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# CAMBRIA

Constructive Thinking

**Report Title**  
FLOOD CONSEQUENCE ASSESSMENT (FCA)  
& DRAINAGE STRATEGY

**Project**  
UPPER COSMESTON FARM

**Report Reference**  
CC1857-CAM-ZZ-XX-RP-C-00-0001

**Client**  
AUSTIN SMITH LORD  
WELSH GOVERNMENT

**Date**  
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## **REPORT CONTROL SHEET**

**Client:** Austin Smith Lord / Welsh Government

**Project:** Upper Cosmeston Farm

**Job Number:** CC1857

**Report Title:** Flood Consequence Assessment (FCA)  
& Drainage Strategy

**Report Reference:** CC1857-CAM-ZZ-XX-RP-C-00-0001

**Prepared By:** B Whyman

**Reviewed and Authorised By:** B Whyman

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## 0 INTRODUCTION

- 0.1 Cambria Consulting Ltd have been commissioned by Austin Smith Lord on behalf of the Welsh Government to provide a Flood Consequence Assessment and Drainage Strategy Report in support of a master planning exercise and outline planning application for 576 new residential dwellings and associated infrastructure located at Upper Cosmeston Farm, Vale of Glamorgan.
- 0.2 Zones of flood risk across Wales have been identified through Development Advice Maps (DAMs) included with the Technical Advice Note (TAN) 15: Development and Flood Risk guidelines published in July 2004. Updated DAMs were issued in 2009 and more recently a larger scale interactive version has become available on the Welsh Government's website with data revised as recently as January 2015. Flood risk maps are also available on the Natural Resources Wales (NRW) website. These maps are still under development and detail flood risk from main rivers, sea, surface water and reservoirs. NRW's latest interactive map shows the site lying primarily within Zone A with some of the site falling into Zone B. Zone A is defined as being at little or no risk of fluvial or tidal/coastal flooding. Zone B are areas known to have flooded in the past evidenced by sedimentary deposits
- 0.3 Given the classification, the primary driver for this report is to ensure the proposed development is suitable to the location and whether suitable measures can be incorporated to ensure that the development is as safe as possible. The report will also ensure an effective surface water management strategy is implemented and disposal is achieved without adverse flood risk impacts. This is aligned to the objectives of the Welsh Government's Planning Policy Wales, Edition 10, December 2016.
- 0.4 This FCA follows the numbering of seventeen points listed in paragraph A1.17 of TAN 15 Appendix 1 with relevant information on the development site and its setting described under the appropriate headings.
- 0.5 At this stage, proposals are largely limited to 'planning' level. This FCA is therefore commensurate with this level of detail and seeks to establish the principles of mitigation to be integrated into the detailed design of the scheme.
- 0.6 This report has been informed by desk study observations, a site walkover, NRW's flood mapping service, an Envirocheck Report obtained from Landmark Information Services, in support of Cambria's own assessment of the fluvial and pluvial flood risks and groundwater flood susceptibility of the area.

# 1 SITE LOCATION

- 1.1 The development site is located at Upper Cosmeston Farm, Lavernock Road.
- 1.2 The site is approximately 25.2ha and a mixture of greenfield land comprising fields that make up winter paddocks and associated with the livery, historic former quarry used as summer paddocks, historic former quarries and landfill and fields used for crop growth. A former railway embankment runs through the central portion of the site. The site is bounded by residential development to the north, Lavernock Road to the west, fields to the south and the coastline to the east.
- 1.3 The site is centred around OS coordinates E: 318280, N: 169157 see in Figure 1.1 below;
- 1.4 A more detailed site location plan is included in **Appendix A**.

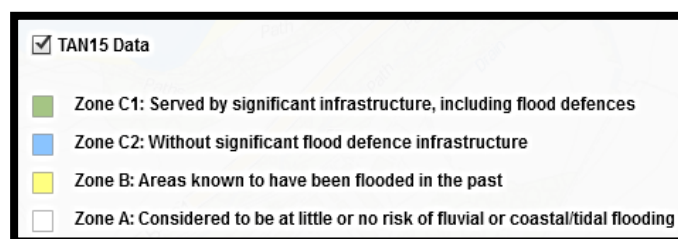
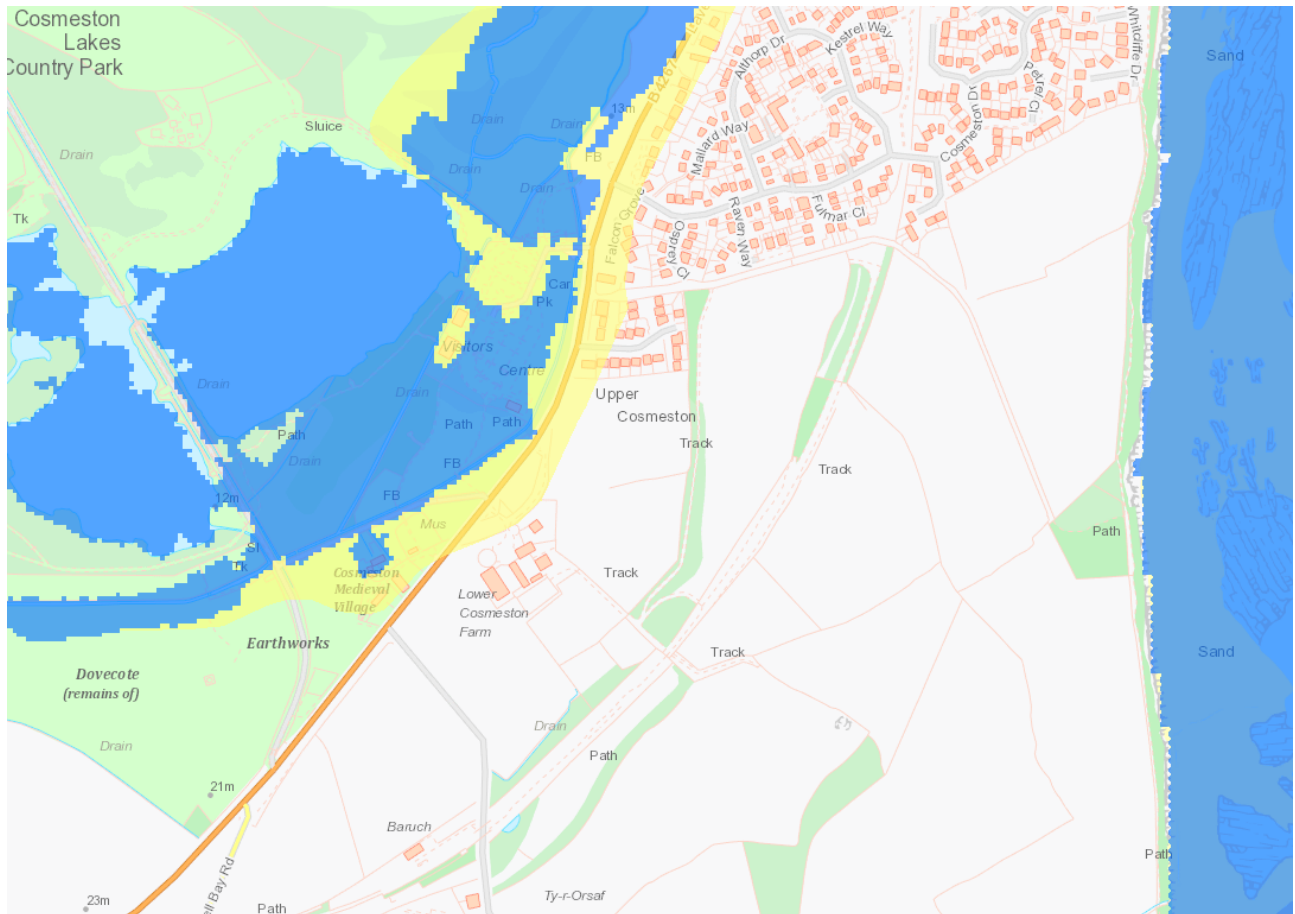


**Figure 1.1 - Location Plan**

*Source: Google Earth*

**CC1857 Upper Cosmeston Farm – FCA & Drainage Strategy**

1.5 The Development Advice Maps (DAM) show the majority of the site is in Zone A with some of the area falling into Zone B. Zone A is defined as being at little or no risk of fluvial or tidal/coastal flooding. Zone B are areas known to have flooded in the past evidenced by sedimentary deposits. An extract of the DAM map is shown in Figure 1.2 below;

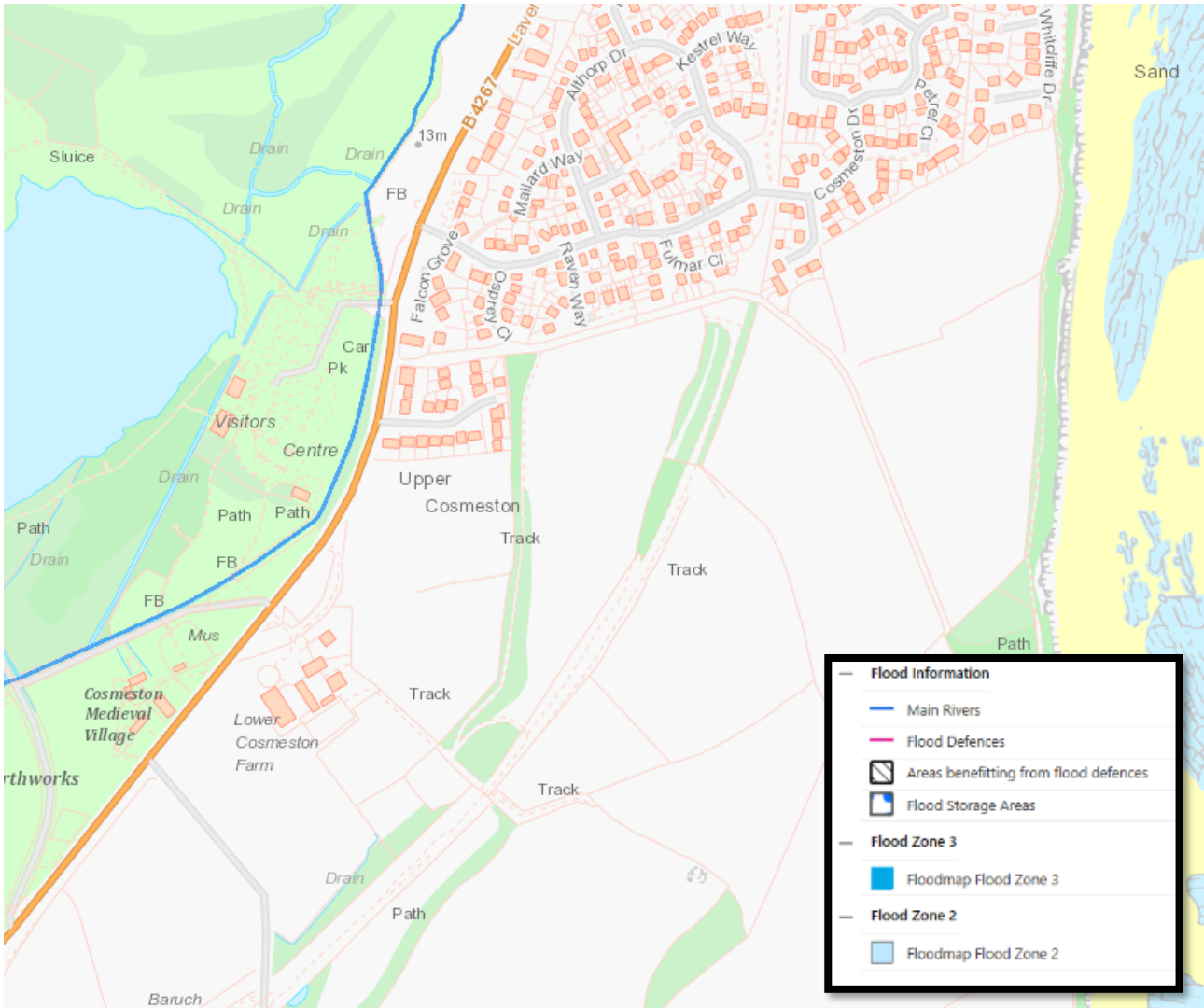


**Figure 1.2 – Flood Risk Zone**  
Source: Natural Resources Wales, DAMs

1.6 The development type would be considered residential premises and therefore is classified as a **‘highly vulnerable development’** within TAN 15. TAN 15 aims to direct development towards sites within Zone A. As the site is situated predominantly in Flood Zone A, partially in Zone B and away from Zone C, it concurs with the aims of TAN 15 and no further justification is required.

### Main Rivers and Ordinary Watercourses

1.7 The NRW Mapping data, shown on Figure 1.3, shows the site is in close proximity to Sully Brook, which is indicated as a main river.



**Figure 1.3 – Main River**

Source: Natural Resources Wales, Flood Risk Map

## 2 EXISTING TOPOGRAPHY

- 2.1 A topographical survey of the site has been provided, a copy of the survey drawing is included within **Appendix C**.
- 2.2 The site generally falls from east to west. The highest point on the site is approx. 36.30mAOD and the lowest point approx. 12.50m AOD. There are two distinct level changes at the points where linear features dissect the site.



### **3 EXISTING FLOOD ALLEVIATION MEASURES**

- 3.1 The closest flood defence measures are to the north of the site at Penarth Promenade and the Cardiff Bay Barrage.

## 4 DEVELOPMENT PROPOSALS

- 4.1 The illustrative masterplan, drawing number UCF-ASL-00-00-DR-A-930 produced by Austin Smith Lord is included in **Appendix B** and an extract of the layout is shown in Figure 4.1 below



**Figure 4.1 – Illustrative Masterplan**

*Source: Austin Smith Lord (ref: UFC-ASL-00-00-DR-A-0930)*

- 4.2 Development proposals include the following;

- 576 Residential Dwellings
- Community Facilities
- Primary School
- Public Open Spaces

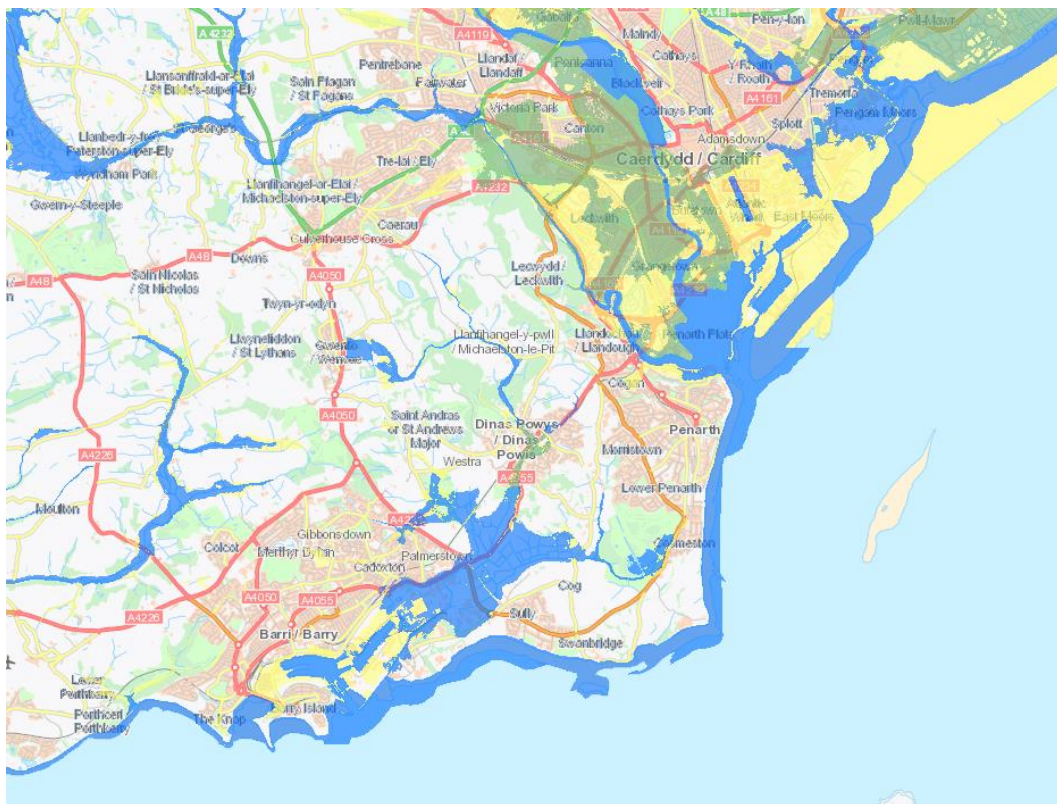
**CC1857 Upper Cosmeston Farm – FCA & Drainage Strategy**

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- Extension of NCN88 through the site
- New Roads, Footways and Cycleways
- SuDs Infrastructure and Landscaping.

## 5 ACCESS AND EVACUATION ROUTES

- 5.1 Vehicular access to the site will be provided via Lavernock Road.
- 5.2 Pedestrian access will be via Lavernock Road, connecting footpaths from the residential development to the north, the existing coastal path and the extended NCN88 cycle route.
- 5.3 The site is to be served by two access points off Lavernock Road adjacent the west boundary of the site. At the site entrances Lavernock Road has an elevation of 12.40m AOD at the south entrance and 12.65m AOD at the north entrance. Both entrances are at the low end of the site.
- 5.4 Should flooding occur as a result of local infrastructure failure / blockage, any resultant overland flows would be channelled along Lavernock Road and collect at localised low points along the highway in the vicinity of the proposed southern access.
- 5.5 Means of escape and emergency access should also consider the wider highway network and the potential impact of zones of higher flood risk to disrupt infrastructure connectivity. With reference to Figure 5.1, While part Lavernock Road is indicated to be affected by extreme events (Zone B) the wider network to the north of the site is unaffected. There are also legal rights in place to connect to Whitcliffe Drive which could be used as a link for an emergency route if necessary. Preferred routes will therefore be accessible during extreme events.



**Figure 5.1 – Wider Area Flood Zones**

Source: Welsh Government, TAN15 DAMs

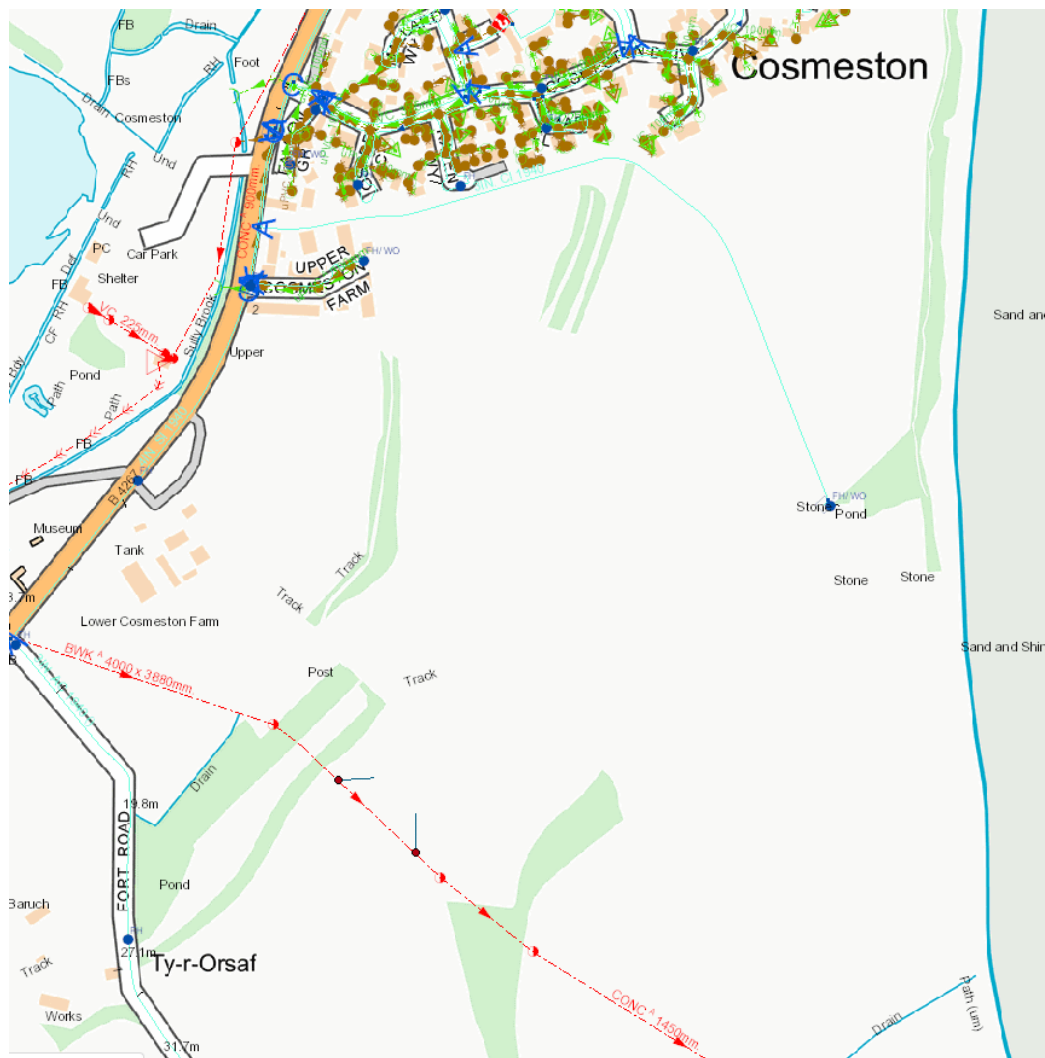
## 6 POTENTIAL FLOODING SOURCES

### Fluvial

- 6.1 The development site is situated predominantly in Flood Zone A, Little or no risk of flooding, with part of the site adjacent Lavernock Road located in Zone B of the DAM maps, areas known to have flooded in the past.

### Pluvial

- 6.2 Welsh Water Dwr Cymru (DCWW) sewerage records, shown in figure 6.1 below, show there is a 4000mm x 3880mm combined brick sewer running south west just within the southern boundary of the site. The records also show a water main in the track that runs along the north boundary then into the top field. A site constraints plan is shown in **Appendix G**.



**Figure 6.1 – Public Sewer Records**

Source: DCWW Record Plan

**CC1857 Upper Cosmeston Farm – FCA & Drainage Strategy**

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- 6.3 There is a risk of pluvial flooding from any drainage network given a susceptibility to surcharge as a result of overloading / insufficient capacity which would be exacerbated during extreme rainfall events, infrastructure failure or blockage. Low lying areas on the network, upstream of a blockage / throttle point, are most vulnerable to the effect of “popped” access covers / gratings where surcharged waters escape the network. In this scenario, escaped flood waters would spread from the source, directed / channelled by kerbs and other physical features and either re-enter the system or locally pond on the surface in low spots or in areas where flow paths are restricted.
- 6.4 The topography of the surrounding area would suggest that the site is not vulnerable to inundation from overland flows as it is higher than the surrounding area, as previously mentioned any overland flows from existing pluvial sources would be directed to and channelled along the existing highway network to Lavernock Road.

**Groundwater**

- 6.5 Intrusive site investigation did not identify groundwater bodies, however further investigation and monitoring will confirm the level of groundwater flooding.

**Reservoir**

- 6.6 NRW mapping shows there is no risk to the site from Reservoir flooding.

## 7 FLOOD HISTORY

- 7.1 Natural Resource Wales DAM indicates the site is primarily in Zone A, areas at little or no flood risk. Part of development site is located within Zone B, an “area known to have flooded in the past evidenced by sedimentary deposits”.



**Figure 7.1 – Historic Flood Mapping**

Source: Welsh Government, TAN15 DAMs

## 8 STRUCTURES INFLUENCING FLOW

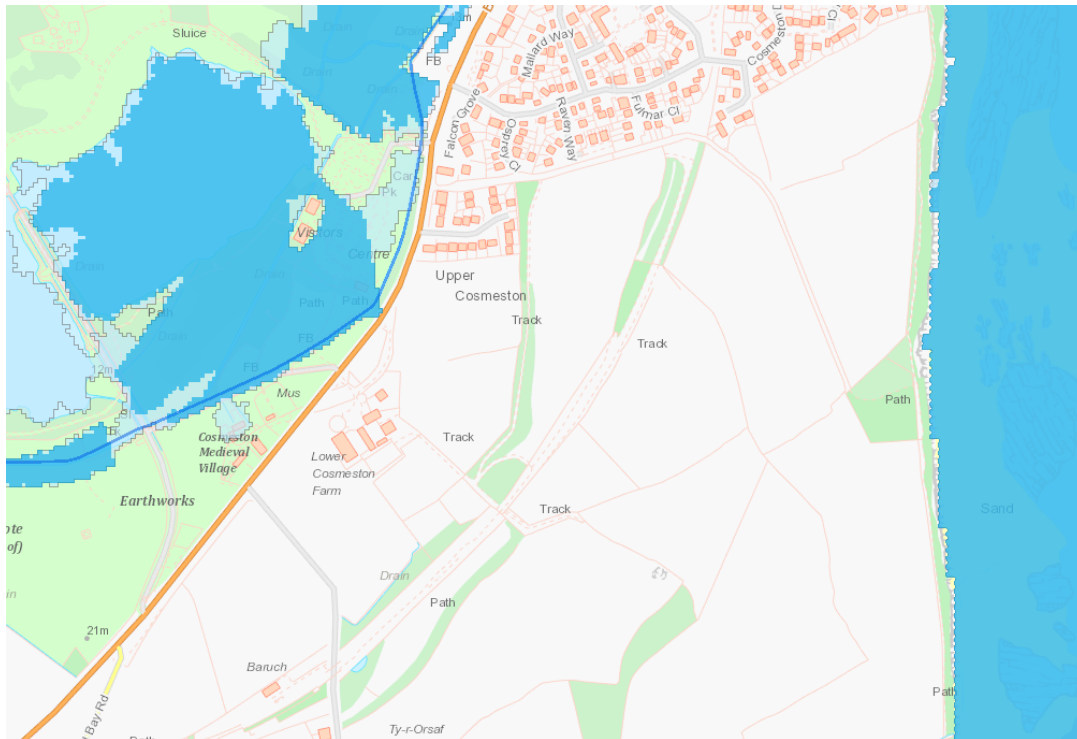
- 8.1 The main river, Sully Brook runs adjacent to the site.
- 8.2 Structures within the proposed drainage network such as headwalls and outlet flow controls are particularly vulnerable to blockage. A regular inspection and maintenance regime should be incorporated to ensure debris build up is removed and de-silting is undertaken as required to ensure continual optimal flow conditions and hydraulic performance.
- 8.3 An overflow facility should be provided in any flow control chambers to allow for future blockages. Any headwall structures should respect the accepting channel section, and consideration should be given to requirements for trash or security screens.



## 9 PROBABILITY OF FLOODING

### Fluvial Flooding

- 9.1 The NRW flood mapping information shown in Figure 9.1 below confirms the site is at little or no risk of fluvial/coastal flooding.



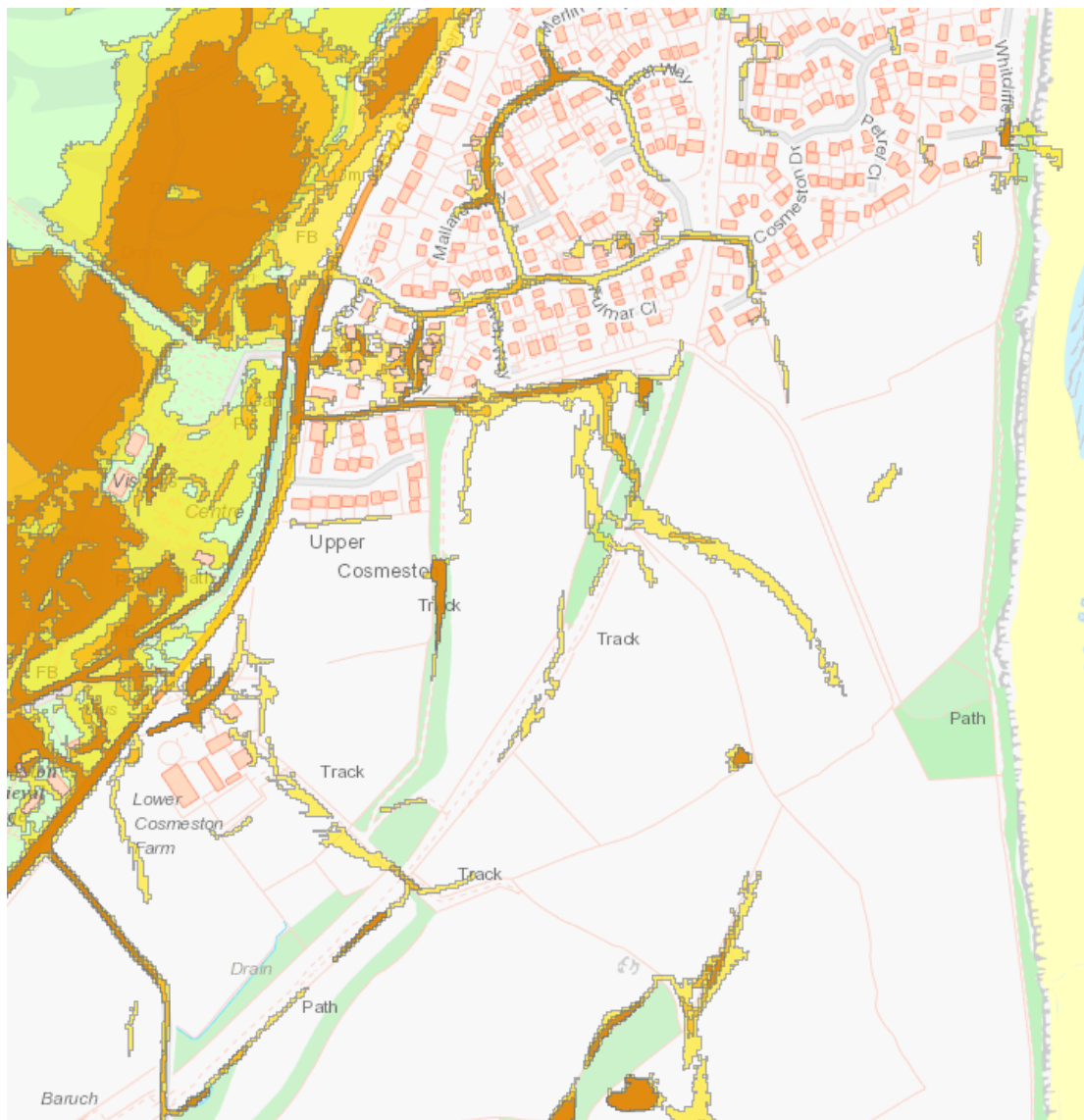
**Figure 9.1 – Current NRW Flood Map**

Source: Natural Resources Wales

### Pluvial Flooding

- 9.2 The NRW mapping data, shown in Figure 9.2 overleaf, shows the risk of flooding from Surface Water. The classifications indicate the annual event probability in the following designations;

- Very low – less than 1 in 1000 (0.1%)
- “Low” – between 1 in 1000 (0.1%) and 1 in 100 (1%) – Coloured yellow
- “Medium” – between 1 in 100 (1%) and 1 in 30 (3.3%) – Coloured orange
- “High” – greater than 1 in 30 (3.3%) – Coloured dark orange



**Figure 9.3 – NRW Risk of Flooding from Surface Water**

*Source: Natural Resources Wales Website – Flood Risk Map*

- 9.3 Pockets of low, medium and high-risk areas of flooding does do exist on the site.
- 9.4 Vale of Glamorgan SAB response does mention the area of high flood risk situated around Whitcliffe Drive and confirms a historic incident of surface water flooding in 2013.
- 9.5 The proposed drainage infrastructure serving the new development will be designed in accordance with current standards, discussed further in Section 12, which typically requires retention of 1 in 100 year (1%) critical storm event flows. Exceedance events beyond this should also be considered and flow paths identified to ensure any overland flows are directed to less sensitive / designated areas mitigating risk of damage to persons and property and ensuring means of access and egress are not compromised.

### **Groundwater Flooding**

- 9.6 A site investigation will be undertaken to establish the exact groundwater levels underlying the site. As part of the site investigation groundwater monitoring shows ground water levels at a minimum of 1.2m below ground level (*refer to ESP report ref:ESP.7061b.3215 Preliminary Controlled Water Risk Assessment*).
- 9.7 Groundwater levels are subject to seasonal variations and as such the design of the site should allow for shallow groundwater levels.
- 9.8 The current evidence suggests there is a low risk of groundwater flooding within the site.

## 10 PROPOSED DEVELOPMENT LEVELS

- 10.1 The proposed external levels design will ensure local grading mitigate the effects and impact of flooding. Falls away from building thresholds will be sought. Levels and physical features such as kerb lines will be used to channel and direct flow paths to lower lying, less sensitive / designated overflow areas without compromising routes of access or egress. The potential impact of ponding within any low-lying areas will be evaluated and if necessary mitigated against.
- 10.2 The specific proposed drainage infrastructure design requirements are discussed within Section 12. Through the introduction of restricted discharge rates, SUDS, attenuation measures and retaining excess flows within the site boundary, the proposed development will demonstrate no adverse impact on flood risk to downstream / neighbouring properties.
- 10.3 An effective design solution will consider drainage performance in conjunction with external level proposals.

## 11 IMPACT OF FLOODING

### Fluvial Flooding

- 11.1 According to NRW data there is a **low risk** of fluvial flooding on the site.
- 11.2 The development therefore is deemed acceptable and no further justification based on flood risk criteria is required.

### Pluvial Flooding

- 11.3 There are isolated pockets of **low, medium and high risk** from surface water flooding in certain areas of the site.
- 11.4 If surface water flooding was to occur, then the design proposals would mitigate against exceedance flows whether the flows emanate from existing or proposed drainage features.

### Groundwater Flooding

- 11.5 As discussed in section 9.3, there is likely to be a **low risk** from groundwater flooding to the site. Further site investigation works will confirm the groundwater flooding risk.
- 11.6 The risk of groundwater flooding can be reduced and managed by ensuring design levels avoid lowering parts of the site significantly and also ensuring surface water storage structures or soakaways are designed at shallow depths.

## 12 DRAINAGE IMPLICATIONS

### Existing Drainage

- 12.1 Welsh water record plans indicate a combined brick sewer running through the south west corner of the site.

### Proposed Drainage

- 12.2 Separate foul and surface water drainage networks are to be provided. The proposed design will be undertaken in accordance with The Statutory Standards for Sustainable Drainage Systems, Sewers for Adoption 7th Edition, Building Regulations - Document H, CIRIA's C753 The SuDS Manual as appropriate.
- 12.3 The SuDS design will be subject to SAB approval.
- 12.4 The preliminary SuDS strategy is illustrated in drainage layout drawings CC1857-CAM-ZZ-XX-SK-C-90-0125 contained within **Appendix D**.

### Foul water

- 12.5 The proposed foul drainage solution will be via a standard gravity piped solution connecting to the existing 900mm diameter combined sewer running through Cosmeston Lakes adjacent Lavernock Road.
- 12.6 A Section 104 application will be required to communicate the proposed foul flows to the existing network.
- 12.7 Welsh Water have confirmed that the existing network has capacity for the proposed 576 dwellings.

### Surface Water

- 12.8 In October 2018, Welsh Government published the 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining Surface Water Drainage Systems'. This standard is now mandatory for new developments with either a construction area greater than 100m<sup>2</sup> or more than 1 dwelling.
- 12.9 The principles which underpin the design of surface water management schemes to meet the Standards are as follows;

SuDS schemes should aim to;

- Manage water on or close to the surface and as close to the source of the runoff as possible;
- Treat rainfall as a valuable natural resource
- Ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it;

- Manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development;
- Take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep;
- Use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water management system (rather than using a single “end of pipe” feature, such as a pond, to serve the whole development);
- Maximise the delivery of benefits for amenity and biodiversity;
- Seek to make the best use of available land through multifunctional usage of public spaces and the public realm;
- Perform safely, reliably and effectively over the design life of the development taking into account the need for reasonable levels of maintenance;
- Avoid the need for pumping where possible; and
- Be affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system.

12.10 There are six mandatory standards to be achieved within the National SuDS standards, S1-S6. The following sections demonstrate compliance with each of these standards.

#### **Standard S1 – Surface Water Run-off Destination**

12.11 This standard reviews the disposal routes for surface water run-off. The destinations are split into 5 levels with level 1 being the most preferential and level 5 being the least preferred and only used in exceptional circumstances.

#### **Priority Level 1: Surface water runoff is collected for use;**

12.12 The feasibility of utilising rainwater harvesting collection systems will be looked at.

#### **Priority Level 2: Surface water runoff is infiltrated to ground;**

12.13 Infiltration testing has been undertaken. Additional infiltration testing is to be undertaken in accordance with comments from SAB. Where possible infiltration methods of drainage will be utilised in the SuDS design.

#### **Priority Level 3: Surface water runoff is discharged to a surface water body;**

The nearest surface water body to the development is Sully Brook. It is proposed to discharge to Sully Brook at a restricted rate. The SAB comments received from Vale of Glamorgan Drainage Team have confirmed acceptance of the philosophy of a restricted rate to Sully Brook. A restricted discharge rate of 127.99 l/s will have to be agreed by SAB. NRW have been contacted regarding a Flood Risk Activity Permit (FRAP), their response is contained in **Appendix H**.

## Standard S2 – Surface Water runoff hydraulic control

### Greenfield Run-off Rates

- 12.14 The Greenfield Runoff rate for the proposed site has been calculated using the FEH method. The Greenfield run-off calculations are included in **Appendix E**. The FEH method gives a QMED value of 1430.2 l/s which had been linearly interpolated for the site area to 127.99 l/s.
- 12.15 Approximate attenuation volumes for the proposed impermeable areas have been calculated using the Source Control tool within Microdrainage. The site has been broken down to 4 catchment areas and a pro rata discharge rate has been applied. The calculations are included in **Appendix F**. A summary of the attenuation requirements are shown in Table 12.3 below.

**Table 12.3 – Approximate Attenuation Storage Volumes**

<b>Total Impermeable Area = 13.686 ha</b> <b>Restricted discharge rate = 127.99 l/s</b>	
<b>Catchment Area</b>	<b>Approximate Attenuation Volume Requirement 1 in 100yr Return Period +30% Climate Change Allowance (m<sup>3</sup>)</b>
Catchment Area A Imp Area = 3.32 ha Pro Rata Discharge Rate = 31 l/s	2,250
Catchment Area B Imp Area = 2.80 ha Pro Rata Discharge Rate = 26.2 l/s	1,900
Catchment Area C Imp Area = 4.05 ha Pro Rata Discharge Rate = 37.9 l/s	2,900
Catchment Area D Imp Area = 3.52 ha Pro Rate Discharge Rate = 32.9 l/s	1,700 <i>(Infiltration potential has been included as part of this attenuation calculation)</i>

The general principles of the SuDS strategy for the site are shown on drawing CC1857-CAM-ZZ-XX-SK-C-52-0125 within **Appendix D** along with the Vale of Glamorgan’s SuDS Approval Body comments.

### Interception of run-off

- 12.16 Interception mechanisms will be required to ensure compliance with the requirement of zero runoff for the first 5mm rainfall for 80% of storm events during the summer and 50% in winter.
- 12.17 With reference to Table G2.1 ‘Interception mechanisms with assumed compliance’ of the



National SuDS standard interception mechanisms will be achieved through the use of infiltration structures, permeable paving, swales, rain gardens, bioretention areas, detention basins and ponds.

**Standard S3 – Water Quality**

12.19 SuDS shall be utilised wherever possible and designed in accordance with the Nation SuDS Standards and The SuDs Manual. Table 12.4 below identifies suitable SuDs techniques that would be appropriate for the development;

**Table 12.4 – Indicative Suitability of SuDs Components within the Management Train**

SuDs Component	Interception	Close to Source/Primary Treatment	Secondary Treatment	Tertiary Treatment	Site Suitability
Rainwater Harvesting	Y				✓
Filter Strip	Y	Y			✓
Swale	Y	Y	Y		✓
Filter Trench	Y		Y		✓
Permeable pavement	Y	Y			✓
Bioretention	Y	Y	Y		✓
Green Roof	Y	Y			x
Detention Basin	Y	Y	Y		✓
Pond		Y	Y	Y	✓
Wetland		Y	Y	Y	✓
Infiltration System	Y	Y	Y	Y	✓
Attenuation Storage Tanks	Y				✓
Proprietary treatment systems		Y	Y	Y	✓

12.20 A SuDs treatment train solution will need to be incorporated prior to discharging the surface water run-off from the site to avoid detriment to the water quality of the receiving watercourse and runoff through the site.

12.21 With reference to the SuDS Manual chapter 26 a simple index approach to water quality risk management will be undertaken. This approach would need to be agreed with the SAB.

**Standard S4 & S5 – Amenity & Biodiversity**

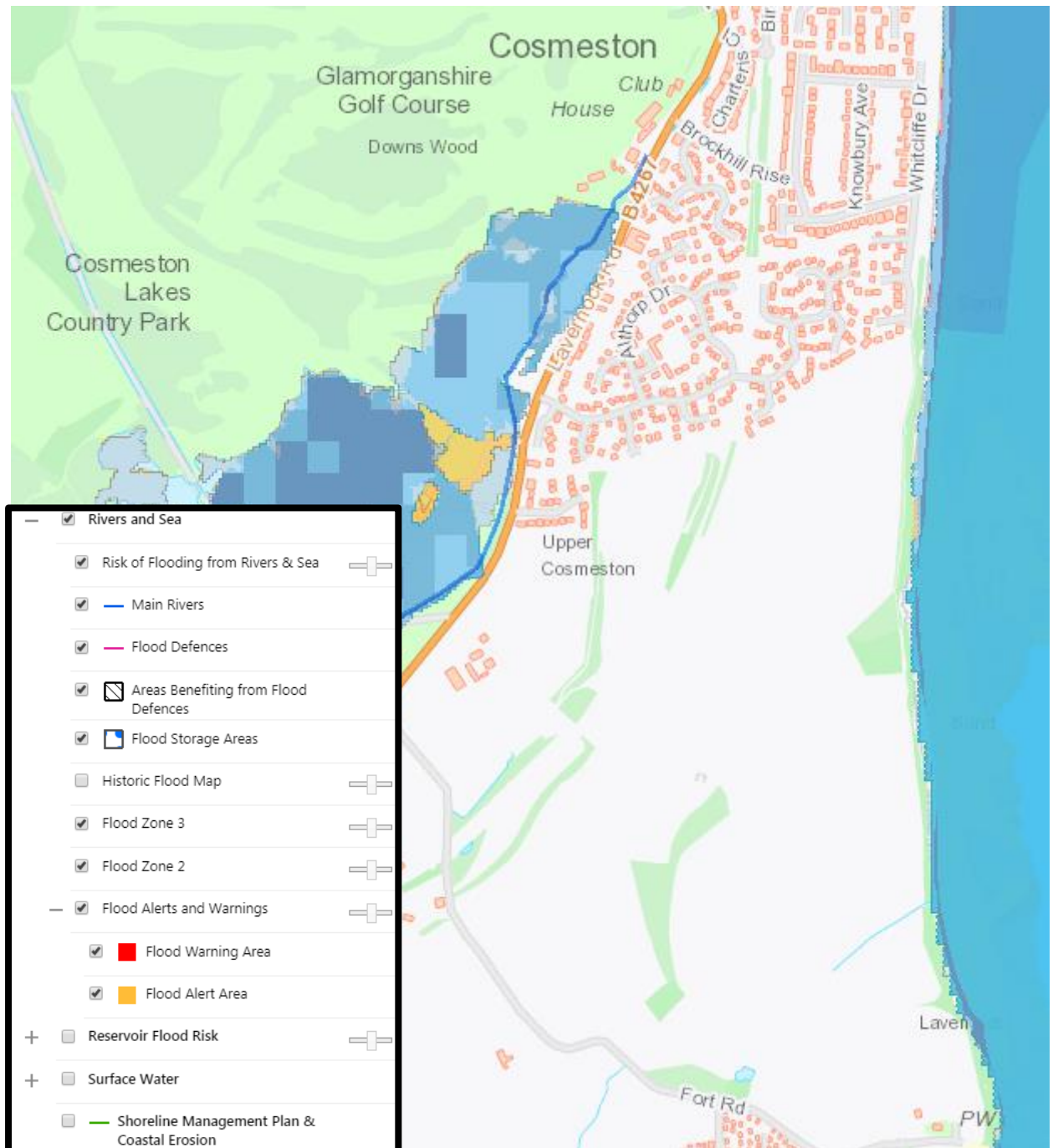
- 12.22 The aim of the Standard S4 & S5 is to ensure the SuDS scheme makes the best contribution to development design by maximising benefits for amenity and biodiversity as well as water quantity and quality.
- 12.23 Potential above ground features to satisfy this criteria would be the use of swales, rain gardens, bioretention areas, detention basins and ponds, which can be incorporated within soft landscaping areas of the site, particularly in POS areas.

**Standard S6 – Design of Drainage for Construction, Operation & Maintenance**

- 12.24 A SuDS maintenance plan would need to be provided for all SuDS features and submitted as part of the SuDS application to the Sustainable Drainage Approval Body (SAB).

## 13 WATER DISPLACED BY DEVELOPMENT

13.1 NRW flood data for the 1 in 100year+CC event suggests no flood water volumes would be displaced by the construction of the development.



**Figure 13.1 – Flood Risk from Rivers and Sea**  
Source: NRW Long Term Flood Risk Maps

## 14 IMPACT OF DISPLACED WATER

- 14.1 The proposed development will incorporate attenuation and SuDS enhancements. The peak flow discharge of the proposed site will be restricted to mimic greenfield run-off rates. These proposals would therefore provide no detriment to downstream properties.

## 15 LONG-TERM IMPACT OF DEVELOPMENT

- 15.1 Through the introduction of anticipated attenuation and SuDS enhancements the proposed developed will stand to reduce flood risk to neighbouring / downstream properties. Allowance for climate change will be incorporated into the design to ensure the longevity and robustness of the infrastructure serving the proposed development.

## 16 ALLOWANCES FOR FUTURE

- 16.1 There are no future expansion proposals being incorporated into the proposed development at this time.
- 16.2 In accordance with current best practice, the proposed surface water drainage network will be designed to incorporate a 30% increase in rainfall intensity as a result of anticipated climate change.

## 17 RESIDUAL RISKS

- 17.1 The residual risk of flooding originating from outside / within the site which might affect the site include:
- Blockages within the neighbouring watercourse
  - Run-off or overflowing drains from extreme rainfall events, from surrounding areas, flowing overland to reach the site.
  - Extreme rainfall events causing ponding on the site itself.
  - Infrastructure failure / blockage on the site.
  - High groundwater levels in excessively wet periods breaking the surface and ponding.
- 17.2 Contributory factors which may increase the risk or severity of flooding include:
- Failure to maintain surface water infrastructure.
- 17.3 In addition to the above, this FCA considers potential sources of flooding from the site which might affect surrounding property:
- Run-off from the site exceeding the capacity of the existing or proposed surface water management system and overflowing onto adjacent land;
  - Run-off from the site as the result of extreme rainfall contributing to a rise in water level in the surrounding network / rivers downstream and affecting riparian property.
- 17.4 A significant residual risk lies with lack of maintenance to the network with attenuation structures and outlet flow controls being particularly vulnerable. A regular inspection and maintenance regime should be incorporated to remove build-up of debris and de-silt as required to ensure optimal flow conditions and hydraulic performance of the network.
- 17.5 The most significant residual risks in relation to the fluvial flood risk to the development and potential adverse effects to 3rd party land.

## 18 SUMMARY

- 18.1 The development satisfies TAN 15.
- 18.2 The surface water drainage strategy proposes a restricted discharge into Sully Brook. Attenuation storage and interception will be provided by a SuDS drainage design which includes, infiltration structures, porous paving systems, bioretention areas, rain gardens, filter drains, detention basins and attenuation ponds.
- 18.3 The strategy and design of the SuDS system will comply with the Statutory Standards for Sustainable Drainage Systems and be subject to SAB approval and adoption.



## 19 RECOMMENDATIONS

- The SuDs application should be progressed to coincide with the planning process.
- Further infiltration testing will be required to establish whether infiltration solutions are feasible on the site.
- External level design should achieve falls from building thresholds, direct overland flows to less sensitive / designated overflow areas without compromising routes of access / egress and mitigating risk of harm to persons or property.
- The residual risks should be reviewed as the design development progresses.
- A regular inspection and maintenance regime should be developed to ensure debris build up is removed and de-silting is undertaken as required to maintain continual optimal flow conditions and hydraulic performance.

## APPENDIX A – Site location

## APPENDIX B – Development Proposals

## APPENDIX C – Topographical Survey

## **APPENDIX D – Proposed SuDS Strategy and SAB Response**

## APPENDIX E – FEH Greenfield Runoff Rate

## APPENDIX F – Attenuation Storage Volumes

## APPENDIX G – Site Constraints Plan



## APPENDIX H – NRW FRAP Response

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