site before river levels in the Afon Lwyd rise to above the lowest site level. Therefore, the risk of groundwater emergence at surface before the site is already flooded is concluded to be 'low'. However, consideration should be given to how groundwater is to be managed in excavations during the construction phase.

### 3.7 Infrastructure Failure Flooding

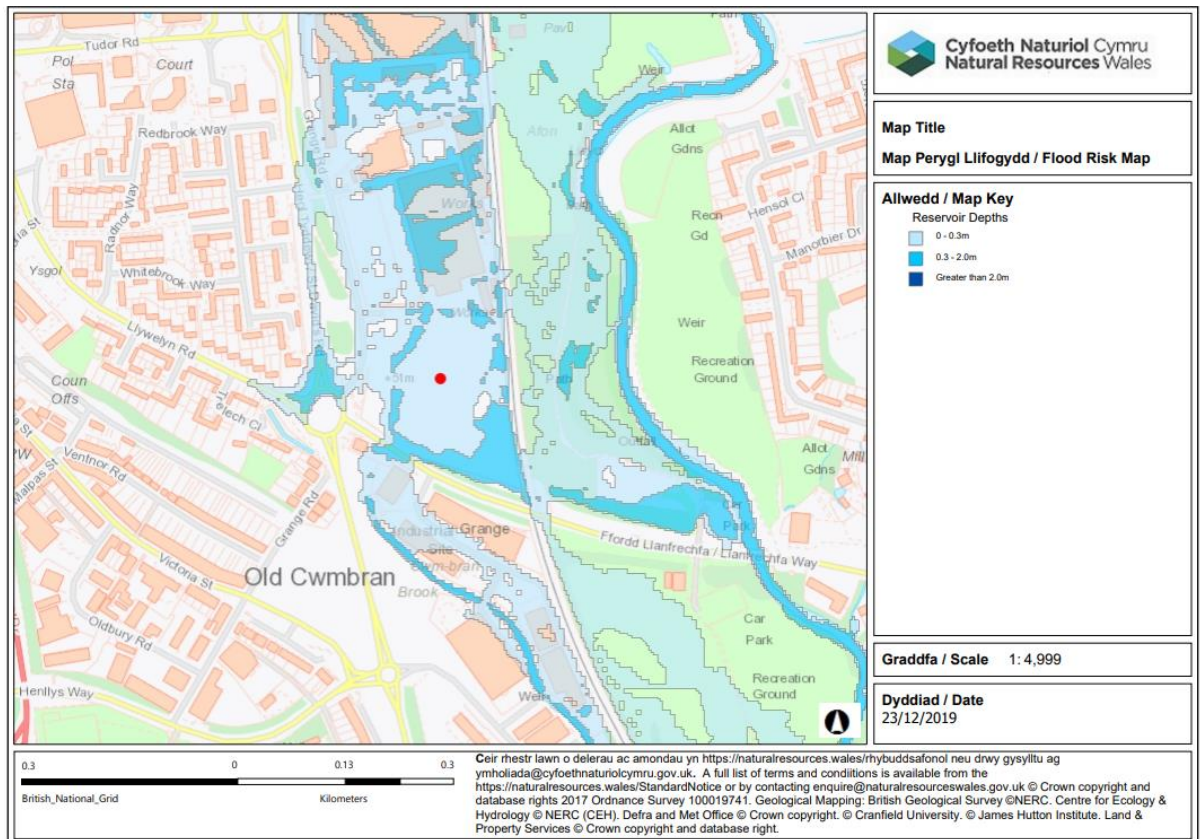
Artificial infrastructure refers to artificially raised waterbodies, reservoirs or canals which pose a residual flood risk of a breach in banks.

The Blaen Bran reservoir is located upstream of the proposed development site, approximately 4.5km away. The NRW 'Risk of Flooding from Reservoirs' map (see Figure 7) shows that the proposed development site is located within the flood extent associated with the failure of the reservoir.

Under the Reservoirs Act 1975 (and subsequent amendments), the reservoir owner is required to ensure that reservoir safety is maintained through regular inspections and maintenance by qualified civil engineers appointed by Defra. Whilst the consequences of reservoir breaching can be very high, continuing management of reservoirs under the Reservoirs Act serves to greatly reduce the likelihood of a breach occurring. The flood extents are also similar to that of the 1 in 1000 year fluvial flood, and so will be mitigated in the same manner discussed for fluvial flooding in (see Section 4). Furthermore, due to the distance of the site from the structure, the flood velocities are shown to be relatively low at no more than 0.5 m/s.

The proposed development is located approximately 800m south-east of the Monmouthshire and Brecon canal. Whilst the canal is situated at a higher elevation than the site, it is not embanked and there is high ground (including the A4051) between the structure and the site. Therefore, the risk from this source is concluded to be 'low'.

Figure 7 Reservoir Flooding



## 4. DEVELOPMENT SUITABILITY AND PROPOSED MITIGATION

### 4.1 Summary of Flood Risk and Mitigation Requirements

Table 3 provides a summary of the flood risk to the site from the various sources and the implications for mitigation.

*Table 3: Summary of Potential Sources of Flood Risk*

| Flood Source    | Risk  | Mitigation Requirements  |
|-----------------|---|--|
| Tidal / Coastal | Negligible  | None   |
| Fluvial         | High  | Major design consideration - see Section 4.2.  |
| Groundwater     | Low risk for proposed development but could be encountered in construction phase. | Contractors construction method statement to allow for groundwater management measures in excavations. |
| Surface Water   | High  | Measures for mitigating fluvial flooding will address this risk - see Section 4.2.                     |
| Sewer           | Low   | None   |
| Infrastructure  | Low risk of occurrence but site is within reservoir floodplain.                   | Measures for mitigating fluvial flooding will address this risk - see Section 4.2.                     |

### 4.2 Planning Policy Requirements

#### 4.2.1 *Justification Test*

The Welsh Government Development Advice Map (Figure 8) shows the majority of the site is classified as Zone C2 which is defined as areas within the 1 in 1000 AEP floodplain not benefiting from significant flood defences. The proposed industrial development is considered 'less vulnerable' to flooding in accordance with Figure 2, Paragraph 5.1 of TAN15. Figure 1, Paragraph 4.2 of TAN15 states that less vulnerable development may be considered acceptable in Zone C2, subject to passing the justification test, including acceptability of flooding consequences.

Paragraph 6.2 of TAN15 states that the development will pass the justification test if:

1. Its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or,
2. Its location in zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;  
and,
3. It concurs with the aims of PPW and meets the definition of previously developed land (PPW fig 2.1); and,
4. The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.

The Local Development Plan (LDP)<sup>11</sup> for Torfaen was reviewed to understand the objectives of the local authority for the site and whether the site meets points 1 and 2 of the justification test. The site is mentioned in the report in page 51, referred to as 'Eastern Strip South'. It is considered to be an 'opportunity area' where the council is aware that the site has the potential to be developed in the

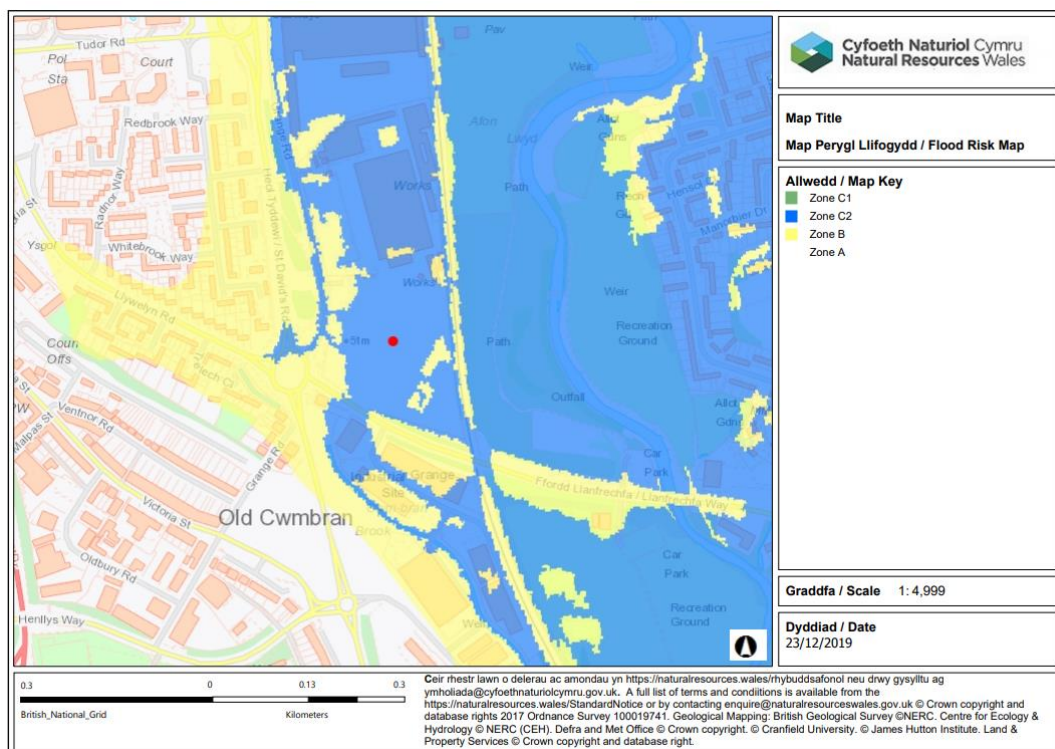
<sup>11</sup> Torfaen County Borough Council (2013) Local Development Plan (to 2021) Adopted December 2013

future, but there was insufficient evidence to support their allocation in the LDP. The key constraints mentioned were contamination and flood risk. The council's vision for the area is:

*'...the comprehensive redevelopment of the site, to create a quality and distinctive location that integrates well to the Town Centre. Any proposals for this site should take full account of the need to integrate fully with the Eastern Strip Central SAA, the Town Centre and wider proposals.'*

It is understood that discussions have already taken place with the council in the development of the masterplan to ensure that the proposals meet their vision and objectives in order to pass the first part of the justification test (Points 1-3). The purpose of this FCA is to demonstrate that the final part of the test is passed, which is discussed in the following sections.

Figure 8. Development Advice Map



#### 4.2.2 Proposed Ground Re-Levelling

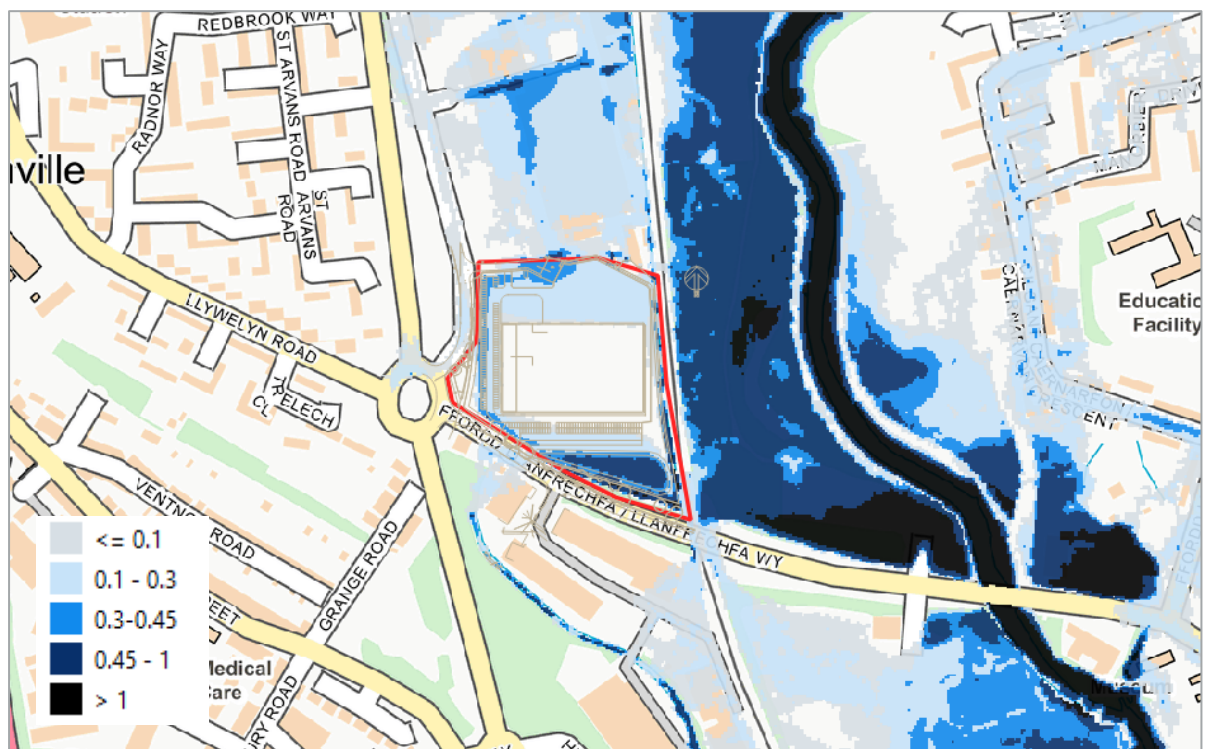
The proposed Finished Floor Level (FFL) of the industrial building is 50.875m AOD, with level access required in the loading zone on the northern frontage. Ground levels in the external areas surrounding the building have been designed to channel flood waters around the building and provide storage in a flood event which compensates for ground raising in the existing area of low-lying ground in the south of the site. A bund has also been proposed along the south-western site boundary in order to restrict the flood flow path over Llanfrechfa Way.

There is an attenuation basin proposed within the south of the site as part of the surface water drainage strategy. The ground level was modelled from the basin top water level of 47.70m AOD which assumes a worst-case scenario that the 1 in 1000 year flood coincides with the peak of the critical 1 in 100 year plus climate change storm. This was to ensure the site would be able to store both the fluvial

flood water from the Blaen Bran and surface water generated from the site without causing detriment elsewhere.

The proposed ground surface has been included in the Afon Lwyd model and run for the 1 in 1000 year event. Figure 9 shows the modelled flood depths on site in this proposed development scenario. The building is flood free in the 1 in 1000 year flood event, which means it will also be flood free in the design 1 in 100 year fluvial flood accounting for climate change. The maximum flood depth within the car park and access into the site is 420mm (measured in the south-west corner of the site), which is below the maximum allowable flood depth of 1m in this event.

Figure 9. Flood Depth (m) in the 1 in 1000 year event - Proposed

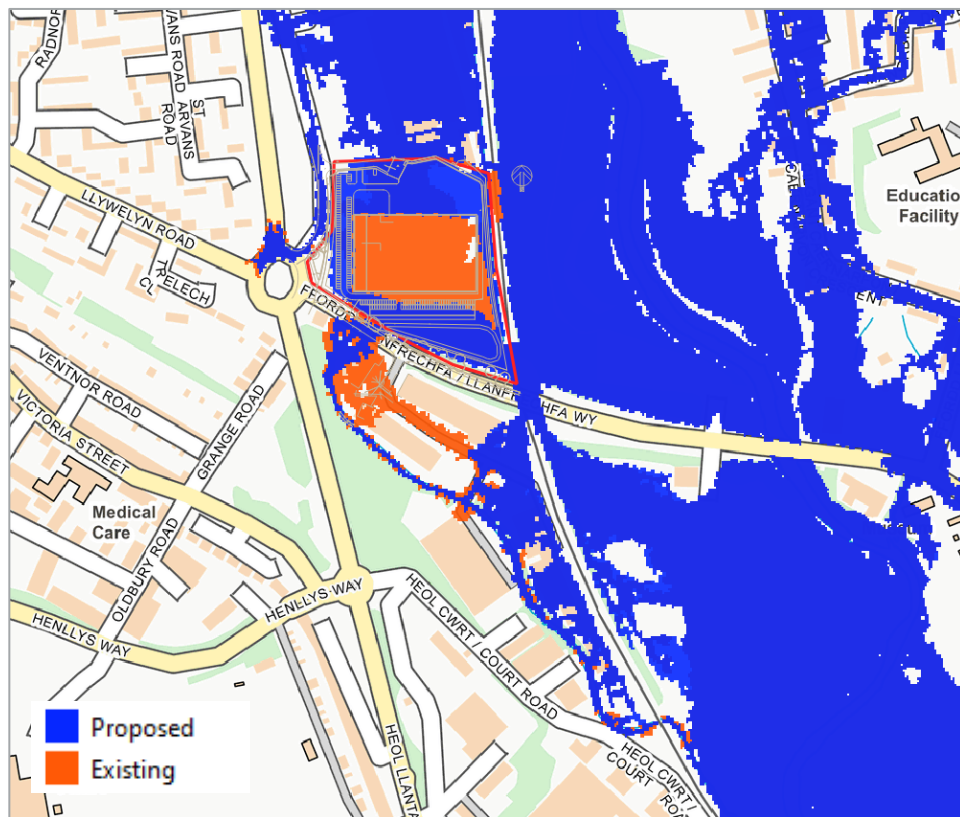


#### 4.2.3 Development Impact on Flood Risk Elsewhere

With a proposed bund of 200-300mm height along the south-western boundary, the flood risk is reduced to the existing industrial development immediately south, including a reduced flood extent around the buildings, and removal of part of the access road off Llanfrechfa Way from the floodplain. There is also a very minor reduction in floodplain extent on the roundabout / St. David's Road by the south-western corner of the site. This is more clearly demonstrated in Figure 10 which shows the areas of reduced flood extent in blue, with the existing flood extent in orange below.



Figure 10. Existing Flood Extent Below Proposed



There is a very minor increase in floodplain predicted within the public parkland and eastern edge of one of the industrial units to the south-east of the site. Figure 11 shows the areas of increased flood extent in blue, and Figure 12 shows the difference between existing and proposed flood depths. The increase in flood depths reaches up to 50mm on the eastern extent of the industrial unit and 80mm in the parkland. The maximum floodplain depths in the eastern industrial area post development is up to 200mm.

The indicated increase in flood depths is as a result of a flow path overtopping the railway embankment in the south-eastern corner of the site, which is fed by flows from the western section of the site, as well as flows channelled along the eastern site boundary between the site and railway embankment. This flow path also exists in the baseline scenario but is less confined along the eastern boundary. It is not possible to prevent flows overtopping the embankment at this location as the low-lying ground running parallel to the railway is outside of the site boundary.

The ground levels proposed, including the 200-300mm high bund along the south-western boundary, represents the best-case scenario for minimising offsite flood risk. This was confirmed through running a number of iterations of ground level proposals. It was found that altering the flood storage provision on the site had little impact on flood levels and the main concern is with flood conveyance i.e. altering flow paths.

Figure 11. Proposed Flood Extent Below Existing

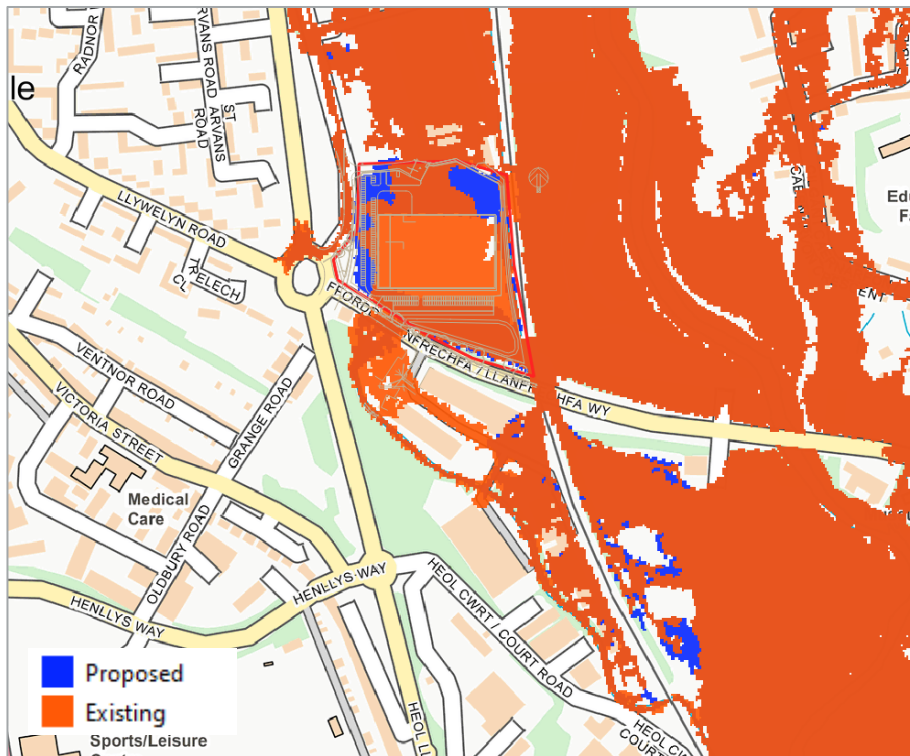
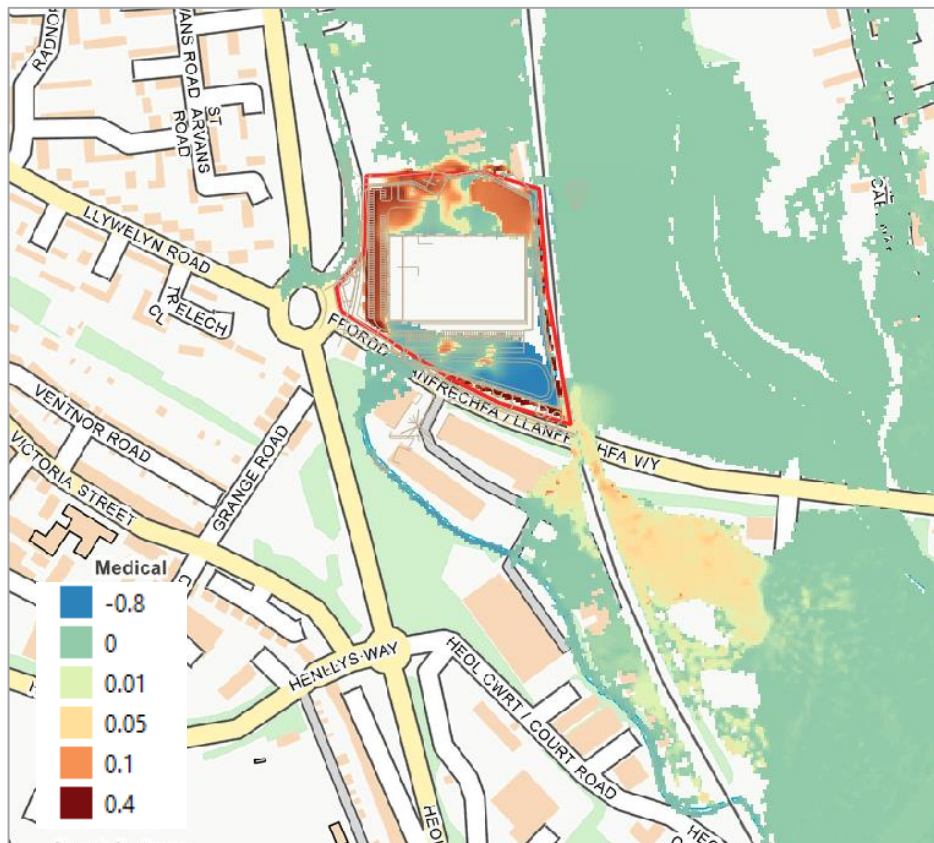


Figure 12. Changes in Flood Depths Post-Development



The consequences of the increased flood risk are considered to be acceptable for the following reasons:

- The increased flood depths occur in areas already within the floodplain i.e. no new development is brought into the floodplain and there is only a very minor change in the floodplain where there is existing development.
- Access / egress is not impeded as a result of the increased flood extent, and the removal of the northern stretch of the access road from the floodplain will actually improve access / egress for all industrial buildings to the south of the site.
- Where there is an increase in flood depths, the increase is relatively minor. As the entrances to the existing industrial building are not raised, this wouldn't lead to a scenario where the building now floods when previously it didn't.
- The industrial building is considered 'less vulnerable' and the parkland is considered 'water-compatible' development.

#### 4.2.4 *Flood Evacuation Plan*

A flood evacuation plan will be produced which will inform future occupants of the risk to the site in extreme events, the procedures for preparing for a flood and the actions required in the event of evacuation.

The development is to be signed up to receive flood warnings which will allow the site to be evacuated in the dry prior to a flood event occurring. There is also a first-floor level proposed which will provide a place of safe refuge for occupants and any important and vulnerable items.

## 5. SUMMARY AND CONCLUSION

This report supports the proposed industrial development on existing industrial land off Grange Road.

The report confirms that the site is within the NRW's Flood Zones 2 and 3 and Zone C2 in the development advice maps, with a 'high' risk of fluvial flooding from the Blaen Bran, a tributary of the Afon Lwyd. Surface water, groundwater and artificial infrastructure failure also pose a potential risk to the site, although the risk posed is less significant than that of fluvial flooding.

It is understood that the council have previously considered the site for re-development and discussions have taken place with the council in the development of the masterplan to ensure the development passes the first part of the justification test.

Hydraulic modelling of the post-development scenario has been undertaken with a proposed floor level of the industrial building of 50.875m AOD. Also included in the model was a 200-300mm high landscaped bund along the south-western boundary and the proposed attenuation basin. The basin was modelled at the top water level of 47.70m AOD which assumes a worst-case scenario that the 1 in 1000 year flood coincides with the peak of the critical 1 in 100 year plus climate change storm.

The results demonstrate that the building would be flood free in the 1 in 1000 year event, with a maximum flood depth in the car park and access to the site of 420mm, which is less than the maximum allowable flood depth of 1m in a 1 in 1000 year event. A flood evacuation plan is also proposed to provide the site with dry access and egress in the design 1 in 100 year storm.

There is a reduced flood extent in the industrial area to the south of the site as a result of the proposed landscape bund, which includes the removal of part of the access road off Llanfrechfa Way from the floodplain. There is a minor increase in floodplain predicted within the public parkland and along the eastern edge of one of the industrial units to the south-east of the site. However, the consequences of this minor increase are considered to be acceptable as there are no new areas or buildings being brought into the floodplain and access and egress is improved for the industrial area post-development.

This report therefore demonstrates that provided an appropriate sustainable drainage scheme is employed, the proposed scheme:

- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient.
- Will not place additional persons at risk of flooding and will offer a safe means of access and egress.
- Will not increase flood risk elsewhere as a result of the proposed development through the loss of floodplain storage or impedance of flood flows.

As such, the application is concluded to meet the flood risk requirements of the TAN15 and Welsh Government planning policy.

## Appendix A – Existing and Proposed Development

| Title              | Source                  | Reference  |
|--------------------|-------------------------|------------|
| -                  | Arctech Partnership LLP | -          |
| Topographic Survey | TPS                     | G__L(00)01 |



