



STONE FALCONER



## FLOOD RISK ASSESSMENT

Land West of Moraunt Drive, Portchester, Hampshire

For Stone Falconer Ltd.

OCTOBER 2014

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## Approvals

This document requires the following approvals:

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## 1.0 INTRODUCTION

- 1.1 Stone Falconer Ltd are promoting Land West of Moraunt Drive, Fareham, Hampshire, PO16 9DR, for inclusion in the Local Plan as a residential allocation site.
- 1.2 The Stilwell Partnership has been instructed by Stone Falconer Ltd, to produce a Flood Risk Assessment as required by the National Planning Policy Framework (NPPF).
- 1.3 Meetings have been held between The Stilwell Partnership (tsp) and representatives of both the Environment Agency and ESCP, any comments raised on the initial drafts of the report have been included.

## 2.0 PLANNING POLICY

### National Planning Policy

2.1 The National Planning Policy Framework (NPPF) is a key part of the government's reforms to make the planning system less complex and more accessible. It vastly simplifies the number of policy pages about planning. The planning practice guidance to support the framework is published online and regularly updated. The framework acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications.

### Para 99

2.2 Local Plans should take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure.

### Para 100

2.3 Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

- applying the Sequential Test;
- if necessary, applying the Exception Test;
- safeguarding land from development that is required for current and future flood management;
- using opportunities offered by new development to reduce the causes and impacts of flooding; and
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations.

**Para 101**

- 2.4** The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

**Para 102**

- 2.5** If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. For the Exception Test to be passed:
- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
  - a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted.

**Sub-Regional Spatial Strategy**

- 2.6** A key objective of PUSH is to prepare a Sub-Regional Spatial Strategy (SRSS) to set out how the local authorities, which make up PUSH, can deliver the economic growth and development targets set out in the draft SEP. The website set up by PUSH states that;

*“the strategy will consider cross-boundary issues and will focus on the economy and economic growth in the region, as well as housing, transport and the environment.”*

**Strategic Flood Risk Assessment (SFRA)**

The SFRA will feed into the SRSS by providing information from which to test the feasibility of the economic growth, housing and development targets as part of the environment and sustainability assessment.

### **Making Space for Water**

**2.7** The Government's Making Space for Water strategy sets out Government policy with regard to planning for flood and coastal erosion risk management in England. Recognising that there are large overlaps between the various responsible bodies in each facet of flood risk management, the strategy sets out the requirements for a holistic approach to the planning and management of flood risks. A key aim is to give the Environment Agency a greater overall strategic role in flood risk management. Land use planning is an important component of the strategy, with the avoidance of future risks often having the potential to remove the need for costly protection measures. SFRA's fulfil a key role within the Government's strategy, by informing the allocation of future development such that flood risk is at best avoided but at least mitigated early on in the planning process. The PUSH SFRA has been carried out under the continued guidance of local Environment Agency Development Control and Flood Risk specialists, ensuring that the Environment Agency were able to carry out their high level role in line with Making Space for Water.

### **Water Framework Directive**

**2.8** The Water Framework Directive is a European Union Directive which sets out a framework for improving the quality of all water bodies by fostering an integrated approach to water management. Its transposition to UK law requires the preparation of River Basin Management Plans to take into account all aspects of water management including flood risk. Strategic planning to avoid flood risk should go hand in hand with planning to accommodate water management. Flood risk alleviation measures such as Sustainable Drainage Systems (SUDS) offer the chance to improve the quality of surface water returned to rivers and it is envisaged that avoidance of flood risk areas when allocating new development will reduce the impact of new development on those sensitive areas located close to water bodies. The PUSH SFRA provides outputs that can facilitate assessments of the impact of new development on the surface water runoff regime and identification of appropriate measures to manage these impacts.

**2.9** The PUSH SFRA has been utilized online for this Flood Risk Assessment and the data provided, along with the South Hampshire Strategic Flood Risk Assessment should be considered overarching documents for this FRA.

### 3.0 SITE LOCATION AND DESCRIPTION

3.1 The site is located to the east of the Wicor Marine Yacht Haven in Portchester. The site is bound by the Wicor Copse woodland and Tattershall Crescent to the north, Moraunt Drive to the east and the Wicor Lake to the south. A Site Location Plan is found at **Appendix A**.

3.2 The Local Authority is Fareham Borough Council.

#### Existing Site

3.3 The existing site, which covers in the region of 8.4 Hectares, is currently undeveloped land. The Topographical Survey can be found at **Appendix B**.

3.4 The site falls gently from north to south with the north boundary being at a level of approximately 5.50m AOD. The site falls to an approximate level of 2.00m AOD where it falls away to the Wicor Lake.

3.5 There is an existing public footpath, the Wicor Path shown on the site location plan, which bisects the northern portion of the site and forms part of the northern boundary. In addition, there is a long distance public footpath called Kings Way which runs along the coastal southern edge of the site.

#### Existing Geology

3.6 The geology of the site has been ascertained by reference to the 1:50,000 British Geological Survey website. The strata in the local area comprises of a mixture of Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation and Culver Chalk Formation described as follows:

*“Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation. Sedimentary Bedrock formed approximately 71 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas. These rocks were formed in warm shallow 'Chalk' shelf seas with little sediment input from land. They often consist of a calcareous ooze of the microscopic remains of plankton, especially the disc shaped calcite plates or coccoliths that make up the spherical coccolithophores.”*

#### Hydrogeology Setting

3.7 The Environment Agency (EA) mapping service indicates the site lies within a “Major Aquifer High” zone. The EA map can be found at **Appendix C** which describes it as:

*“These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.”*



- 3.8** In addition, the Environment Agency mapping indicates the site is not located within a groundwater source protection area. However, the SFRA PUSH data as included in **Appendix C** shows that the site lies within a major groundwater vulnerability zone.
- 3.9** In addition, the SFRA PUSH data indicates that the site is of high bedrock permeability and has no history of groundwater flooding. It is recommended that a full geotechnical investigation be undertaken to determine the exact properties of the underlying strata within the site.
- 3.10** The local borehole information from the British Geological Survey website can be found at **Appendix T**. The borehole located on Cranleigh Road to the west of the site indicates the presence of chalk strata with a possible silt cap on site.
- 3.11** The site falls between two areas that may have been used as landfill at some time in their history and potentially may be contaminated ground. The information provided by the Eastern Solent Coastal Partnership described later in this report indicates it is not in a risk area. However, a geotechnical investigation is required to confirm the ground is not contaminated and does not contain any specialised fill material.

### **Hydrology**

- 3.12** The nearest strategic watercourse is the Wicor Lake (which opens out into the English Channel via Portsmouth Harbour) located directly south of the site. It should be noted that there are no designated main rivers in the vicinity of the site and there are no local watercourses nearby.

## 4.0 FLOOD ZONE INFORMATION

4.1 As set out in the National Planning Policy Framework, inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. For these purposes:

- “areas at risk of flooding” means land within Flood Zones 2 and 3; or land within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency;
- “flood risk” means risk from all sources of flooding - including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

4.2 Flooding information for Planning has been obtained from the Environment Agency (EA) and has shown that the site lies primarily within Flood Zone 1.

*“There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year. The majority of England and Wales falls within this area. (For planning and development purposes, this is the same as Flood Zone 1, in England only.)”*

The Environment Agency Flood Map is attached at **Appendix E**.

4.3 The southern portion of the site lies within a flood zone. The mapping from the EA as found in **Appendix H** indicates that the site is at a “High” risk of flooding (Defined as Flood Zone 2 & 3 for planning). This is described by the EA as:

*“Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year*

*Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year”*

4.4 In addition, the Partnership for Urban South Hampshire Strategic Flood Risk Assessment (SFRA) and associated guidance note for Fareham catchment confirms the site to be in both Flood Zone 1, 2 and 3. The SFRA mapping can be found at **Appendix F**, which was taken from the Hampshire online PUSH mapping.

- 4.5** Fareham borough occupies a central position in the PUSH sub-region, situated to the north west of Portsmouth. It covers a total area of approximately 74 km<sup>2</sup>. The Borough has 8.5 km of open coastal frontage, 14.5 km of frontage on the tidal River Hamble and 11.5 km of frontage onto Portsmouth Harbour. The Rivers Wallington and Meon flow through the Borough, with a total main river length of 35 km. At present, approximately 9% of the Borough's land area is designated as within Flood Zones 2 and 3a/3b.
- 4.6** The SFRA Mapping gives further information included in **Appendix F**. It confirms that there are areas on the site in Flood Zone 2 for tidal and fluvial floods, while the Flood Zone 3 is for tidal water only. The Mapping also gives predicted flood zones for the site up to the year 2115. Risk to the site from all forms of flooding will now be analysed in the next section of the report.

## 5.0 FLOOD RISK

5.1 The data obtained from the EA's website in their updated mapping shows the risk of flooding at the site is 'Low' to 'High' as found in **Appendix K**.

5.2 The Environment Agency confirmed that the southern part of the proposed development site is located within Flood Zone 2 & 3 for Planning. According to Table 1 of National Planning Policy Framework (NPPF), Zone 2 is classified as at risk of flooding from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year; or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year. The proposed development, according to Table 2 of NPPF, is classified as more vulnerable. According to NPPF Table 3 'Flood Risk Vulnerability and Flood Zone Compatibility' the development is permitted if an exception test is satisfied.

**Table 3: Flood risk vulnerability and flood zone 'compatibility'**

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	*	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	*	*	*

**Key:**      ✓ Development is appropriate.  
              \* Development should not be permitted.

### Exception Test

5.3 If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and

- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

**5.4** Based on the local planning policy mentioned in section 2, the proposed development complies with the requirements of the exception test. In addition, this FRA will demonstrate that this site will be developed to reduce the flood risk by the provision of flood defences. The proposed defences keep the dwellings safe for their lifetime (100 years).

#### Tidal Flood Risk

**5.5** Further information was sought from the Environment Agency which is located at **Appendix G**. This gives flood levels for an extreme storm event in the north west corner of the site as follows:

Year	Tide Level (mAOD*)	
	0.5% annual exceedance probability/1 in 200 Year (Flood Zone 3)	0.1% annual exceedance probability/1 in 1000 Year (Flood Zone 2)
<b>2010</b>	3.2	3.4
<b>2070</b>	3.7	3.9
<b>2115</b>	4.3	4.5

\* Levels in metres above Ordnance Datum Newlyn.

#### Tidal Node Levels

**5.6** In addition to the EA data, the PUSH SFRA provides nodal data for the tidal modelling as found at **Appendix H**. The site is located within Zone 13, north of the primary sea level recorder station.

**5.7** Tidal node levels for Zone 13 can be found as follows:

Year	Tide Level (mAOD*)	
	1 in 200 Year tidal level	1 in 1000 year tidal level
<b>1990 Baseline</b>	3.1	3.3
<b>2010</b>	3.2	3.4
<b>2025</b>	3.2	3.4
<b>2055</b>	3.5	3.7
<b>2085</b>	3.9	4.1
<b>2115</b>	4.3	4.5

It can be seen that these levels match the modelled EA flood levels for the proposed site.

### **Flood Defences**

- 5.8** It should be noted that there are no defences for the site but there are some in the surrounding area. There are two natural defences protecting Fareham Lake. They are design standard 1:1 for fluvial flooding and not near the site and so are not of great relevance to the site.
- 5.9** The SFRA PUSH mapping goes into more detail into the existing flood defences for the site as found in **Appendix J**. The site benefits from a natural flood defence along the southern edge but has no formal constructed flood defences. Topography of the site indicates that these natural defences will not be adequate for the proposed development.
- 5.10** The information provided in the SFRA gives indicative crest and tide levels for the present day and in the year 2115. Also, the mapping indicates levels for natural and coastal defences and the potential investment to provide 200 year crest/tide level defence.

### **Standard of Protection**

- 5.11** In terms of flood risk, Standard of Protection (SoP) defines the flood event return period above which significant damage and possible failure of flood defences will occur. An “appropriate” SoP is often used to identify the shortfall of existing defences. The draft Practice Guide states that the minimum acceptable standard of protection for new developments should be:
- 100 years (1% annual probability) for fluvial flooding
  - 200 years (0.5% annual probability) for coastal flooding

including allowances for climate change. The guidance also states that wherever a greatly increased standard of protection can be achieved at little extra cost, then such opportunities should always be taken.

- 5.12** Defra has produced guidance on the appraisal of flood and coastal defences and identifies methods for valuing costs and impacts in monetary terms. This guidance is based on schemes funded with public money and sets out a recommended decision process, based on economic values and cost benefit ratios. The indicative standards and land use descriptions are shown in the table below, taken from Flood and Coastal Defence Project Appraisal Guidance (CDPAG3).

Land use band	Description	Indicative standards of protection (return period in years)	
		Coastal/saline	Fluvial
A	Typically intensively developed urban areas at risk from flooding and/or erosion.	100 - 300	50 - 200
B	Typically less intensive urban areas with some high-grade agricultural land and/or environmental assets of international importance requiring protection.	50 - 200	25 - 100
C	Typically large areas of high-grade agricultural and and/or environmental assets of national significance requiring protection with some properties also at risk, including caravans and temporary structures	10 - 100	5 - 50
D	Typically mixed agricultural land with occasional, often agriculturally related properties at risk. Agricultural land may be prone to flooding, water logging or coastal erosion. May also apply to environmental assets of local significance.	2.5 - 20	1.25 - 10
E	Typically low-grade agricultural land, often grass, at risk from flooding, impeded land drainage or coastal erosion, with isolated agricultural or seasonally occupied properties at risk, environmental assets at little risk from frequent inundation	>5	>2.5

- 5.13** Based on this information and the EA data, the site could be classed as land use A. This gives an indicative standard of protection of 200 years fluvial and 300 years coastal. This is slightly more stringent than the PPS25 statement of protection to 1 in 100 years fluvial and 1 in 200 years tidal flooding.
- 5.14** The SFRA notes that insurance for proposed dwellings will also be determined on the standard of protection for the site. It is recommended that a “large town” have a standard of protection for 1 in 500 years. It is also recommended that improvements on protection levels be made wherever necessary.
- 5.15** All dwellings will be adequately protected against a 0.5% Annual Exceedance Probability (AEP) for the year 2115 with 300mm freeboard. Therefore, a potential safe level of 4.60m AOD will be adopted. It should be noted that this will also protect against the 1 in 1000 year (2115) AEP storm event (still water level) and therefore comply with the appropriate SoP required by legislation.

### **Wave Overtopping**

- 5.16** The Wave Energy mapping as found at **Appendix L**, shows how exposure to wave energy varies along the frontage of the study area. Such information can be used to assess, at a high level, the risk of flooding caused by extreme wave overtopping. Fareham’s harbour frontages experience low wave energies but its open coast frontage experiences moderate wave energies.

- 5.17** Based on information from other similarly exposed frontages in the PUSH sub-region, it is recommended that all applications for development within the vicinity of the open coast frontage of Fareham Borough include an assessment of extreme wave overtopping, regardless of which Flood Zone the site is in. This will ensure that this risk is always considered for new development in the relevant locations.
- 5.18** The site has a low wave energy level which is defined along the southern boundary. The risk of wave overtopping can be considered minimal.

#### **Defence Breach**

- 5.19** The PUSH SFRA mapping of the risk from a flood defence breach can be found at **Appendix M**. The mapping provides information on the variation of potential flood hazard within the Flood Zones. In this case the index is defined as the 'Danger to People from Breaching' of flood defences, and differs from the Undefended Flood Hazard index in that it is a function of the distance from defences where a breach could occur rather than the potential velocity of the flood water. As with the Undefended Flood Hazard, it is also a function of the potential depth of flood water and has been estimated using appropriate assumptions and methods identified in best practice guidance. The southern part of the site, as expected, has increasing risk closer to the potential defence rated from "no risk" to "risk for many".

#### **Residual Risk**

- 5.20** Based on the information above, there is a noted residual risk to any parts of the development located within the flood zone. The residual risk increases towards the southern boundary of the site. Setting the ground levels at 4.60m AOD mitigates most of the residual risk, but there is a danger from an extreme storm event coupled with a high tide.
- 5.21** There is no further modelling of the site for this scenario, but from the information stated above, it can be seen that there is a low wave energy in the area and the residual risk is low. Further modelling is required at the detailed design stage to ensure that all dwellings are protected.

#### **Further Information**

- 5.22** The Eastern Solent Coastal Partnership (ESCP) are responsible for maintaining the coastal defences in the area including the southern boundary of the site. A coastal defence strategy (Hamble to Portchester Coastal Flood and Erosion Risk Management Strategy) will include the site.
- 5.23** A review of the ESCP strategy reveals that the site itself falls within SMZ location boundary 1 (Hospital Lane Portchester to Upper Quay Fareham) and ODU4 as shown in the mapping located at **Appendix Q**. The area is characterised as follows:



*“Estuarine, low wave energy environment. Mainly residential and recreational use. Potentially contaminated land, environmentally designated areas. Localised flood and erosion risk increasing with time.”*

- 5.24** The total coastal defence for this area has a cost of £5m to implement and a benefit of £10m giving it a ratio of 2:1. Typically coastal defences will not be implemented unless there is a ratio of 8:1 in benefit to the residents of that area. The ODU4 region is lined for potential strategic works in 2030.
- 5.25** This was confirmed by ESCP in a meeting held on 21<sup>st</sup> October 2014. In such, any measures would have to be implemented by the contractor with a portion of funding available from the Environment Agency and the option for ESCP to adopt/maintain the structures post-construction (all with accompanying legal agreements).
- 5.26** The defence condition assessment (Appendix B of the ESCP report) covers the site area, which is labelled as 5a21j and is shown as undefended land under the ownership of Fareham Borough Council. The report summary has been included at **Appendix R** and shows no details of the condition of any defences as it is natural land.
- 5.27** The contaminated land assessment (Appendix C of ESCP report) indicates the land has not been historically used for industrial purposes but does indicate there is a risk of erosion to 2110 (NAI). Therefore any proposed works will have to use the “hold the line” approach to the coastal defence to ensure there is no danger of coastal erosion. The site is not identified as high risk from a contaminated land viewpoint.
- 5.28** The Tuflow Model Report (Appendix F of the ESCP report) confirms the risk of site from flooding and provides maximum flood depth for the site as per the mapping found at **Appendix S**. The mapping provides fluvial flood envelope for the 1 in 100 year (1% AEP) storm event in 2015 and 2115.

### **Fluvial Flooding Risk**

- 5.29** Parts of Fareham Borough are at risk of fluvial flooding from the Rivers Wallington and Meon. The PUSH SFRA mapping shows the fluvial Flood Zones, which show the Wallington Village and Titchfield to be the key areas at risk of fluvial flooding in the Borough. The proposed development is not deemed to be at risk from this form of flooding.

### **Historic Flood Data**

- 5.30** The South Hampshire SFRA undertook a detailed review of the flood history of each PUSH sub-region. This review fed into the development of methodologies used in the generation of the SFRA Output Packages and the flood risk overviews presented in the SFRA Guidance Documents. Sources of historic flood incidents were:

- Environment Agency GIS data showing historic observed flooding by source in the sub-region.
- Environment Agency Winter 2000/01 Flood Reports for Hampshire
- Southern Water Flooding Incidents (Hydraulic Overload) 1996-2006
- Consultation discussions with flood risk engineers from each LPA, Hampshire County Council and the Environment Agency as part of Stage 1.
- All available CFMPs / SMPs / Coastal Strategies.

**5.31** The mapping does not show any indication of historic flood events within the site. It is possible that there have been flood events due to tidal swells historically but these have not been recorded.

**5.32** In addition, local residents in the Wicor Marine Yacht Club were contacted to determine if there was any anecdotal evidence of flood water. The owner of the club did recall a high tidal level in the winter of 2013 and large swells during the hurricane of 1987 in addition to numerous high tide events over the years. But he did state that in the 50 years the club has been operating, there has been no flooding within their site.

#### **Groundwater**

**5.33** Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. A ground water flood event results from a rise in ground water level, sufficient for the water table to intersect the ground surface and inundate low lying land. Groundwater floods may emerge from either a single point or diffuse locations.

**5.34** Information provided by the Environment Agency and the SFRA provided in **Appendix C** indicate there is minimal risk from groundwater emergence within the site.

#### **Flooding from Sewers**

**5.35** Flooding from sewers can occur because of different reasons; if sewers are blocked during the heavy rainfalls, or if sewer cannot provide adequate capacity, then flooding can cause a large amount of damage.

**5.36** The SFRA mapping and investigations into the local area indicate no risk from sewer flooding within the site.

#### **Flooding from Reservoirs**

**5.37** Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and ensures that reservoirs are inspected regularly and essential safety work is carried out.

- 5.38** The Environment Agency provide mapping for risk of flooding from reservoirs which indicates the site is at no risk from a potential reservoir flood or breach.

#### **Flooding from Surface Water**

- 5.39** The Environment Agency provides mapping showing potential surface water flood risk. The mapping indicates that there is no risk to the site from surface water flooding. The PUSH SFRA system goes into more detail and mapping related to surface water flooding can be found at **Appendix N**.

- 5.40** The SFRA mapping reflects the EA mapping in showing there is no risk from surface water flooding within the site. It goes further to show there is no potential risk from surface water flooding in a 1 in 30 year storm event. In addition, it gives the impact of land use on the site as “medium” suggesting that developing the site will increase the risk of surface water flooding via overland flow.

#### **Overland Flow**

- 5.41** The PUSH SFRA mapping gives an indication of risk from overland flow as found in **Appendix P**. The risk from overland flow can be mitigated with the inclusion of sustainable surface drainage design at the detailed design stage.

## 6.0 DRY ESCAPE ROUTE

6.1 During an extreme flood event, up to and including the 1 in 1000 year event, all dwellings within the site would remain unaffected. However, if residents / users need to evacuate a dry route of escape will be available via the main access roads.

6.2 The route of escape from each property will need to be examined in liaison with the Local Planning Authority to ensure that there is safe egress from site for all residents.

## 7.0 FLOOD COMPENSATION

7.1 Since the site lies primarily within Flood Zone 1 and the remainder of the site will be protected by flood defences, no flood compensation measures are required.

7.2 As the main source of flood risk is tidal, there is no requirement for Flood Zone compensation for the entirety of the site as agreed with the Environment Agency.

## 8.0 DEVELOPMENT POTENTIAL

8.1 The site is being promoted for allocation on the basis of having the potential to deliver up to 200 dwellings with associated access roads and open space, etc. The current proposal is for Approximately 216 No. new residential units separated into 45 No. semi-detached houses, 62 No. terraced houses and 93 No. flats with associated car parking and amenity spaces. An indicative layout is included in **Appendix D**.

8.2 All dwellings will be located within Flood Zone 1 for planning and have a finished floor level of 4.60m AOD as a minimum. It must be shown that all dwellings are protected from an extreme storm and tidal event for their lifetime. This can be done at detailed design stage.

### **Drainage Strategy**

8.3 The principles of the drainage strategy are outlined as part of this FRA to indicate the mitigation of risk from tidal flooding. The drainage strategy will need to incorporate the following considerations:

- Any existing drainage routes through the site must be identified and maintained. An examination of the site indicates this may be natural paths for surface water to drain back into the sea but there are no indications in the SFRA mapping that this is the case.
- The surface water system should be designed to account for tidal locking. It is envisaged that there is a high likelihood that the outfall will be surcharged in a high tide and intense storm event

- The appropriate stages of treatment of surface water should be indicated prior to outfall into the sea.
- Maintaining the sea frontage and making improvements, where practicable, to improve water flow and ecological habitat.
- Providing adequate space for exceedance waters to flow naturally back into the sea post-development.

**8.4** All surface water run-off from site will be restricted to the flow for a 1 in 1 year storm event. Any excess water up to a 1 in 100 year storm event including 30% climate change will be attenuated within the curtilage of the site.

**8.5** National SuDS standards and Sewers for Adoption recommend that the 1 in 30 year storm event is managed below ground with exceedance flows managed above ground.

**8.6** Pending a full ground investigation (groundwater and contaminated), it is envisaged there will be no direct infiltration into the ground. Permeable systems will be utilized with an impermeable membrane under the sub-base layer to prevent groundwater interaction.

## 9.0 SUMMARY AND CONCLUSIONS

- 9.1** Stone Falconer Ltd are promoting a Planning Application for a proposed residential development on the Land West of Moraunt Drive, Fareham, Hampshire, PO16 9DR for inclusion in the Local Plan as a residential allocation site.
- 9.2** The Stilwell Partnership has been instructed by Stone Falconer Ltd, to produce a Flood Risk Assessment as required by the National Planning Policy Framework (NPPF).
- 9.3** The Environment Agency website has confirmed that the site is primarily within Flood Zone 1, but has areas in Flood Zone 2 & 3. The development is only proposing properties and associated roads within Flood Zone 1.
- 9.4** The flood risk assessment has identified that the primary source of flooding is from tidal water breaching the coastal boundary. To mitigate this risk, the EA recommends that any dwellings on the development are to have a finished floor level of 4.60m AOD. This limited amount of development may take place on the site without further assessment of tidal flooding until detailed design stage.
- 9.5** It may be feasible to allow further development within the site (Flood Zones 2 & 3) but would be subject to detailed analysis. If development in the southern area of the site is promoted in the future, it is recommended that any detailed design proposals be accompanied by modelling of sea defences including extreme tidal events, wave overtopping and breach analysis.
- 9.6** All other sources of flooding for the site have been investigated and shown to be of minimal risk.
- 9.7** In support of the development, a full geotechnical investigation would be required to determine the underlying strata, potential for infiltration and possible ground contamination.
- 9.8** This Flood Risk Assessment has confirmed that the proposed development is appropriate and sustainable in the terms as set out in NPPF.

**APPENDIX A**  
**Site Location Plan**



SITE

Wicor Lake



**STILWELL LIMITED CONSULTING ENGINEERS**  
 SATELLIET HOUSE  
 2 NEXUS PARK  
 ASH VALE  
 SURREY  
 GU12 5QE  
 Tel: 01276 700400  
 Fax: 01252 544934  
 E-Mail: info@stilwell-ltd.co.uk  
 Web: www.stilwell-ltd.co.uk

Client:

Project: Project Darktown  
 Title: Site Location Plan

A	FIRST ISSUE	23.07.14
Date:	July 2014	Drawn: AJ
Checked:	DB	
Scale:	NTS @ A4	Status: Preliminary
Drawing No:	TSP/STF/P2614/001	Rev: A



**APPENDIX B**  
**Topographical Survey**



Allotment Gardens

MORAUNT DRIVE

ALBION CLOSE

CADDO DRIVE

KILWICH WAY

WICOR MILL LANE











<b>STILWELL LIMITED CONSULTING ENGINEERS</b> SATELLIET HOUSE 2 NEXUS PARK ASH VALE SURREY GU12 5QE	
Tel: 01276 700400 Fax: 01252 544934 E-Mail: info@stilwell-ltd.co.uk Web: www.stilwell-ltd.co.uk	
<b>STONE FALCONER LTD</b>	
Project:	Project Darktown Fareham, Hampshire
Title:	Topographical Survey
Date:	July 2014
Drawn:	AJ
Checked:	DB
Scale:	1:2500 @ A0
Status:	Preliminary
Drawing No:	TSP/STF/P2614/002
Rev:	A

THIS IS A CONTROLLED DOCUMENT

## **APPENDIX C**

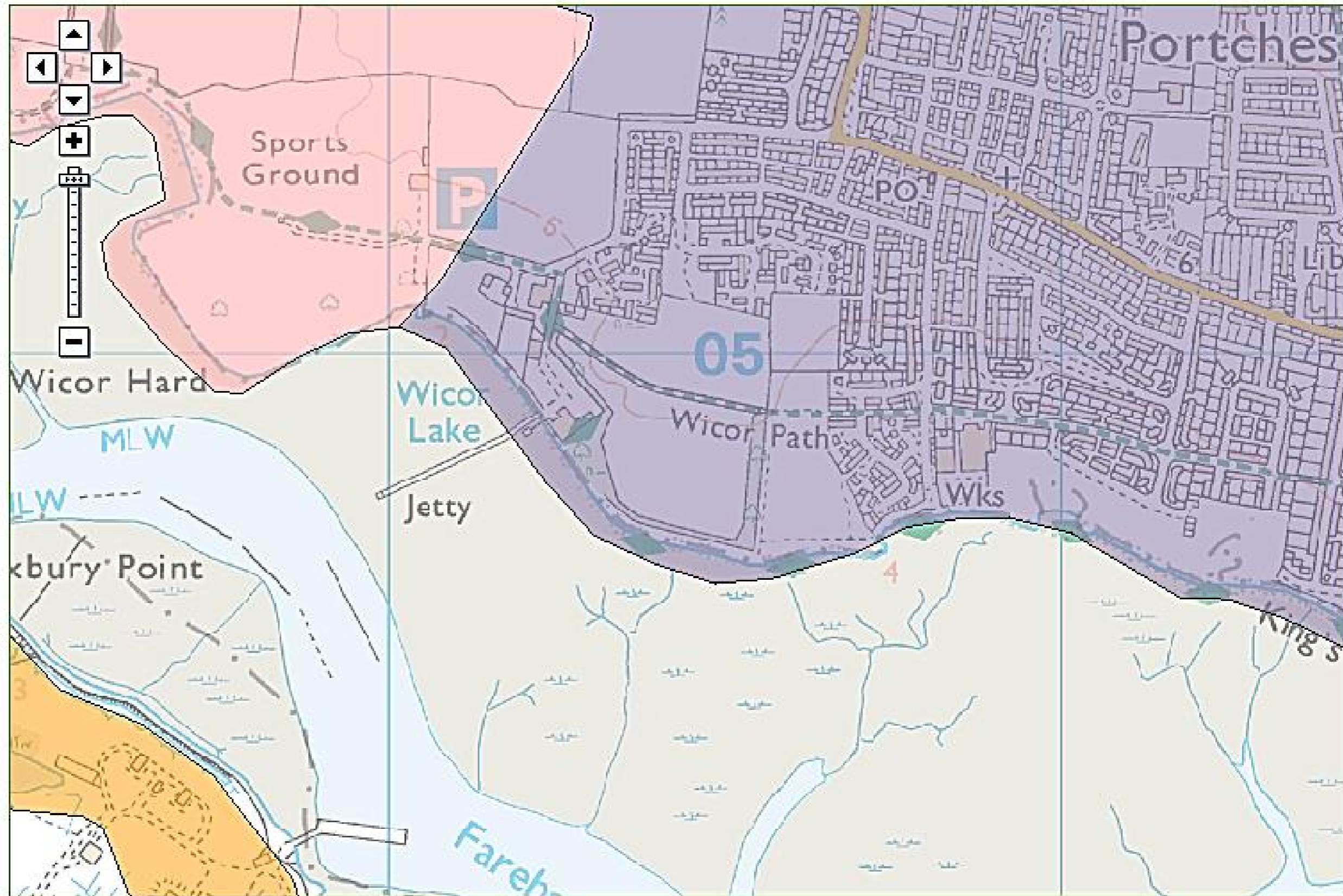
### **Environment Agency Geological Map**

### Map legend

- Groundwater source protection zones 
- Aquifer Maps - Superficial Deposits Designation 
- Aquifer Maps - Bedrock Designation 
- Groundwater Vulnerability Zones 
  
-  Major Aquifer High
-  Major Aquifer Intermediate
-  Major Aquifer Low
-  Minor Aquifer High
-  Minor Aquifer Intermediate
-  Minor Aquifer Low

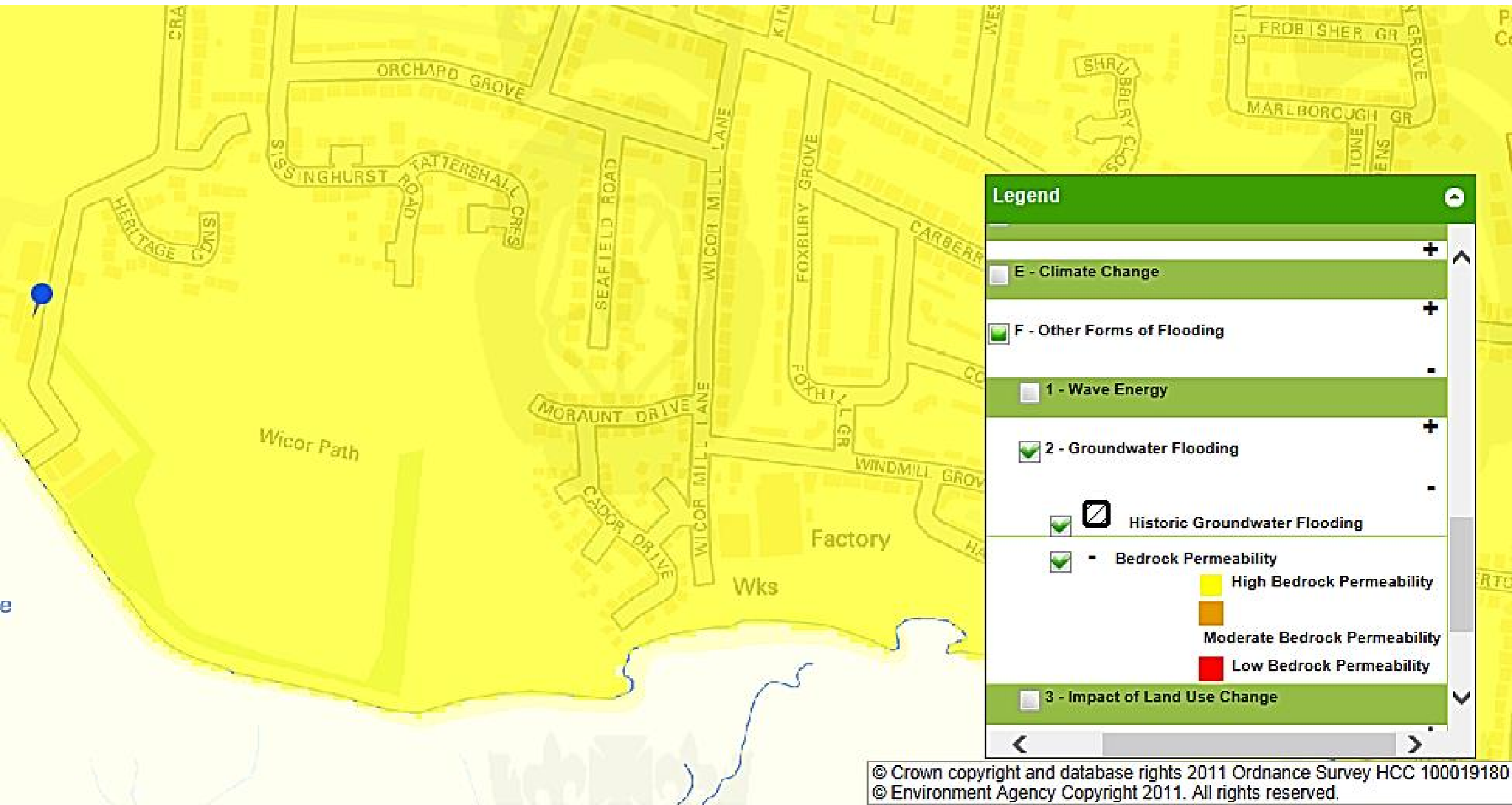
Map of X: 460,434.67; Y: 104,853.38 at scale 1:10,000

[Other maps](#)  [Data search](#)  [Text only version](#) 

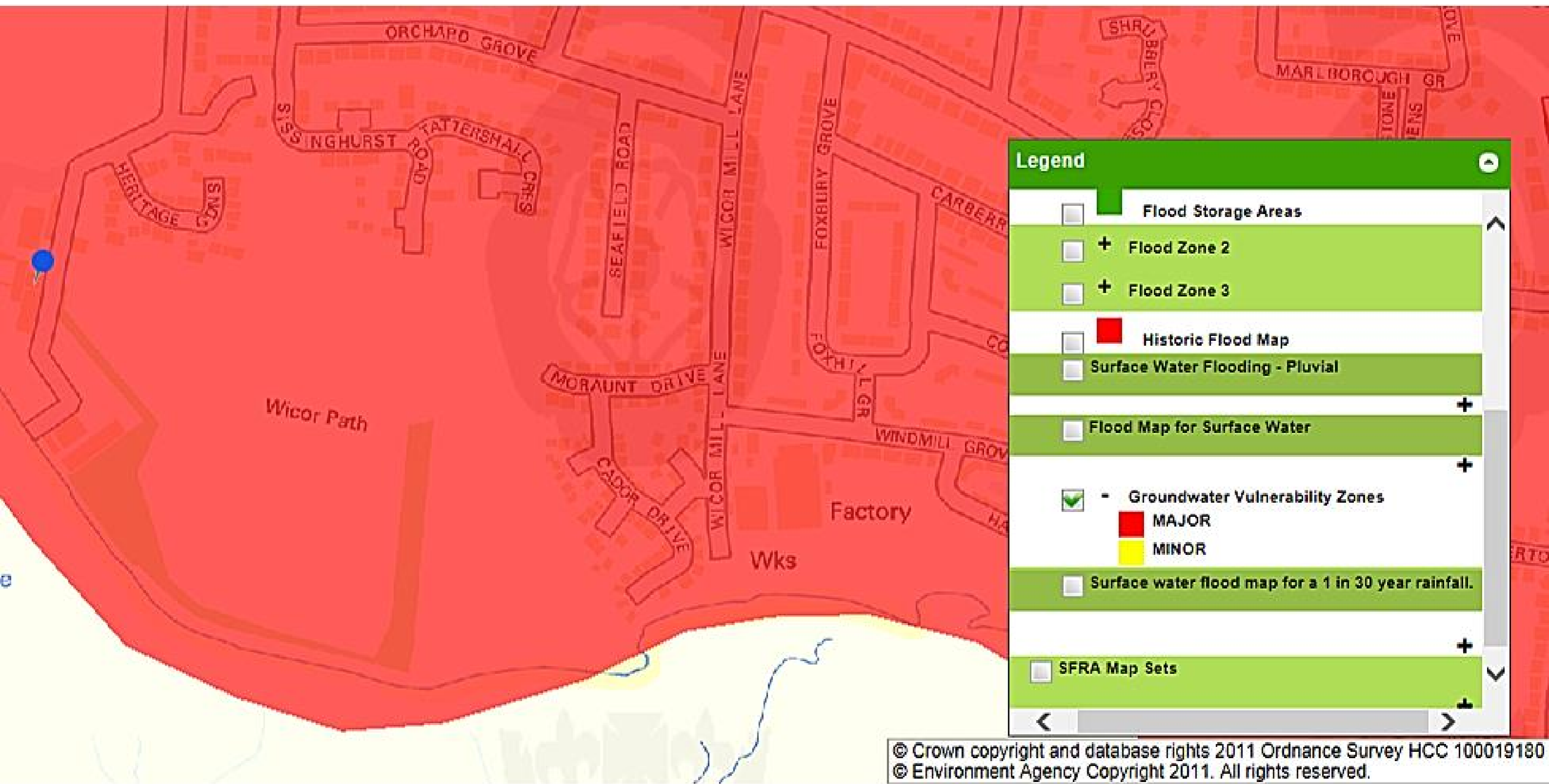


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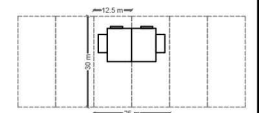
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## **APPENDIX D**

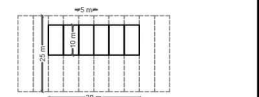
### **Site Layout**



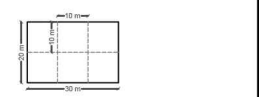
**Semi-Detached Houses**  
Tot = 45 plots



**Terrace Houses**  
Tot = 62 plots



**Flats**  
Tot = 93 flats



- Landscaping / Garden Areas
- Wicor Path
- Proposed Public Open Space
- Existing Public Open Space

**GENERAL NOTES:**  
All dimensions to be checked on site prior to the commencement of construction and any discrepancies should be reported to the Site Manager.  
All setting out and levels to be checked on site and their datum confirmed.  
This drawing must be read in conjunction with the relevant specification clauses and working drawings.  
All contractors / Sub-Contractors MUST ensure they have the latest issue drawing before they commence work on site.  
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**PROJECT TITLE:**  
Project Dark Town

**CLIENT:**  
Stone Falconer Limited

**DRAWING TITLE:**  
Proposed Sketch Block Site Layout

**DATE:**  
April 2014

**DRAWING No:**  
219 - 14 - 002

**REVISION:**

**DRAWN BY:**  
LIME

**SCALE:**  
1:2500 @ A4

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E info@LIME.uk.com









## **APPENDIX E**

### **Environment Agency Flood Map**

### Map legend

Click on the map to see what Flood Zone (National Planning Policy Guidance definitions) the proposed development is in.

Flood Map for Planning (Rivers and Sea) 

-  Flood Zone 3
-  Flood Zone 2
-  Flood defences (Not all may be shown\*)
-  Areas benefiting from flood defences (Not all may be shown\*)
-  Main rivers

X: 460,435;Y: 104,853 at scale 1:10,000

[Other maps](#)  [Data search](#)  [Text only version](#) 



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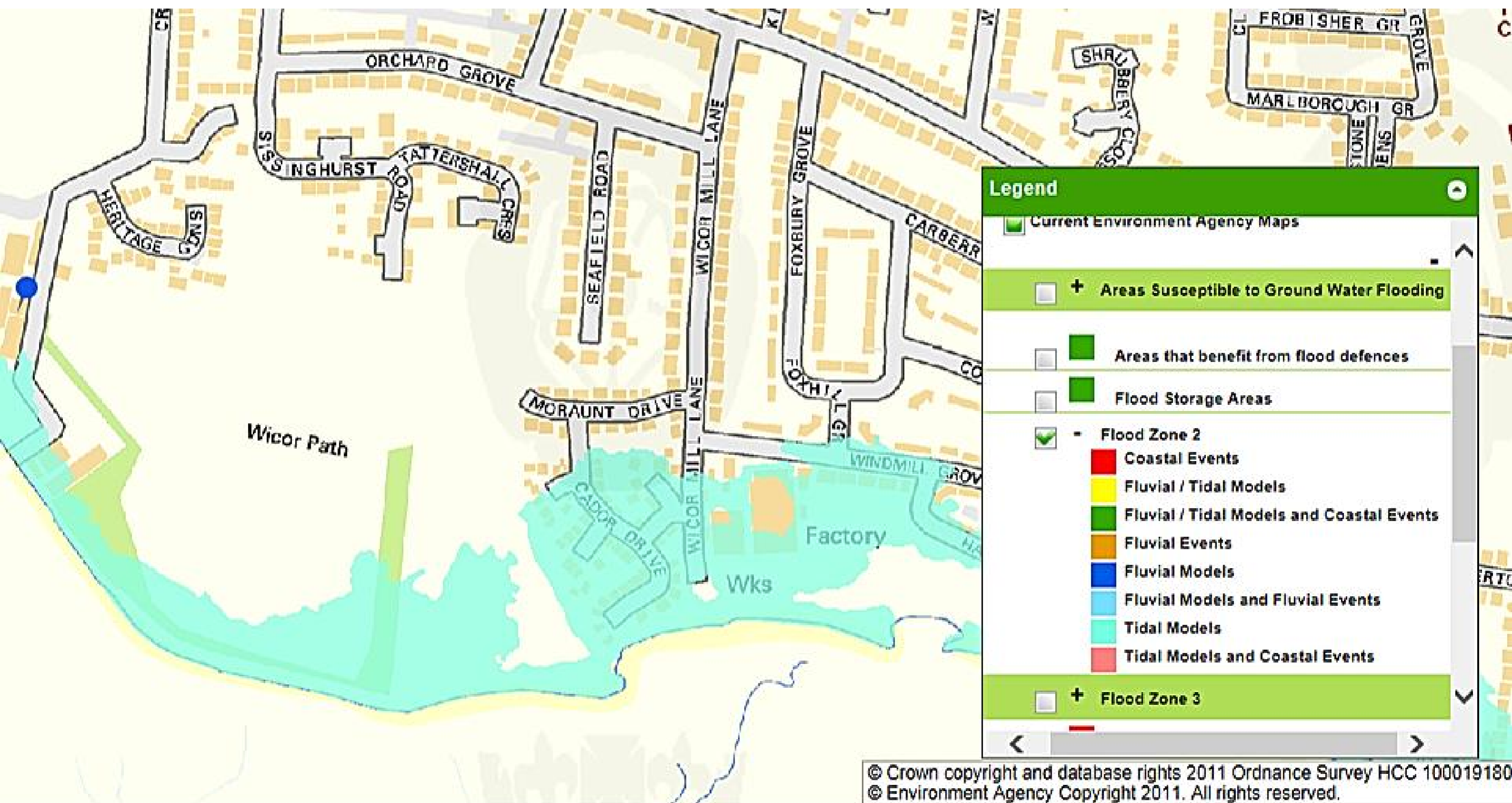
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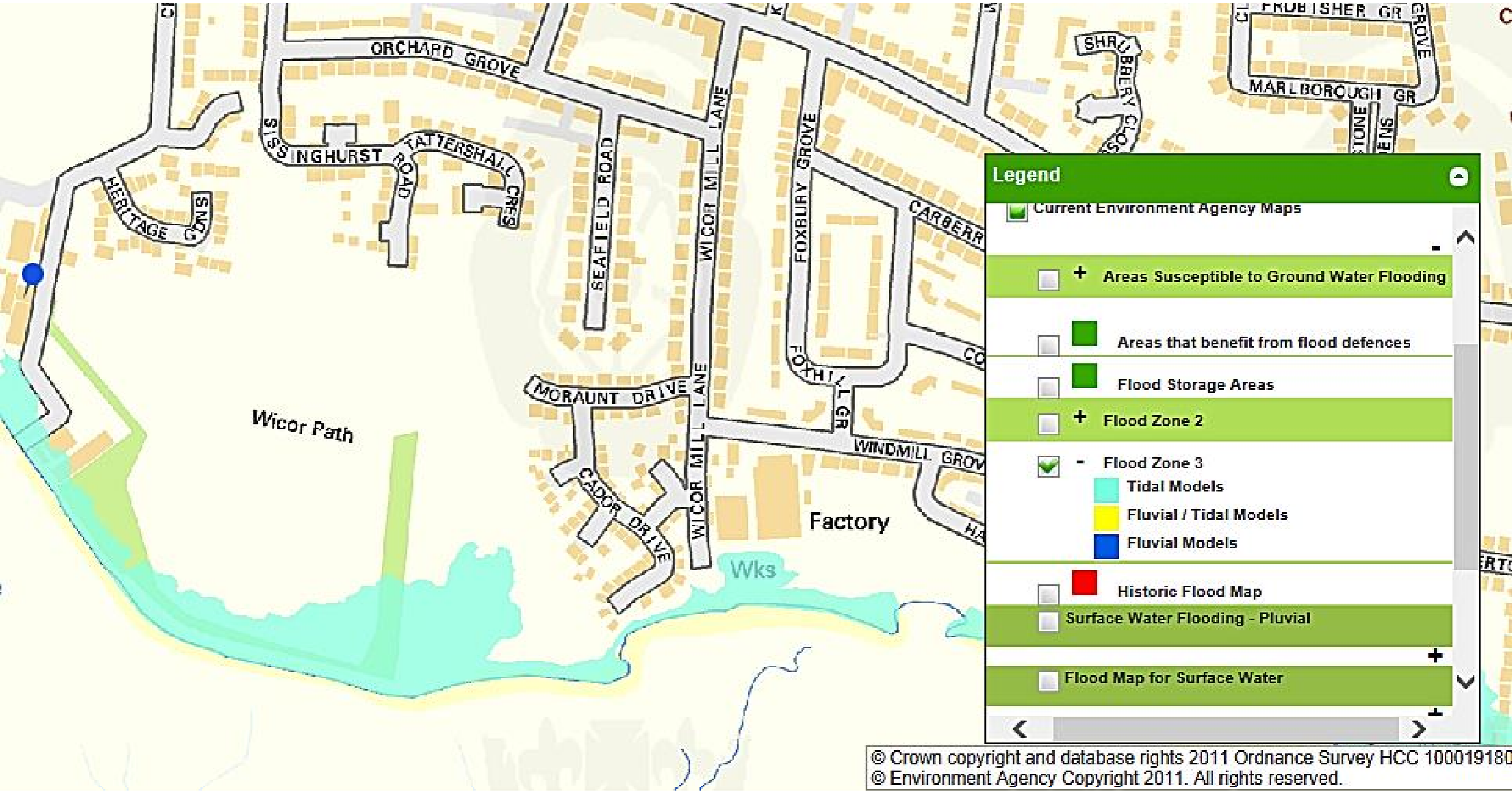
## **APPENDIX F**

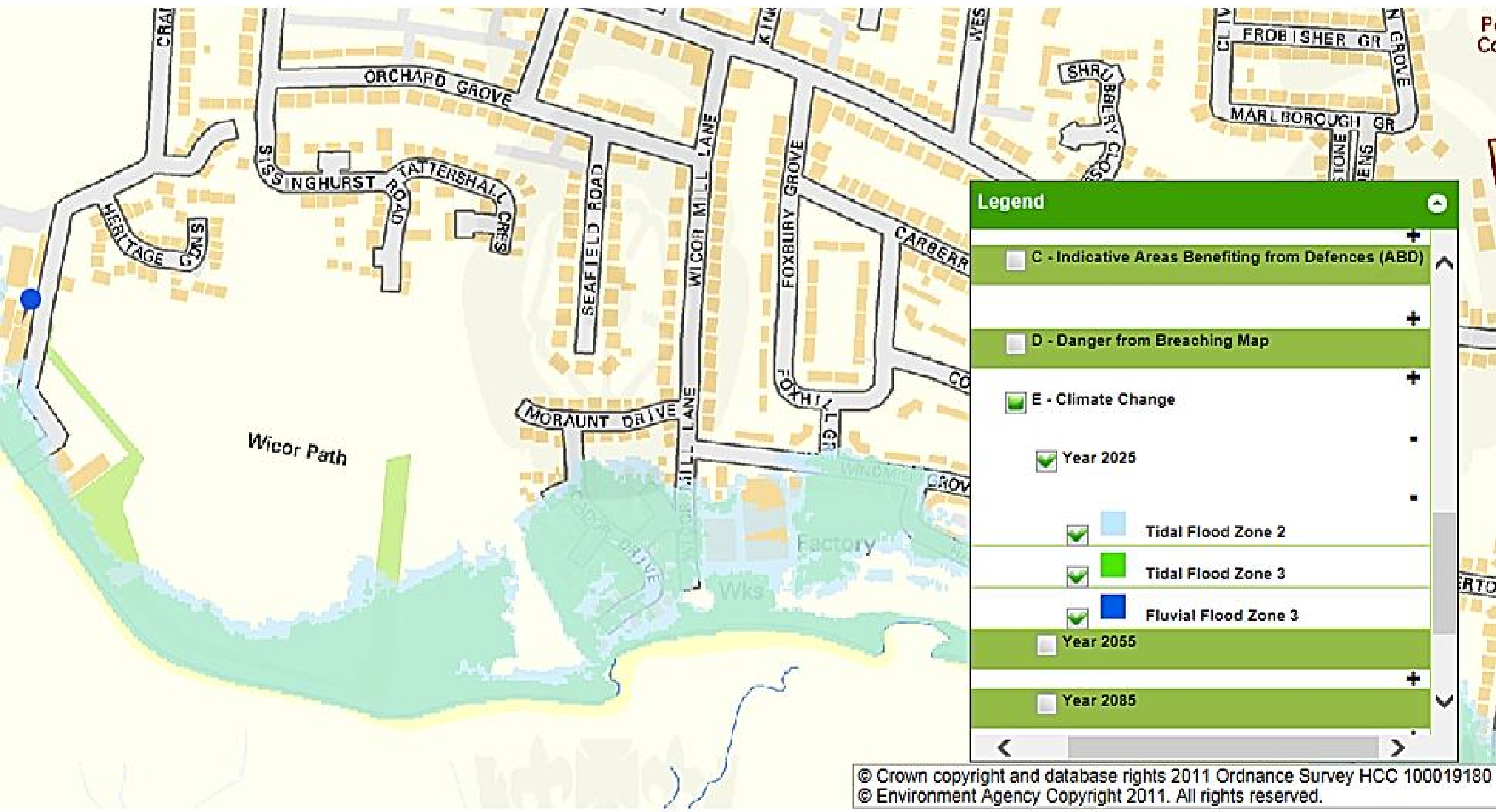
### **SFRA Flood Zone Map**



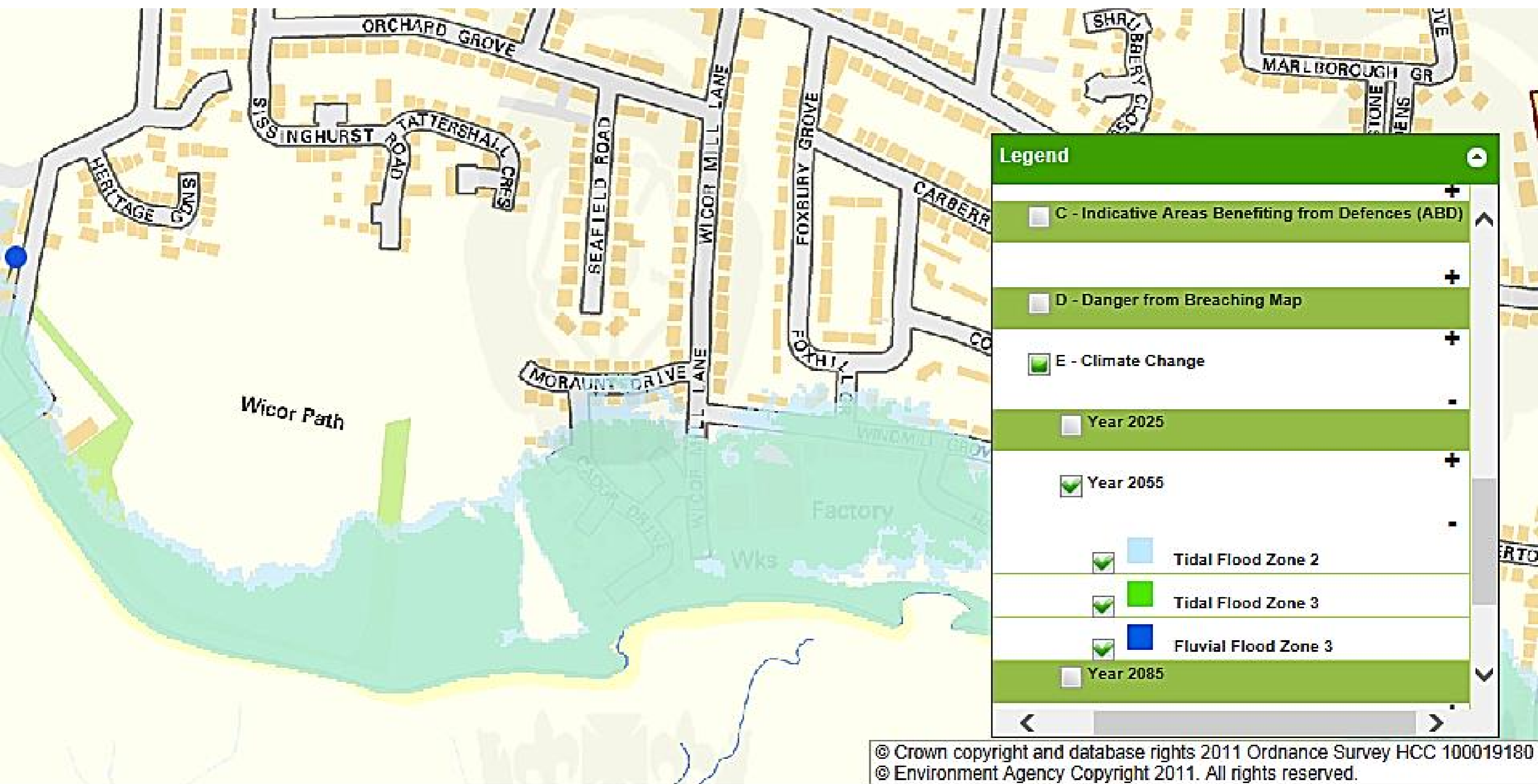
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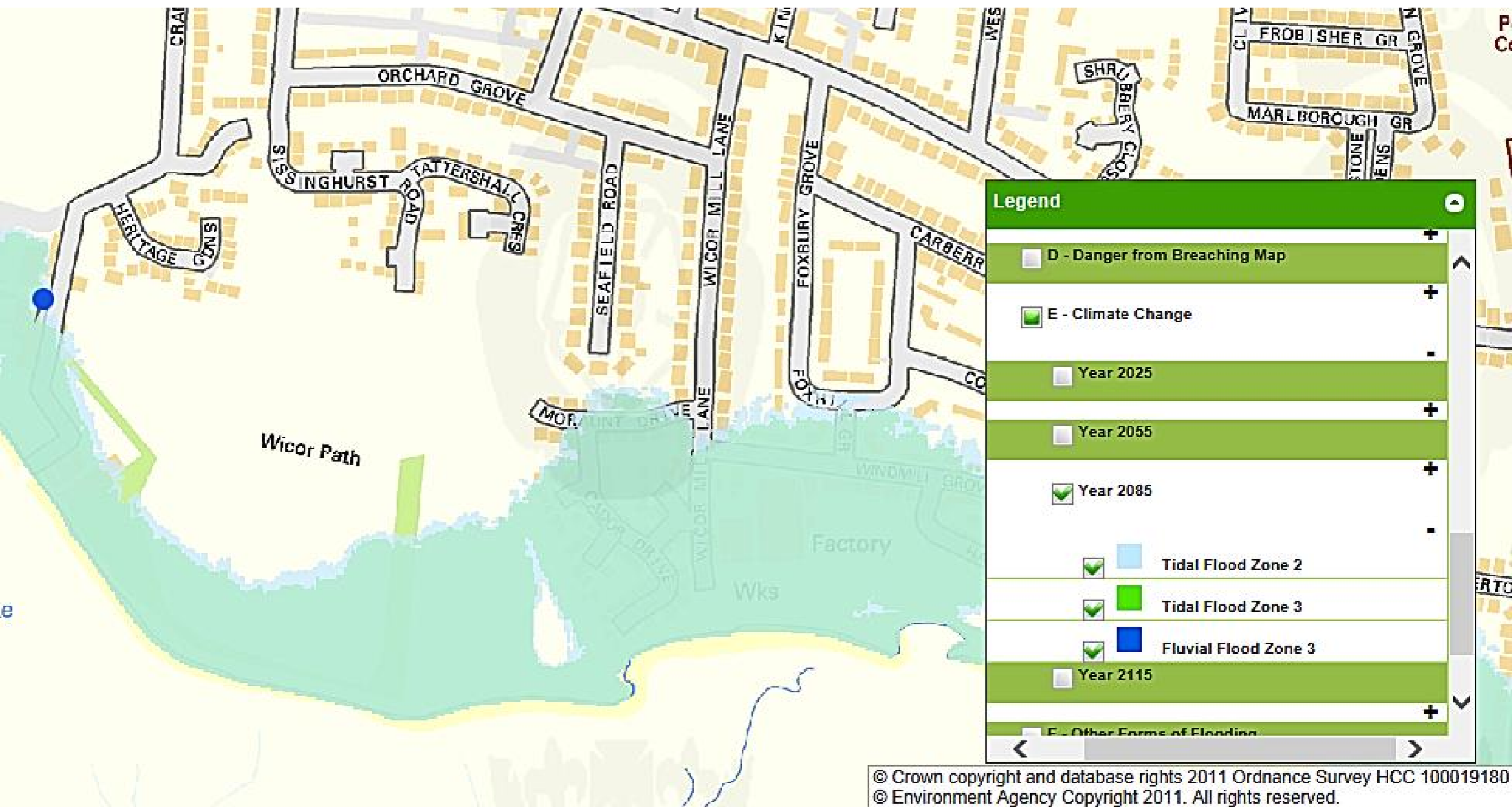


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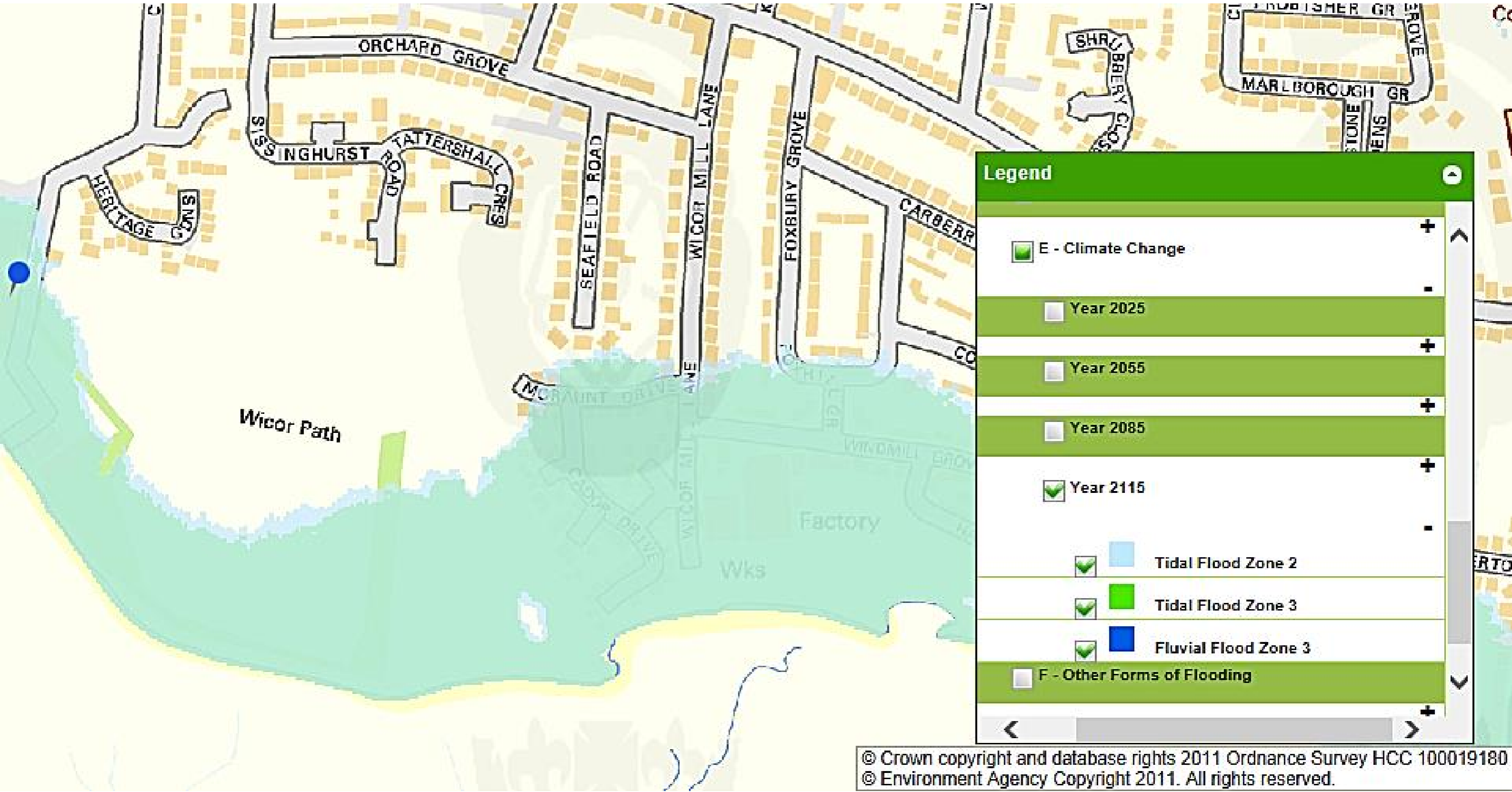


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## **APPENDIX G**

### **Environment Agency Flood Data**

## Andy Johnson

---

**From:** Partnership and Strategic Overview team, HIOW <psohiow@environment-agency.gov.uk>  
**Sent:** 23 July 2014 12:20  
**To:** Andy Johnson  
**Cc:** SSD Enquiries  
**Subject:** Flood Risk Information for Project Dark Town - Ref: SSD/4460  
**Attachments:** Defences.pdf; Flood Map.pdf; FRA Advisory Text.pdf; Standard Notice.pdf

Dear Andy,

### **Provision of Product 4 for Project Dark Town, Fareham**

Thank you for your request of 2 July 2014 to use Environment Agency data, Product 4, in the development of *Project Dark Town, Fareham*. The information is attached.

If you have requested this information to help inform a development proposal, then you should note the detail in the attached advisory text on the use of Environment Agency Information for Flood Risk Assessments / Flood Consequence Assessments.

The site may be affected by an extreme flood. According to our published flood map, which provides a general estimate of the likelihood of flooding across England & Wales, the property is shown to be within Flood Zone 3 - an area which may have a 0.5% chance of flooding annually (1 in 200), **ignoring** the presence and effect of any flood defences.

The Environment Agency has no record of flooding to this area, but not all flooding events are reported to us and further information may be available from Fareham Borough Council.

Defences . See attached map. The defences were found to be in good condition when we last inspected them.

The Environment Agency holds data about extreme sea levels around the coast of England, Wales and Scotland.

Sea levels (still water design estimates) for the 0.5% (1:200) and the 0.1% (1:1000) annual exceedance probabilities relevant to your site are provided in the table below.

Year	Tide Level (mAOD*)	
	0.5% annual exceedance probability/1 in 200 Year (Flood Zone 3)	0.1% annual exceedance probability/1 in 1000 Year (Flood Zone 2)
2010	3.2	3.4
2070	3.7	3.9
2115	4.3	4.5

\* Levels in metres above Ordnance Datum Newlyn.

These values are based on 2008 base data, and have been projected for climate change using estimates for sea level rise presented in Table 4 of the Technical Guidance to the National Planning Policy Framework.

#### **Note 1:**

Extreme sea level values are for still water sea levels only. Extreme sea level values include the effect of storm surge but do not account for any local increase in sea level that may be induced by onshore wave action. Wave set-up would need to be estimated separately.

**Note 2:**

Annual exceedance probability describes the likelihood (chance) of being exceeded in any given year.

This information is provided subject to the enclosed notice, which you should read.

If you have any queries or would like to discuss the content of this letter further please contact the Partnership and Strategic Overview team at the Environment Agency.

Yours faithfully

**Aimee Cox**  
**Partnership and Strategic Overview team, Hampshire and Isle of Wight**  
**Environment Agency**

Direct dial (01794) 834569

Email [psohiow@environment-agency.gov.uk](mailto:psohiow@environment-agency.gov.uk)

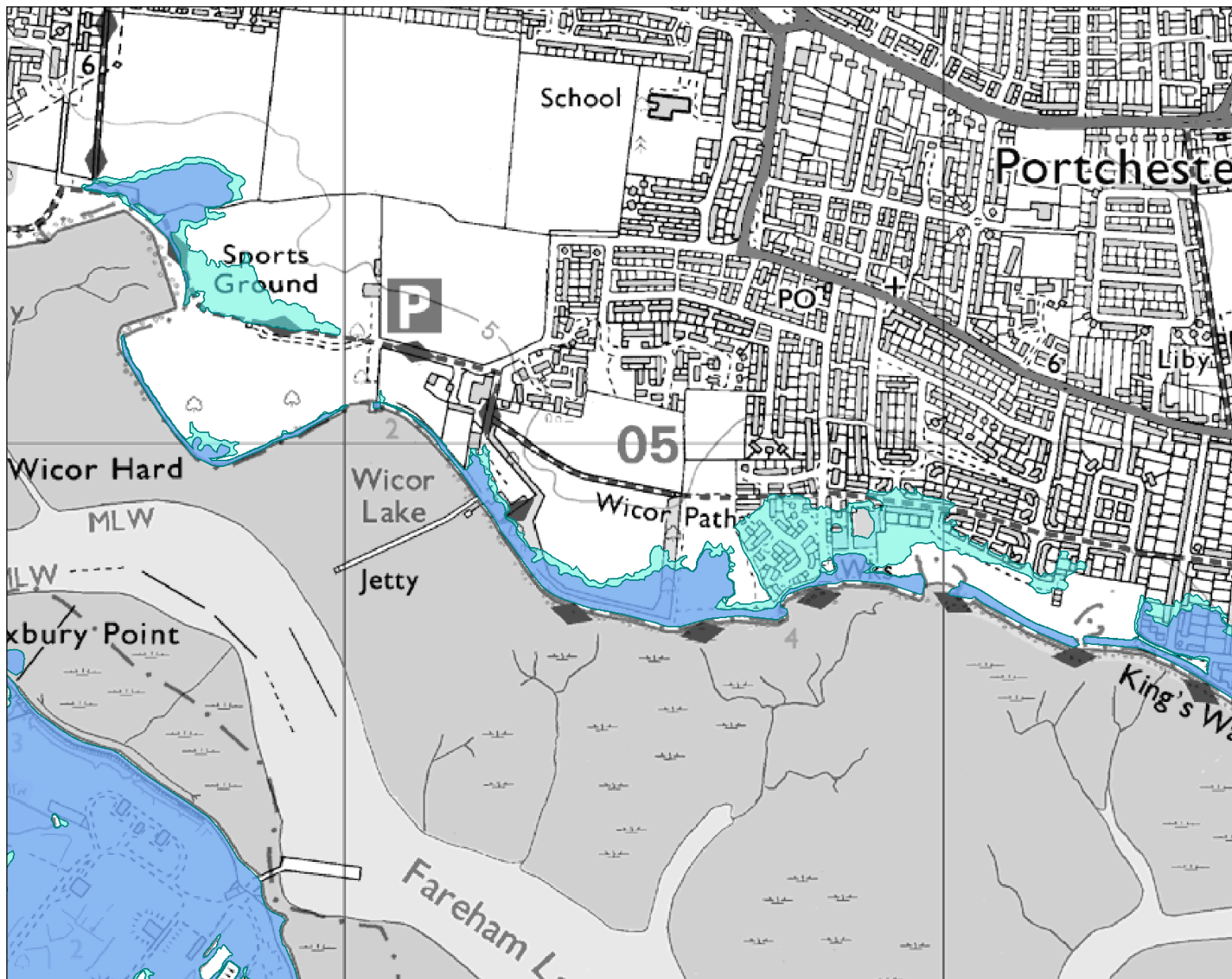
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# Flood Map (Rivers & Sea) Centered on Grid Ref 460471, 104914 - Created 23 July 2014



Scale 1:10,001



## Flood Map for Planning (Rivers and Sea)

-  Flood Map - Defences
-  Areas Benefiting from Flood Defences
-  Flood Map - Flood Storage Areas
-  Flood Map - Flood Zone 3
-  Flood Map - Flood Zone 2

## Flood Map for Planning (Rivers and Sea) (assuming no defences)

**Flood Zone 3** shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

**Flood Zone 2** shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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# Defences Centered on Grid Ref: 460471, 104914 - Created 23 July 2014 (Ref: SSD/4460)



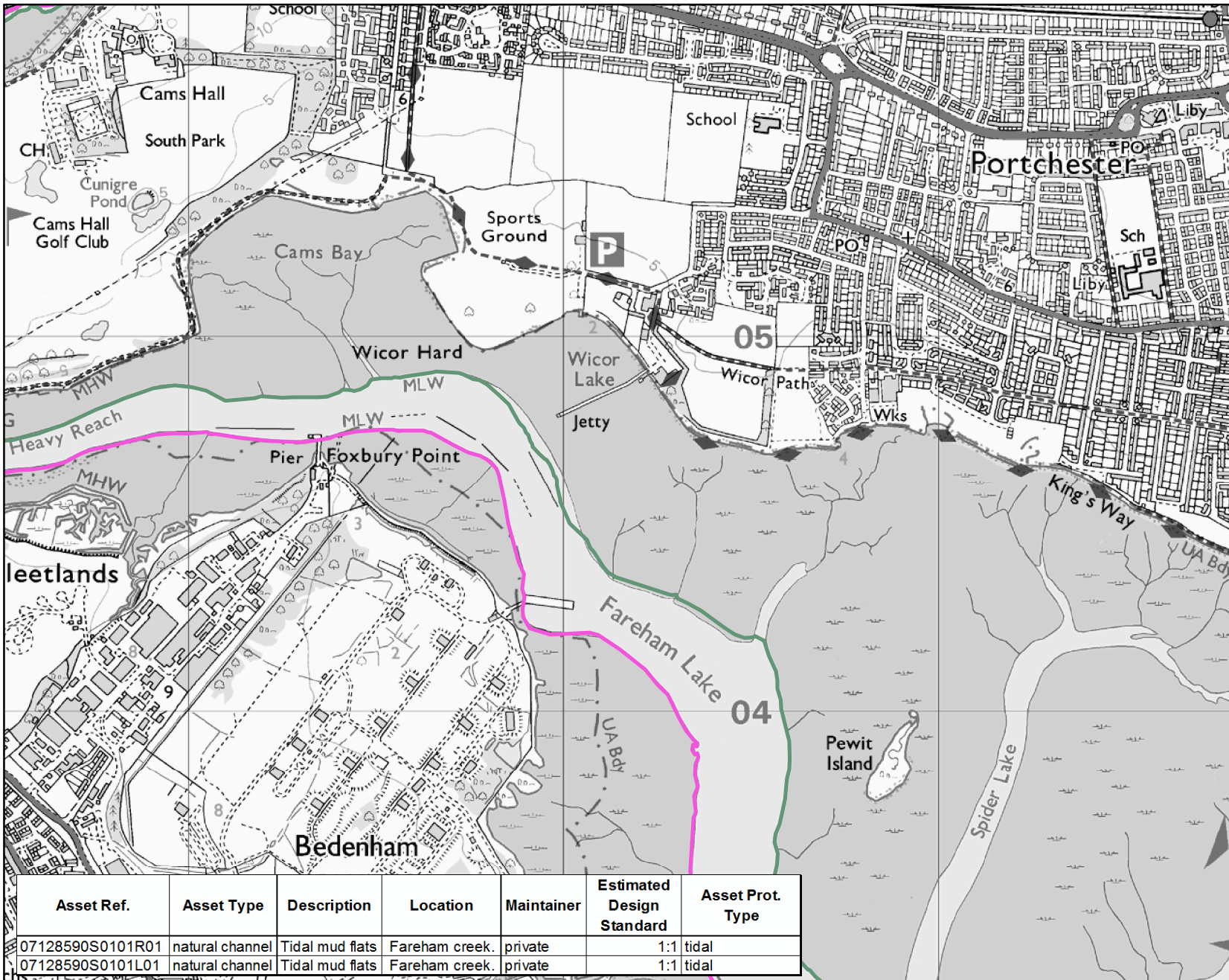
## Legend

Defences

Asset Ref

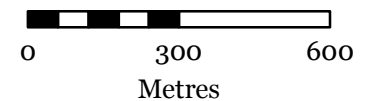
— 07128590S0101L01

— 07128590S0101R01



1:14,991 \*

\*when printed at A4.

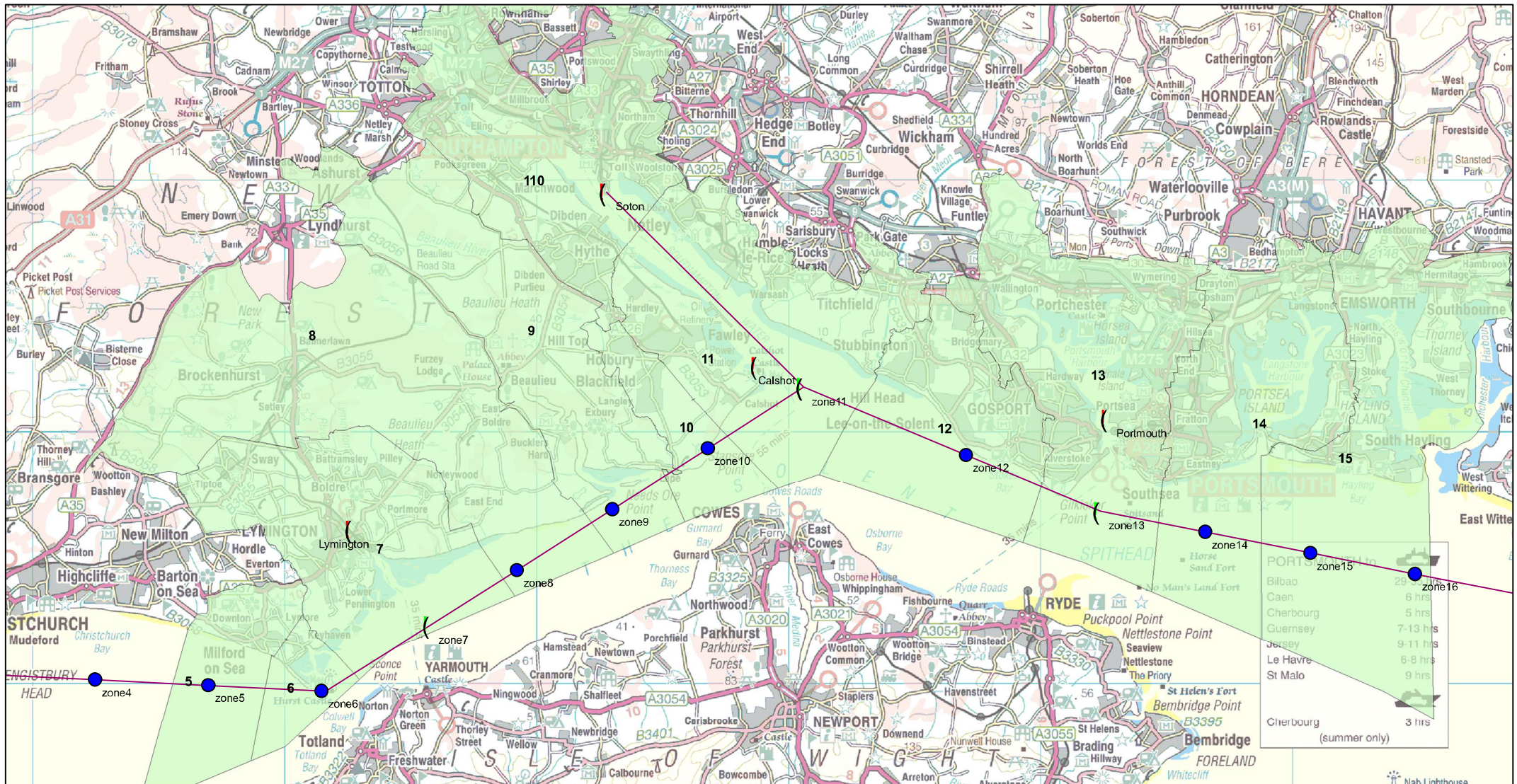


Asset Ref.	Asset Type	Description	Location	Maintainer	Estimated Design Standard	Asset Prot. Type
07128590S0101R01	natural channel	Tidal mud flats	Fareham creek.	private	1:1	tidal
07128590S0101L01	natural channel	Tidal mud flats	Fareham creek.	private	1:1	tidal

**APPENDIX H**  
**SFRA Tidal Level Map**



# Location of Analysed Tide Level Stations and Interpolated Zones



## Legend

### Location Station

- Interpolated node
- { primary sea level recorder station
- { projected primary sea level recorder station
- Line of interpolation
- Tidal Zones

**Notes:** Distance between tidal zone nodes equates to 100mm difference in tide level.

**Date:** 01/06/2007  
**Prepared by Flood Risk Mapping And Data Management Team (Tony Burch and Stefan Laeger)**



Col.1      Col.1a      Col.2      Col.2a      Col.3      Col.4      Col.5      Col.5A      Col.6      Col.7      Col.8      Col.9      Col.10

200 year tidal level for Analysed Sites (in grey) and intermediate tidal zones												
Location	Tidal Zone	Km	Km	at 2000 from Table 4 (2)	at 2000 from Appx. B (3)	at 1990 adjusted from Appx. B (4)	1990 BASELINE (Col. 5 to 1 decimal place)	2010 (1990 +80mm)	2025 (1990 + 140mm)	2055 (2025 + 255mm)	2085 (2055 + 360mm)	2115 (2085 + 450mm)
<b>Bournemouth</b>	1	0.00		<b>2.0</b>	<b>1.96</b>	<b>1.90</b>	<b>1.9</b>	<b>2.0</b>	<b>2.0</b>	<b>2.3</b>	<b>2.7</b>	<b>3.1</b>
Southbourne	2	4.50					<b>2.0</b>	2.1	2.1	2.4	2.7	3.2
Hengisbury Head	3	9.00					<b>2.1</b>	2.1	2.2	2.5	2.8	3.3
Barton on Sea	4	13.50					<b>2.2</b>	2.2	2.3	2.5	2.9	3.4
Milford on Sea	5	18.00					<b>2.2</b>	2.3	2.4	2.6	3.0	3.4
Hurst Castle	6	22.50					<b>2.3</b>	2.4	2.5	2.7	3.1	3.5
<b>Lymington</b>	7	27.00	0.00	n/a	<b>2.50</b>	<b>2.44</b>	<b>2.4</b>	<b>2.5</b>	<b>2.5</b>	<b>2.8</b>	<b>3.2</b>	<b>3.6</b>
Thornes Beach	8		4.50				<b>2.5</b>	2.6	2.7	2.9	3.3	3.7
Needs Ore Point	9		9.00				<b>2.7</b>	2.7	2.8	3.0	3.4	3.9
Stansore Point	10		13.50				<b>2.8</b>	2.9	2.9	3.2	3.5	4.0
<b>Calshot</b>	11	0.00	18.00	<b>3.0</b>	<b>2.96</b>	<b>2.90</b>	<b>2.9</b>	<b>3.0</b>	<b>3.0</b>	<b>3.3</b>	<b>3.7</b>	<b>4.1</b>
Lee on Solent/Gosport	12	7.50					<b>3.0</b>	3.1	3.1	3.4	3.8	4.2
<b>Portsmouth (harbour)</b>	13	15.00	0.00	<b>3.1</b>	<b>3.13</b>	<b>3.07</b>	<b>3.1</b>	<b>3.2</b>	<b>3.2</b>	<b>3.5</b>	<b>3.9</b>	<b>4.3</b>
Langstone Harbour	14		4.25				<b>3.2</b>	3.3	3.3	3.6	4.0	4.4
Chister Harbour	15		8.50				<b>3.3</b>	3.4	3.4	3.7	4.1	4.5
West Wittering	16		12.75				<b>3.4</b>	3.5	3.5	3.8	4.2	4.6
Bracklesham	17		17.00				<b>3.5</b>	3.6	3.6	3.9	4.3	4.7
West Selsy Bill	18		21.25				<b>3.6</b>	3.7	3.7	4.0	4.4	4.8
East Selsy Bill	19		25.50				<b>3.7</b>	3.8	3.8	4.1	4.5	4.9
Pagham	20		29.75				<b>3.8</b>	3.9	3.9	4.2	4.6	5.0
Bognor Regis	21		34.00				<b>3.9</b>	4.0	4.0	4.3	4.7	5.1
Middleton on Sea	22		38.25				<b>4.0</b>	4.1	4.1	4.4	4.8	5.2
<b>Littlehampton</b>	23		42.50	<b>4.1</b>	<b>4.12</b>	<b>4.06</b>	<b>4.1</b>	<b>4.2</b>	<b>4.2</b>	<b>4.5</b>	<b>4.9</b>	<b>5.3</b>
<b>Southampton</b>	110			<b>3.0</b>	<b>3.03</b>	<b>2.97</b>	<b>3.0</b>	<b>3.1</b>	<b>3.1</b>	<b>3.4</b>	<b>3.8</b>	<b>4.2</b>

Prepared by Flood Risk Mapping and Data Management (Tony Burch and Stefan Laeger)  
Date: 01 June 2007

Col 1      Col 1a      Col.2    Col. 2a      Col.3      Col.4      Col.5      Col.5A      Col 6      Col. 7      Col. 8      Col. 9      Col. 10

1,000 year tidal level for Analysed Sites (in grey) and intermediate tidal zones

Location	Tidal Zone	Km	Km	at 2000 from Table 4 (2)	at 2000 from Appx. B (3)	at 1990 adjusted from Appx. B (4)	1990 BASELINE (Col. 5 to 1 decimal place)	2010 (1990 +80mm)	2025 (1990 + 140mm)	2055 (2025 + 255mm)	2085 (2055 + 360mm)	2115 (2085 + 450mm)
<b>Bournemouth</b>	1	0.00		<b>2.1</b>	<b>2.14</b>	<b>2.08</b>	<b>2.1</b>	<b>2.2</b>	<b>2.2</b>	<b>2.5</b>	<b>2.9</b>	<b>3.3</b>
Southbourne	2	4.50					<b>2.2</b>	<b>2.3</b>	<b>2.3</b>	<b>2.6</b>	<b>2.9</b>	<b>3.4</b>
Hengisbury Head	3	9.00					<b>2.3</b>	<b>2.3</b>	<b>2.4</b>	<b>2.7</b>	<b>3.0</b>	<b>3.5</b>
Barton on Sea	4	13.50					<b>2.4</b>	<b>2.4</b>	<b>2.5</b>	<b>2.7</b>	<b>3.1</b>	<b>3.6</b>
Milford on Sea	5	18.00					<b>2.4</b>	<b>2.5</b>	<b>2.6</b>	<b>2.8</b>	<b>3.2</b>	<b>3.6</b>
Hurst Castle	6	22.50					<b>2.5</b>	<b>2.6</b>	<b>2.7</b>	<b>2.9</b>	<b>3.3</b>	<b>3.7</b>
<b>Lymington</b>	7	27.00	0.00	n/a	<b>2.63</b>	<b>2.57</b>	<b>2.6</b>	<b>2.7</b>	<b>2.7</b>	<b>3.0</b>	<b>3.4</b>	<b>3.8</b>
Thornes Beach	8		4.50				<b>2.7</b>	<b>2.8</b>	<b>2.9</b>	<b>3.1</b>	<b>3.5</b>	<b>3.9</b>
Needs Ore Point	9		9.00				<b>2.9</b>	<b>2.9</b>	<b>3.0</b>	<b>3.2</b>	<b>3.6</b>	<b>4.1</b>
Stansore Point	10		13.50				<b>3.0</b>	<b>3.1</b>	<b>3.1</b>	<b>3.4</b>	<b>3.7</b>	<b>4.2</b>
<b>Calshot</b>	11	0.00	18.00	<b>3.2</b>	<b>3.15</b>	<b>3.09</b>	<b>3.1</b>	<b>3.2</b>	<b>3.2</b>	<b>3.5</b>	<b>3.9</b>	<b>4.3</b>
Lee on Solent/Gosport	12	7.50					<b>3.2</b>	<b>3.3</b>	<b>3.3</b>	<b>3.6</b>	<b>4.0</b>	<b>4.4</b>
<b>Portsmouth (harbour)</b>	13	15.00	0.00	<b>3.3</b>	<b>3.32</b>	<b>3.26</b>	<b>3.3</b>	<b>3.4</b>	<b>3.4</b>	<b>3.7</b>	<b>4.1</b>	<b>4.5</b>
Langstone Harbour	14		4.25				<b>3.4</b>	<b>3.5</b>	<b>3.5</b>	<b>3.8</b>	<b>4.2</b>	<b>4.6</b>
Chister Harbour	15		8.50				<b>3.5</b>	<b>3.6</b>	<b>3.6</b>	<b>3.9</b>	<b>4.3</b>	<b>4.7</b>
West Wittering	16		12.75				<b>3.6</b>	<b>3.7</b>	<b>3.7</b>	<b>4.0</b>	<b>4.4</b>	<b>4.8</b>
Brackelsham	17		17.00				<b>3.7</b>	<b>3.8</b>	<b>3.8</b>	<b>4.1</b>	<b>4.5</b>	<b>4.9</b>
West Selsey Bill	18		21.25				<b>3.8</b>	<b>3.9</b>	<b>3.9</b>	<b>4.2</b>	<b>4.6</b>	<b>5.0</b>
East Selsey Bill	19		25.50				<b>3.9</b>	<b>4.0</b>	<b>4.0</b>	<b>4.3</b>	<b>4.7</b>	<b>5.1</b>
Pagham	20		29.75				<b>4.0</b>	<b>4.1</b>	<b>4.1</b>	<b>4.4</b>	<b>4.8</b>	<b>5.2</b>
Bognor Regis	21		34.00				<b>4.1</b>	<b>4.2</b>	<b>4.2</b>	<b>4.5</b>	<b>4.9</b>	<b>5.3</b>
Middleton on Sea	22		38.25				<b>4.2</b>	<b>4.3</b>	<b>4.3</b>	<b>4.6</b>	<b>5.0</b>	<b>5.4</b>
<b>Littlehampton</b>	23		42.50	<b>4.3</b>	<b>4.32</b>	<b>4.26</b>	<b>4.3</b>	<b>4.4</b>	<b>4.4</b>	<b>4.7</b>	<b>5.1</b>	<b>5.5</b>
<b>Southampton</b>	110			<b>3.2</b>	<b>3.21</b>	<b>3.15</b>	<b>3.2</b>	<b>3.3</b>	<b>3.3</b>	<b>3.6</b>	<b>4.0</b>	<b>4.4</b>

Prepared by Flood Risk Mapping and Data Management (Tony Burch and Stefan Laeger)



Date: 01 June 2007

**APPENDIX J**

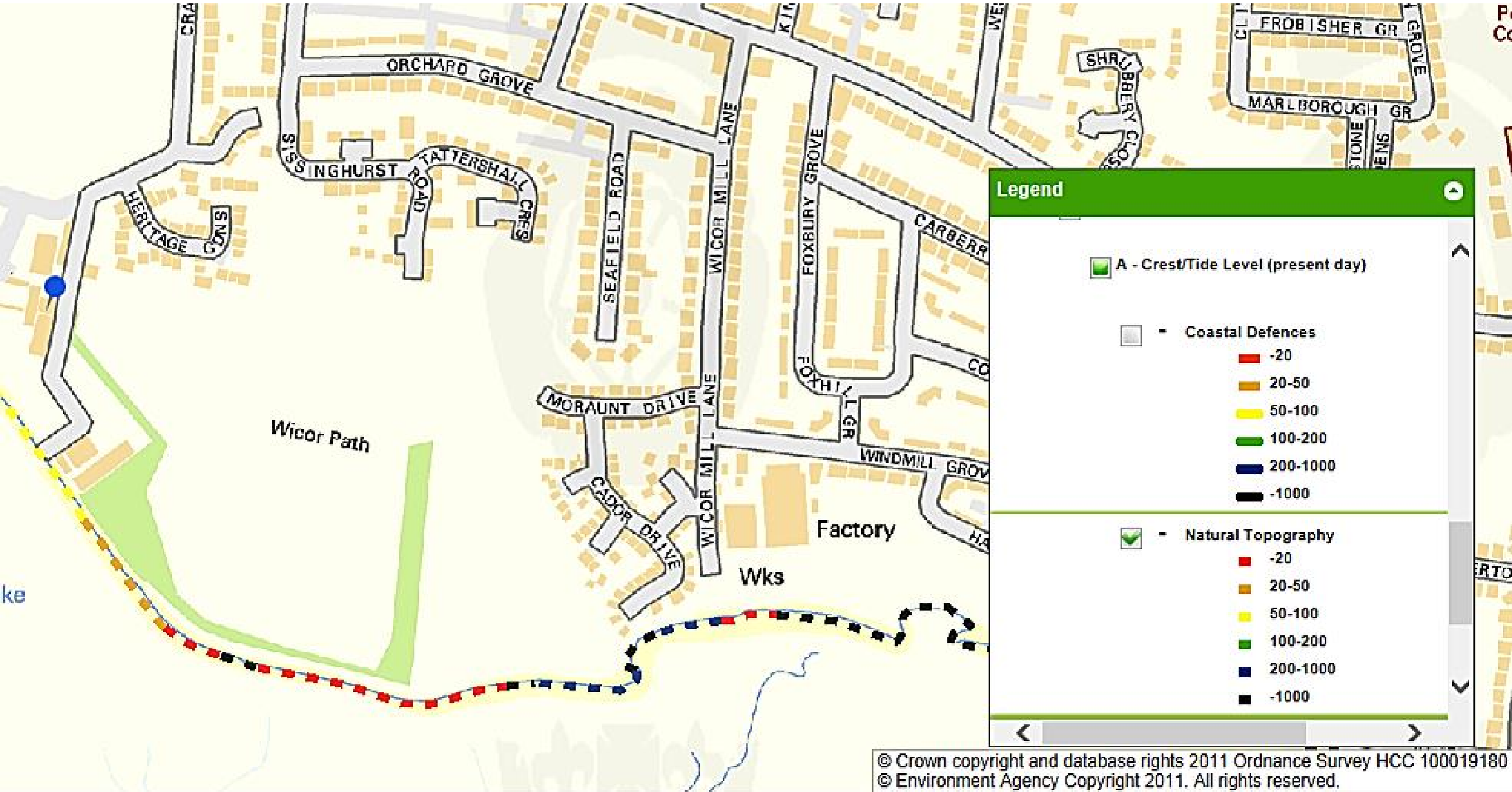
**SFRA Flood Defence Maps**

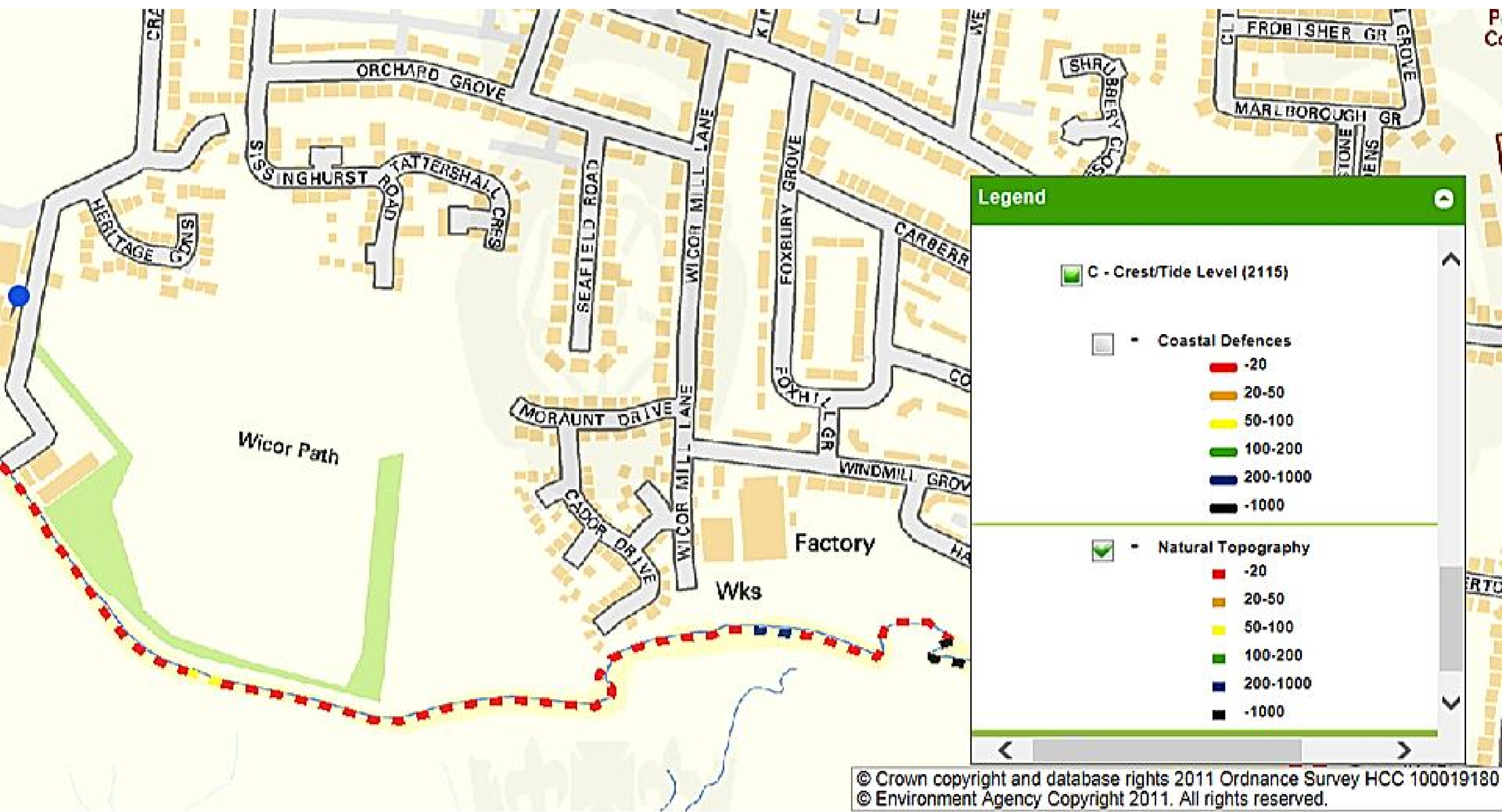


**Legend**

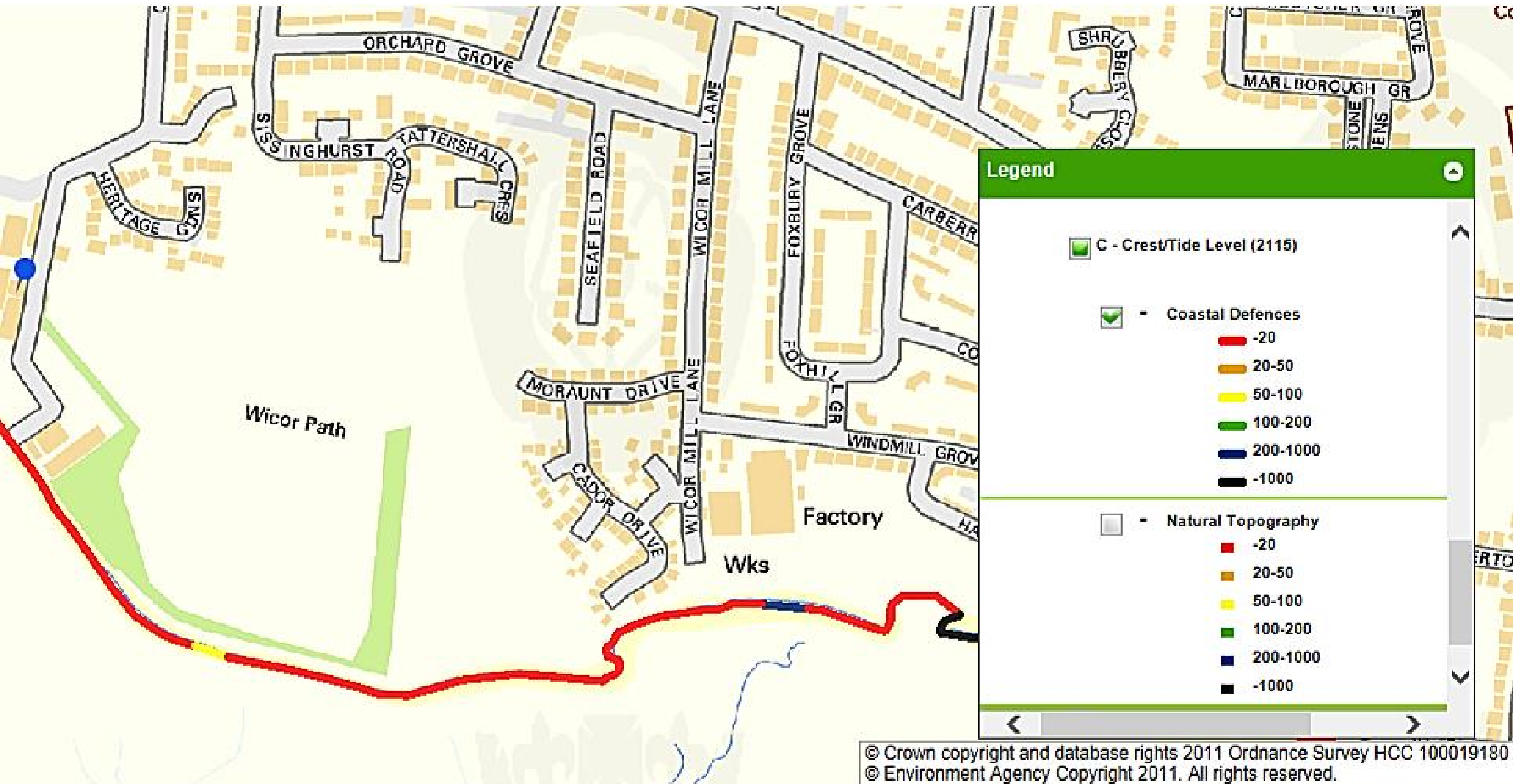
- Sequential Test & Supporting Information
- A - Environment Agency
- B - Hazard Map
- C - Indicative Areas Benefiting from Defences (ABD)
-  FZ3 - Frontages Protected from Tidal 0.5% Flood
-  FZ3 - Indicative Areas Benefitting from Defences ( )
- D - Danger from Breaching Map
- E - Climate Change
- F - Other Forms of Flooding

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## **APPENDIX K**

### **Environment Agency Flood Risk Map**

# Risk of Flooding from Rivers and Sea

River flooding happens when a river cannot cope with the amount of water draining into it from the surrounding land. Sea flooding happens when there are high tides and stormy conditions.

The shading on the map shows the risk of flooding from rivers and the sea in this particular area.


Click on the map for a more detailed explanation.


Map of X: 460,434; Y: 104,853 at scale 1:10,000


[Data search](#) 


**Map legend**

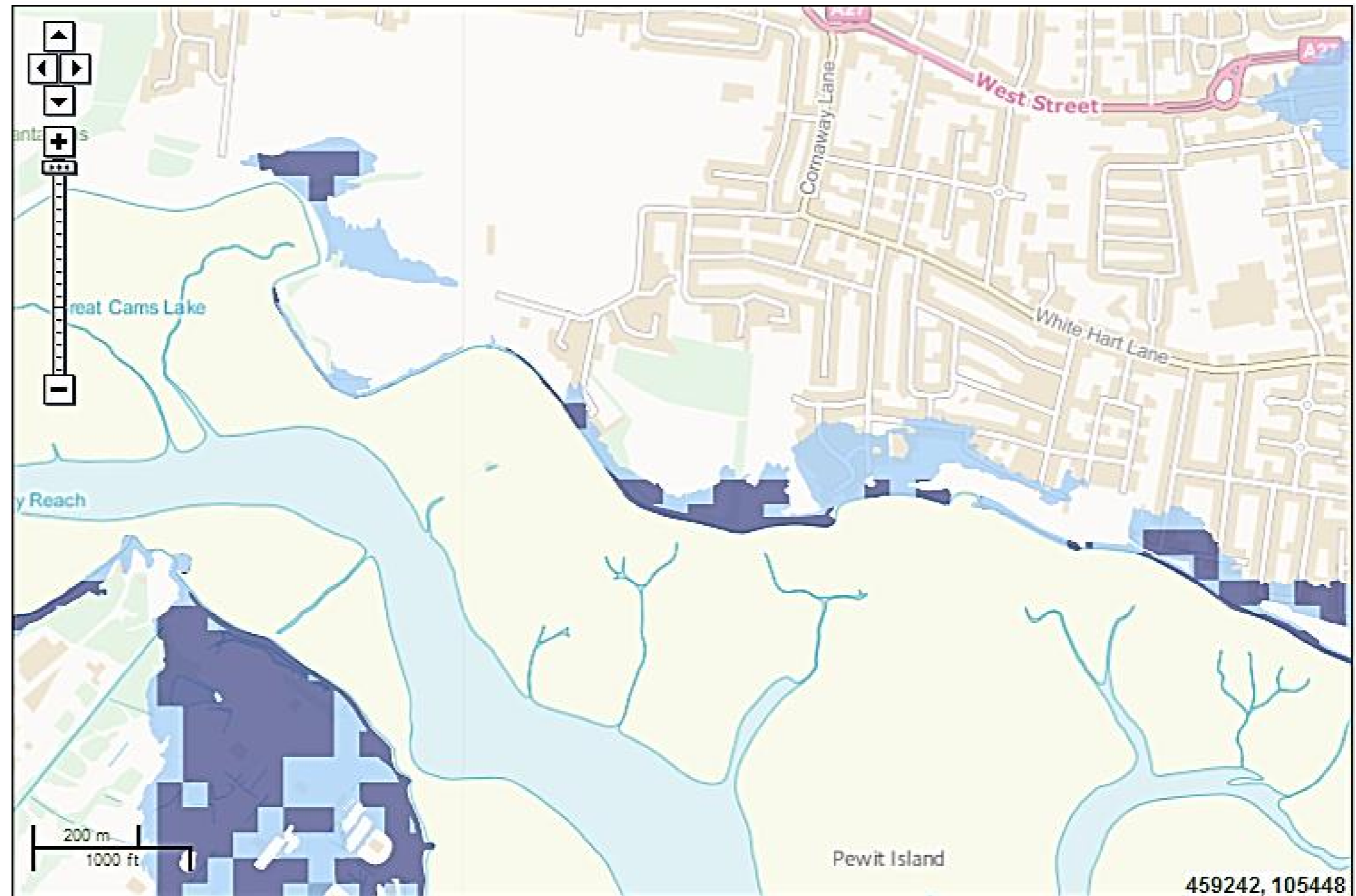
Risk of Flooding from Rivers and Sea

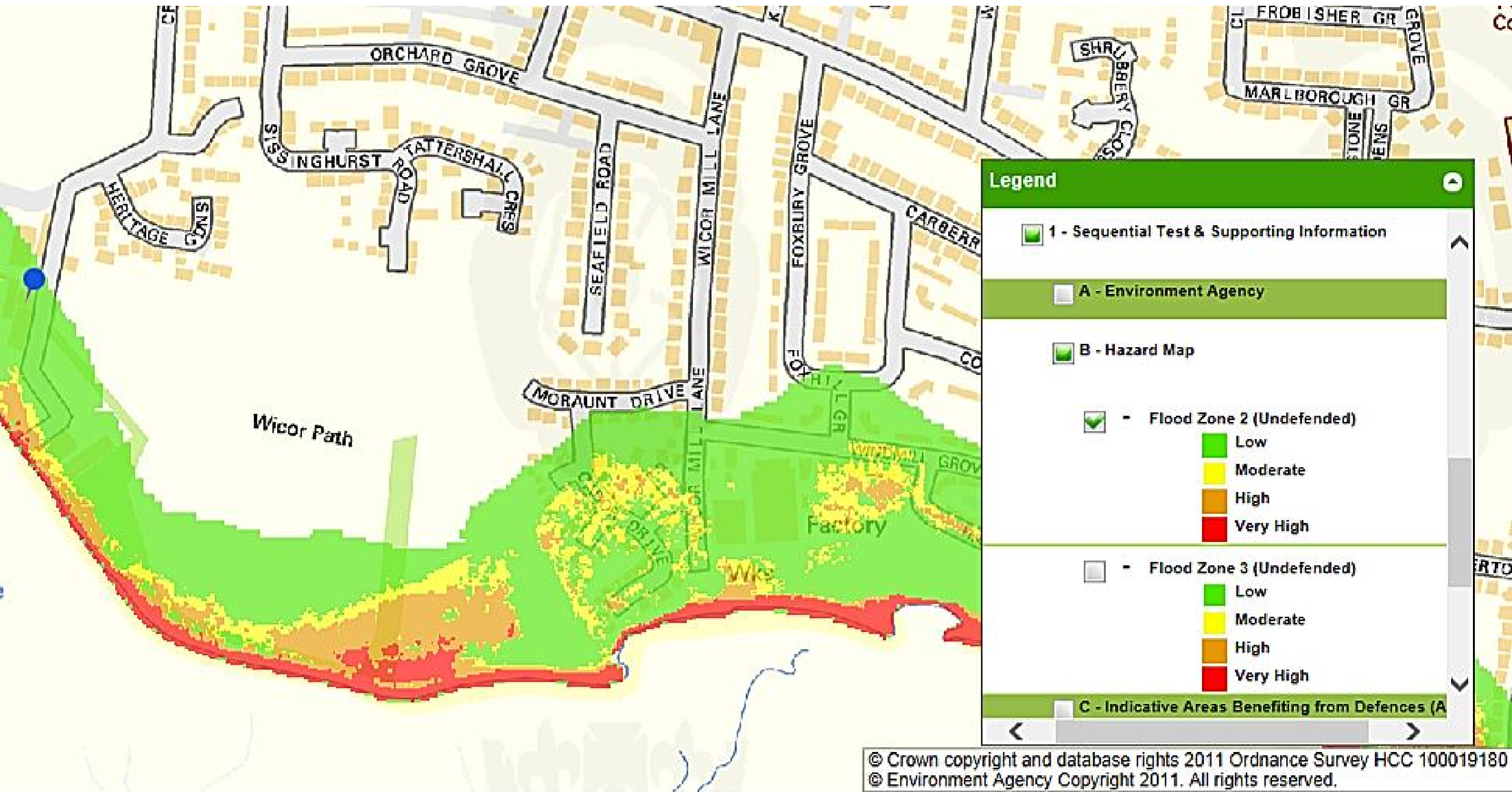
 High

 Medium

 Low

 Very Low

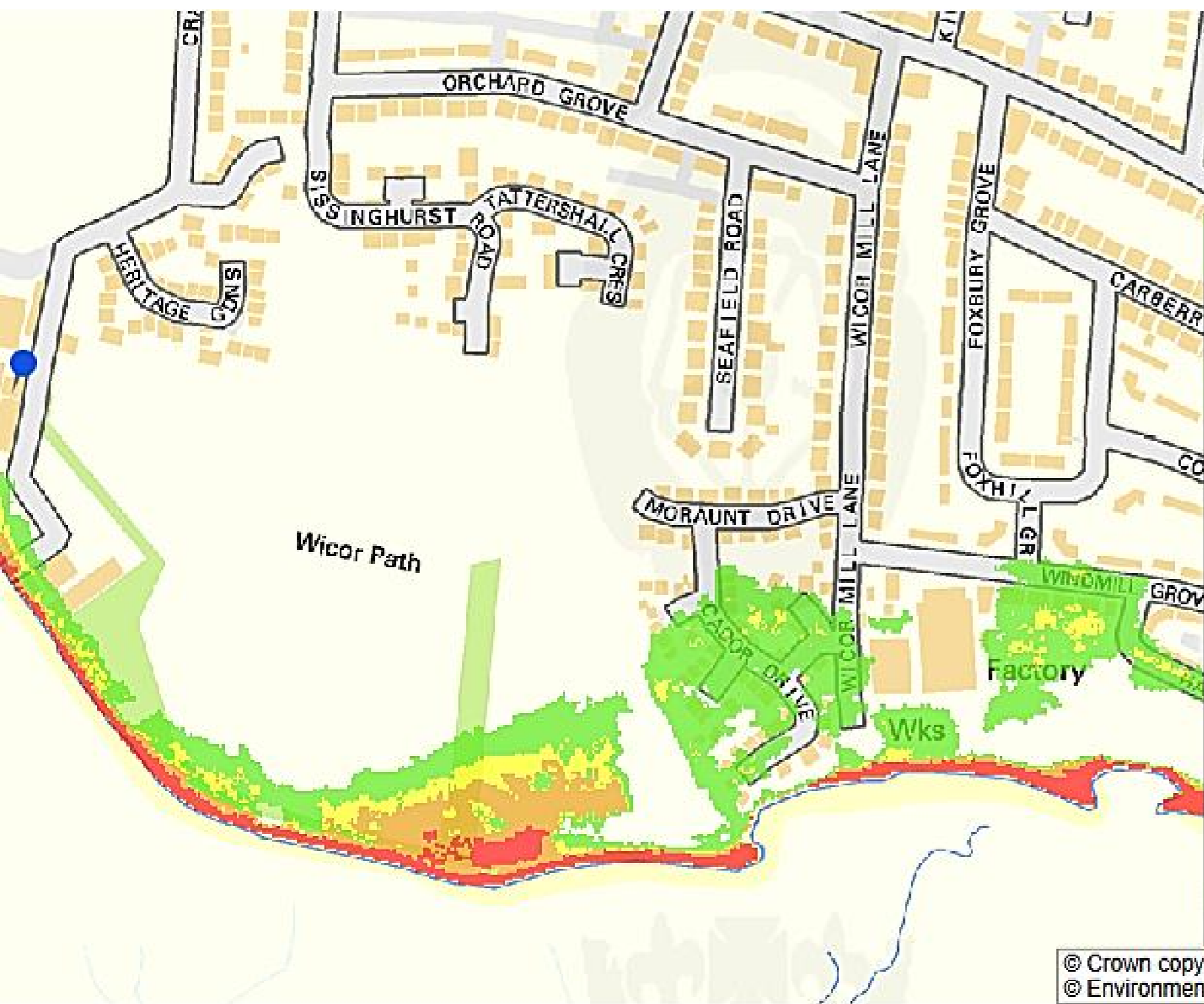




**Legend**

- 1 - Sequential Test & Supporting Information
- A - Environment Agency
- B - Hazard Map
- Flood Zone 2 (Undefended)
  - Low
  - Moderate
  - High
  - Very High
- Flood Zone 3 (Undefended)
  - Low
  - Moderate
  - High
  - Very High
- C - Indicative Areas Benefiting from Defences (A)

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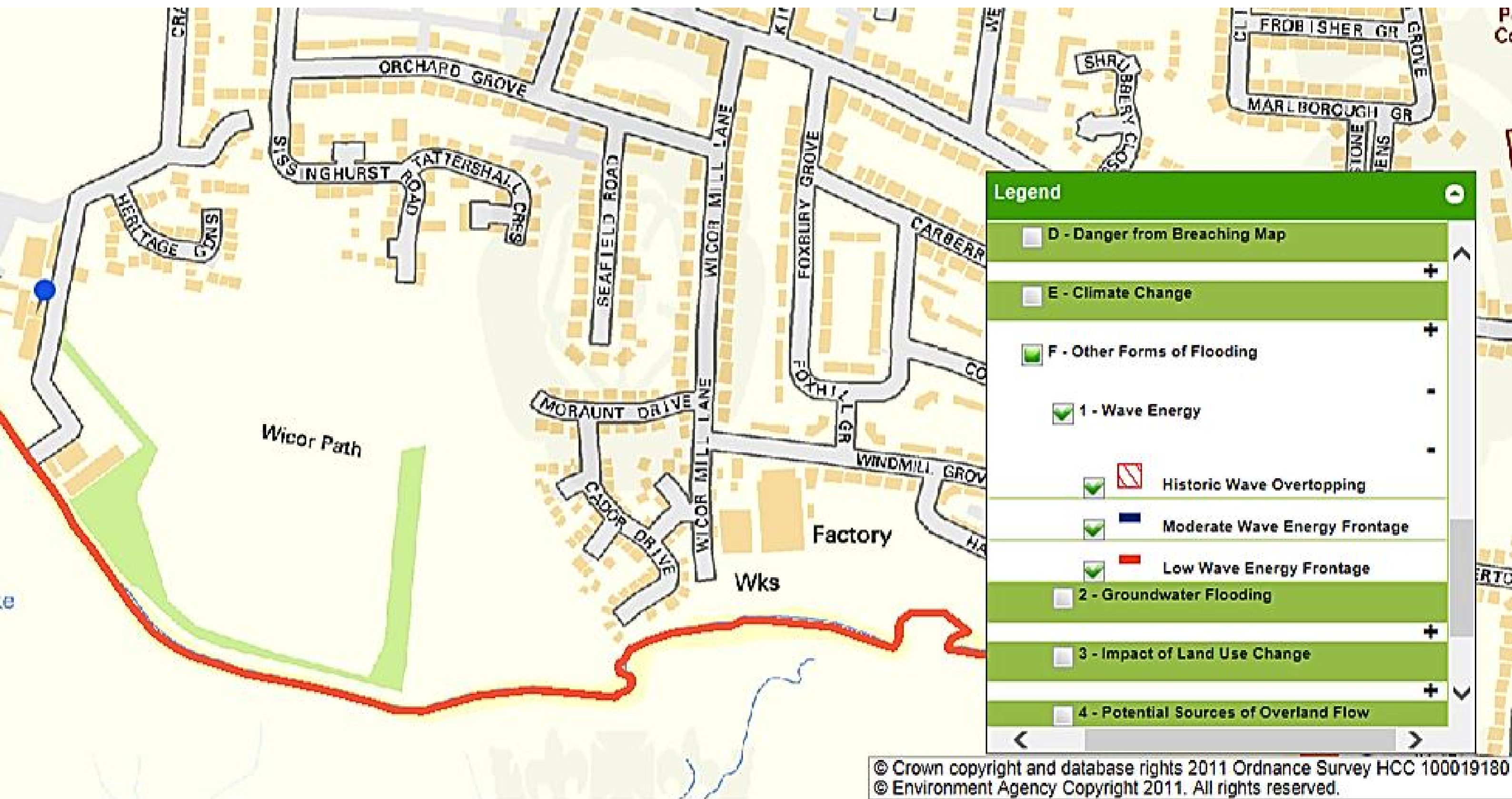


**Legend**



- 1 - Sequential Test & Supporting Information
- A - Environment Agency
- B - Hazard Map
  - Flood Zone 2 (Undefended)
    - Low
    - Moderate
    - High
    - Very High
  - Flood Zone 3 (Undefended)
    - Low
    - Moderate
    - High
    - Very High
- C - Indicative Areas Benefiting from Defences (A)

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**APPENDIX L**  
**SFRA Wave Energy Map**



### Legend

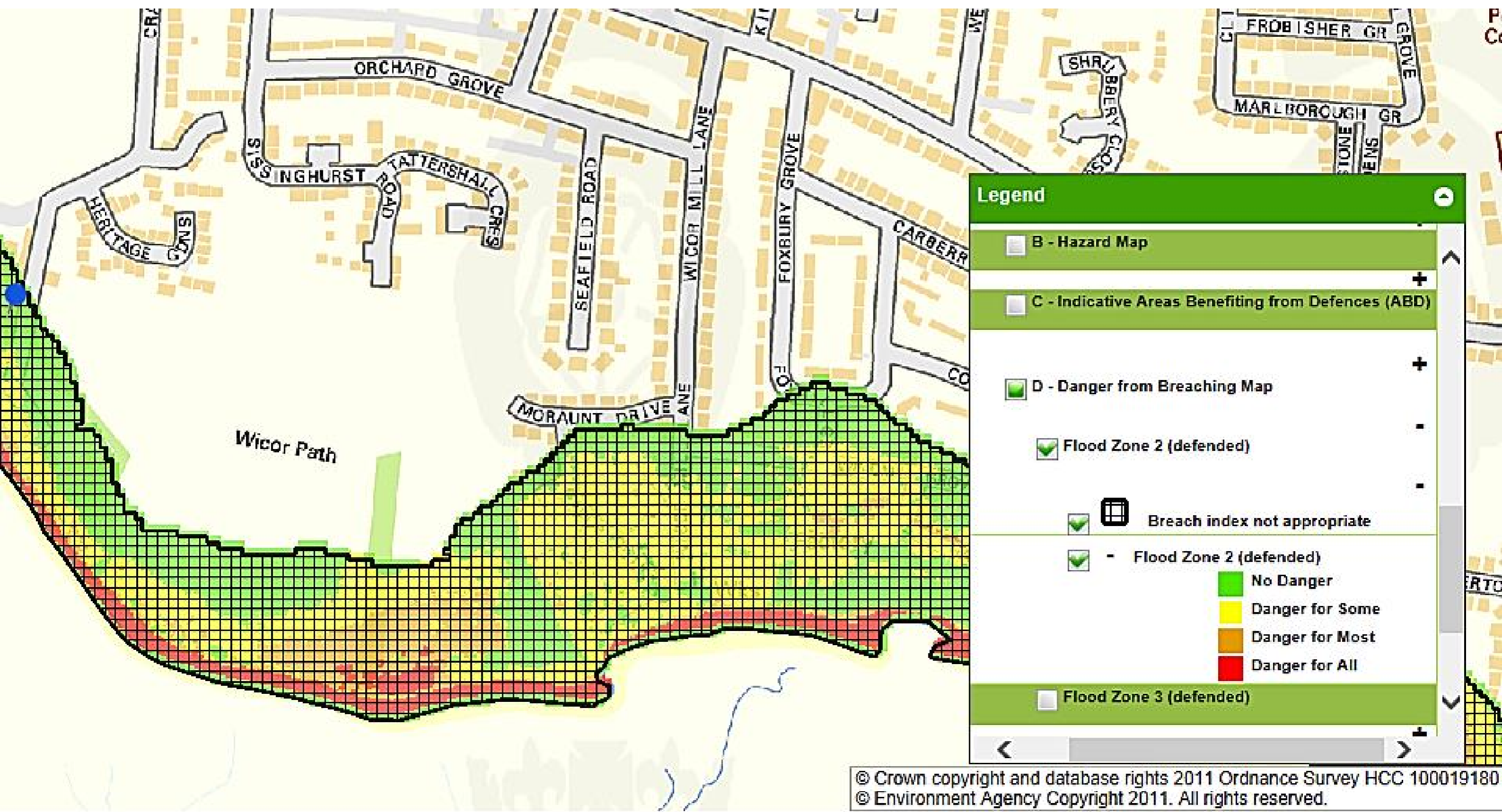
- D - Danger from Breaching Map
- E - Climate Change
- F - Other Forms of Flooding
  - 1 - Wave Energy
  -  Historic Wave Overtopping
  -  Moderate Wave Energy Frontage
  -  Low Wave Energy Frontage
- G - Groundwater Flooding
  - 2 - Groundwater Flooding
  - 3 - Impact of Land Use Change
  - 4 - Potential Sources of Overland Flow

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**APPENDIX M**

**SFRA Breach Risk Map**





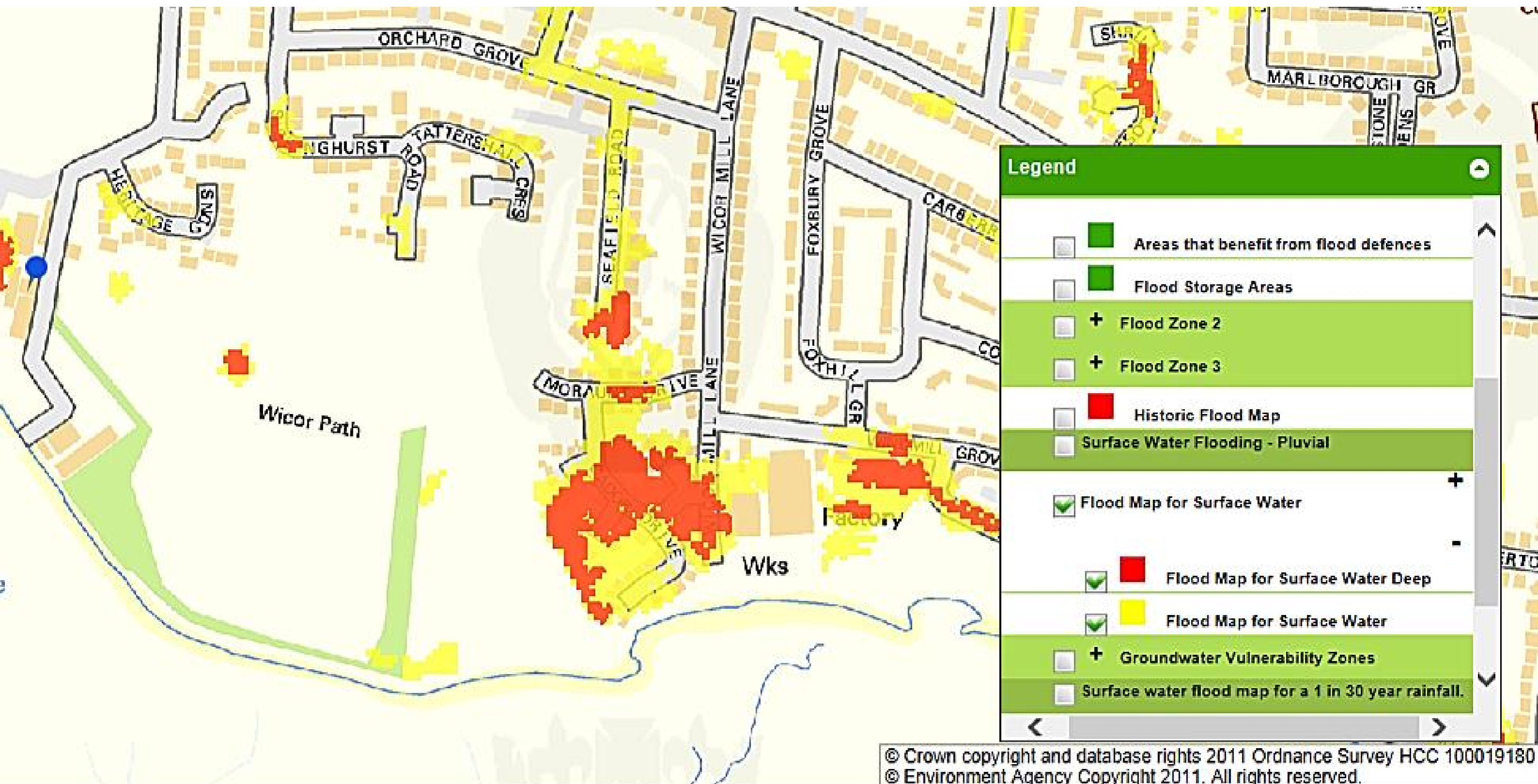
### Legend

- C - Indicative Areas Benefiting from Defences (ABD)
- D - Danger from Breaching Map
- Flood Zone 2 (defended)
- Flood Zone 3 (defended)
-  Breach index not appropriate
- Flood Zone 3 (defended)
- No Danger
- Danger for Some
- Danger for Most
- Danger for All
- E - Climate Change

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## **APPENDIX N**

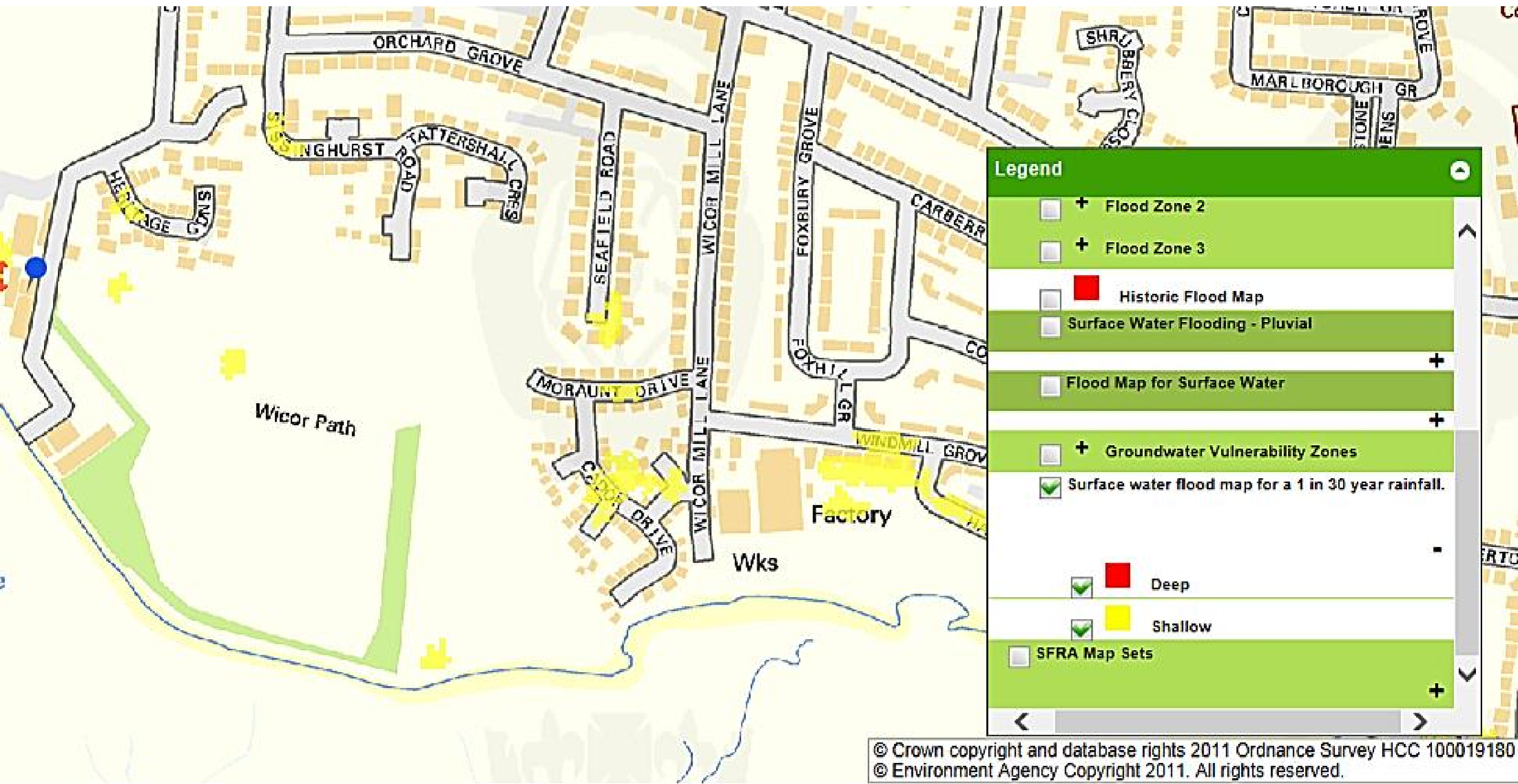
### **SFRA Surface Water Mapping**



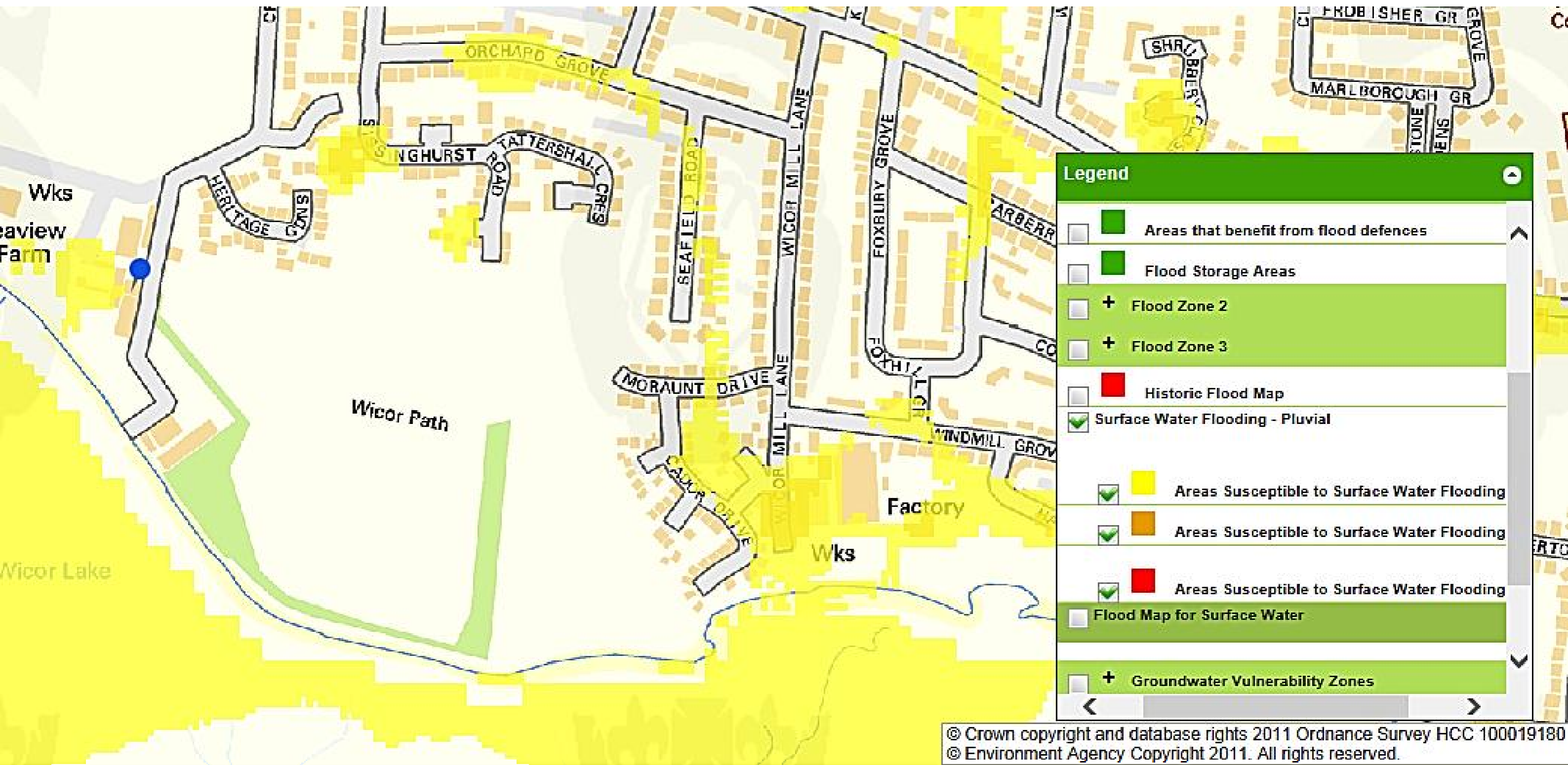
**Legend**

- Areas that benefit from flood defences
- Flood Storage Areas
- + Flood Zone 2
- + Flood Zone 3
- Historic Flood Map
- Surface Water Flooding - Pluvial
- Flood Map for Surface Water
- Flood Map for Surface Water Deep
- Flood Map for Surface Water
- + Groundwater Vulnerability Zones
- Surface water flood map for a 1 in 30 year rainfall.












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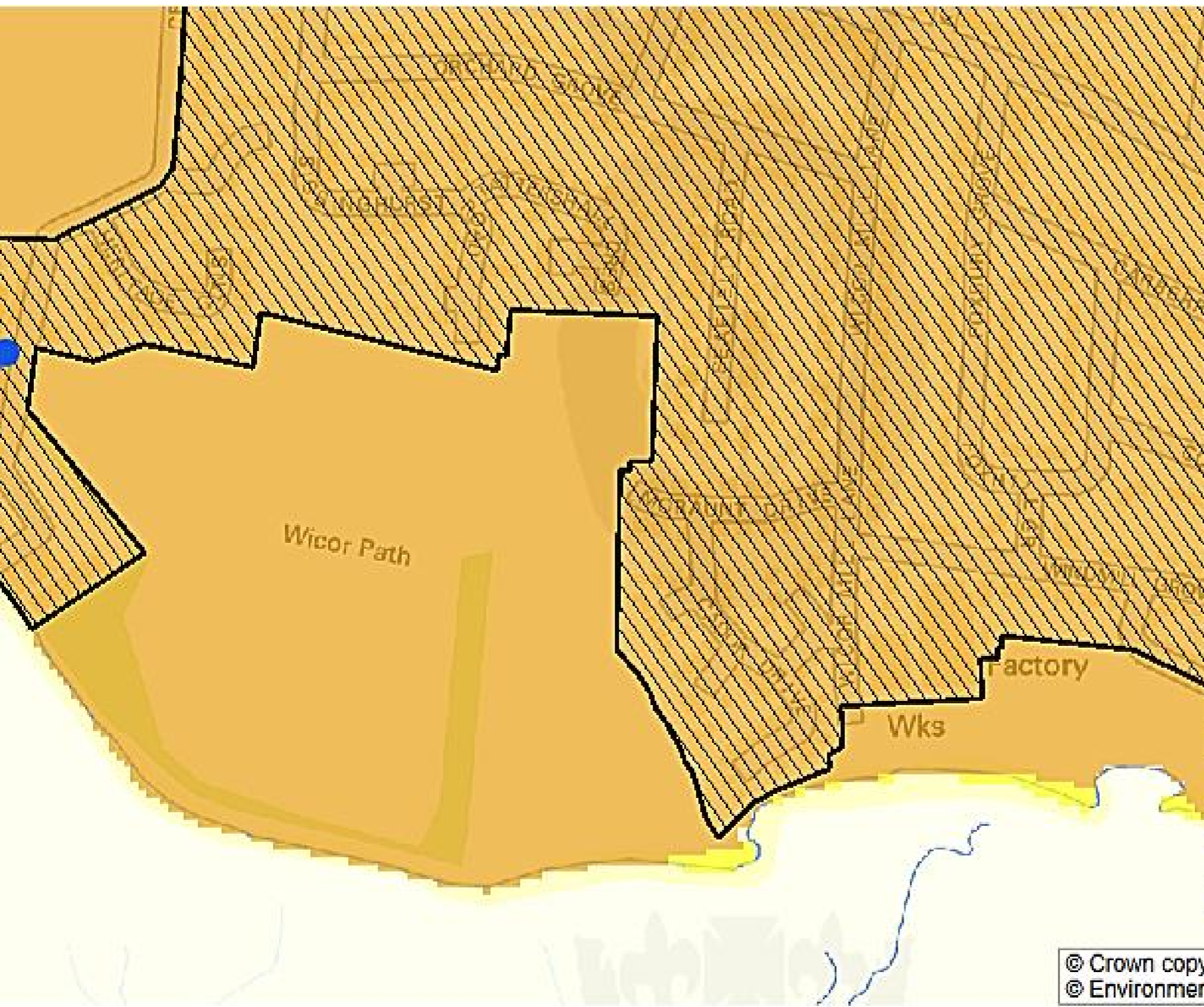
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**Legend**

-  Areas that benefit from flood defences
-  Flood Storage Areas
-  Flood Zone 2
-  Flood Zone 3
-  Historic Flood Map
-  Surface Water Flooding - Pluvial
  -  Areas Susceptible to Surface Water Flooding
  -  Areas Susceptible to Surface Water Flooding
  -  Areas Susceptible to Surface Water Flooding
-  Flood Map for Surface Water
-  Groundwater Vulnerability Zones

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### Legend

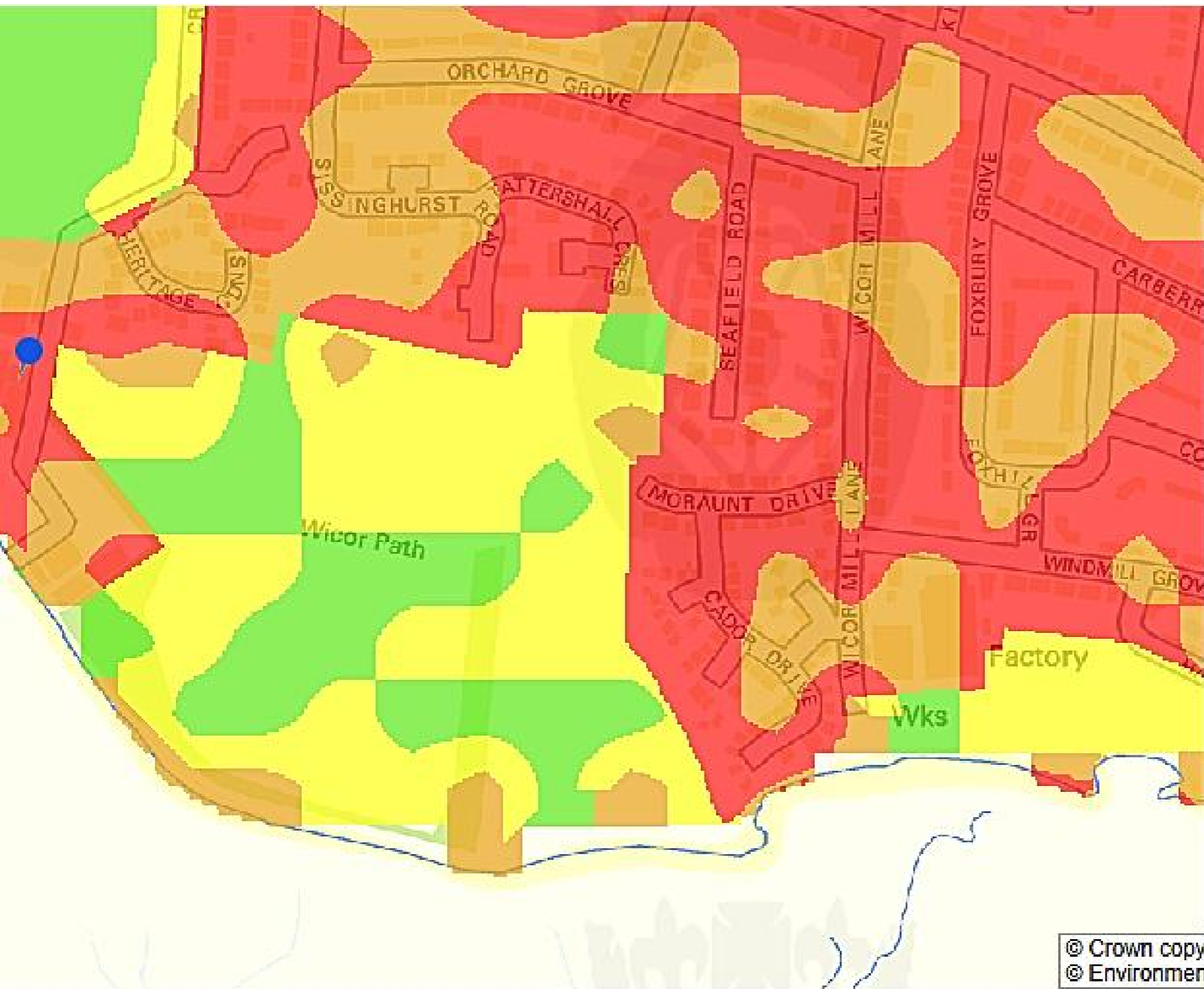
- 1 - [unclear]
- 2 - Groundwater Flooding
- 3 - Impact of Land Use Change
-  Developed Areas
- Impact on Surface Water Runoff
  -  Low Impact
  -  Moderate Impact
  -  High Impact
- 4 - Potential Sources of Overland Flow
- 5 - Surface Water Sewer Flooding
- 3 - Defences and Associated Investment Indices

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## **APPENDIX P**

### **SFRA Overland Flow Mapping**

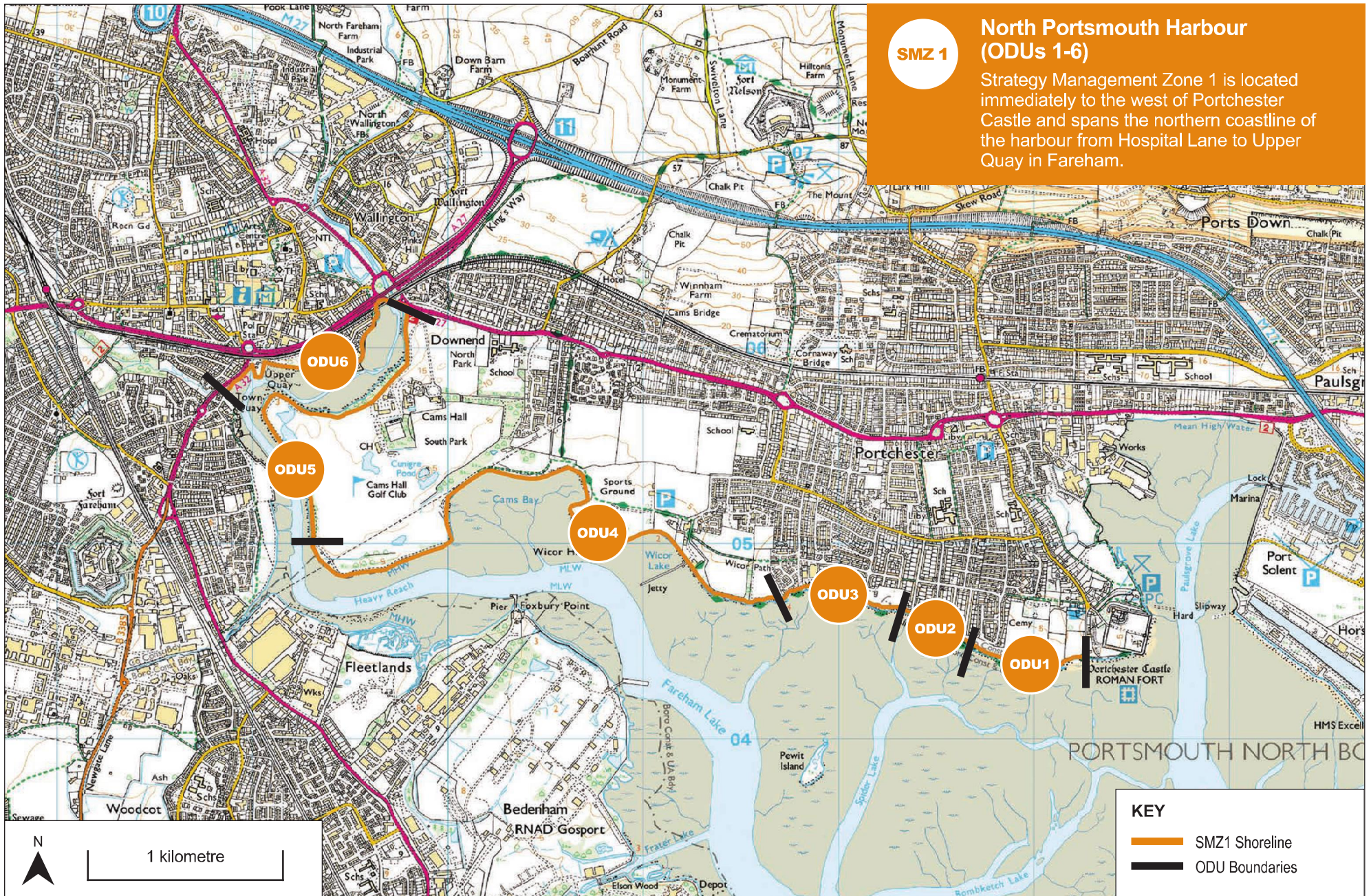


### Legend

- 1 - Wave Energy
- 2 - Groundwater Flooding
- 3 - Impact of Land Use Change
- 4 - Potential Sources of Overland Flow
  - Potential Source of Overland Flow
  - Low
  - Moderate
  - High
  - Very High
- 5 - Surface Water Sewer Flooding
- 3 - Defences and Associated Investment Indices

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**APPENDIX Q**  
**ESCP Location Zones**



**SMZ 1 Preferred Strategic Option:** Maximise the life of existing defences then sustain a minimum 1:100 year (1% annual chance) Standard of Protection from 2030, with environmental improvements to currently eroding former landfill sites

**KEY**

	Do Nothing		Property Level Protection		Upgrade
	Maintenance		Environmental Enhancement		Planning/Monitoring
	Capital Works				

Cost	Benefits - Damages avoided	Benefit:Cost ratio
£5,124,000	£10,010,000	2:1

**ODU 1 | Hospital Lane to Beachway**

2015-2030	2030-2060	2060-2115	
			

Existing defences will require ongoing maintenance and repairs. From 2060 a new frontline defence (e.g. wall) will be required.

**ODU 4 | Cadour Drive to Cams Pumping Station**

2015-2030	2030-2060	2060-2115	
			

Plan environmental improvement of currently undefended potentially contaminated land. Work to unlock funding to implement remediation or protection of these sites by 2030.

**ODU 2 | Beachway to Alton Grove**

2015-2030	2030-2060	2060-2115	
			

The life of the existing defence will be maximised through maintenance until 2030 when a new defence, such as a crest wall, will be required to sustain a minimum 1:100 year SoP.

**ODU 5 | Cams Pumping Station to A27 Cams Hill**

2015-2030	2030-2060	2060-2115	
			

Plan environmental improvement of currently undefended potentially contaminated land. Work to unlock funding to implement remediation or protection of these sites by 2030.

**ODU 3 | Alton Grove to Cadour Drive**

2015-2030	2030-2060	2060-2115	
			



The life of the existing defences will be maximised through maintenance until 2030 when a new defence, such as a new seawall, will be required to sustain a minimum 1:100 year SoP.

**ODU 6 | A27 Cams Hill to Upper Quay**

2015-2030	2030-2060	2060-2115	
			

Existing defences will require ongoing maintenance and repairs. From 2060 a new defence (e.g. wall) will be required to sustain a minimum 1:100 year SoP against flooding.

**APPENDIX R**  
**ESCP Defence Condition**

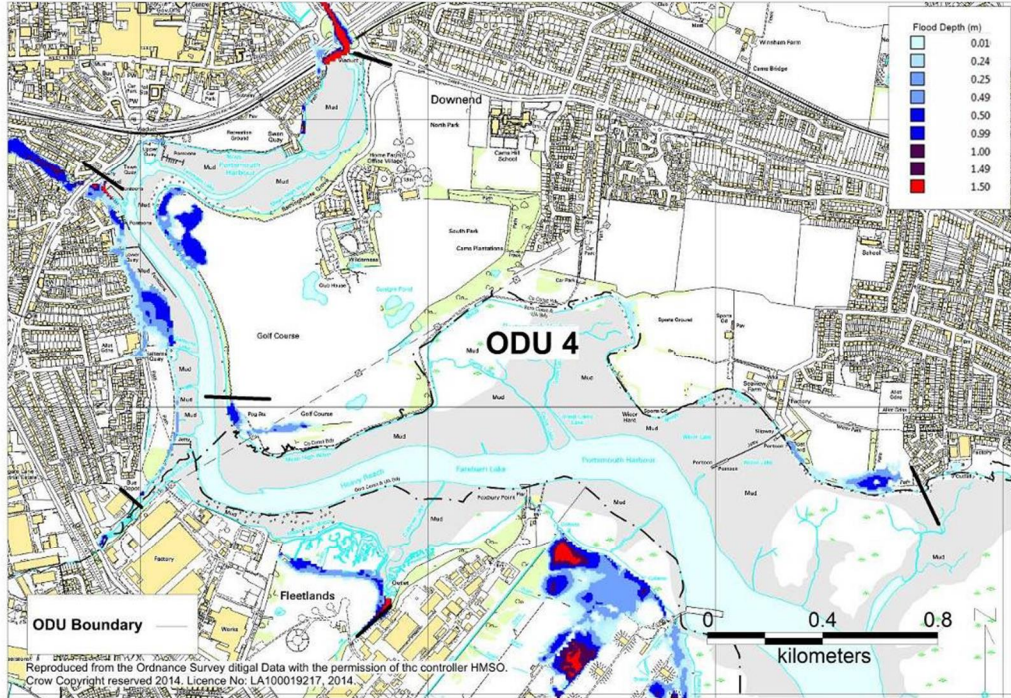
<b>Defence Element:</b>	5a21j (Length: 532m).	<b>Defence Section:</b>	Open Ground	
<b>Location (WP):</b>	WP46	<b>Year of Construction:</b>	Unknown	
<b>Defence Description:</b>				
Open space undefended.				
<b>Construction Material:</b>	None			
<b>Foreshore Description:</b>				
Upper: Gravel. Middle: Seaweed and mud. Lower: Extensive mudflats.				
<b>Defence Condition and Grade:</b>		NA		
<b>Residual Life (no maintenance) Yrs:</b>				
	NA	<b>Maintainer (EA/LA/MOD/Private):</b>	FBC	
<b>Owner (FBC/GBC/Private/HA/HCC/MOD/EA/SWS/EH):</b>		FBC		
<b>Comments:</b>				

**APPENDIX S**

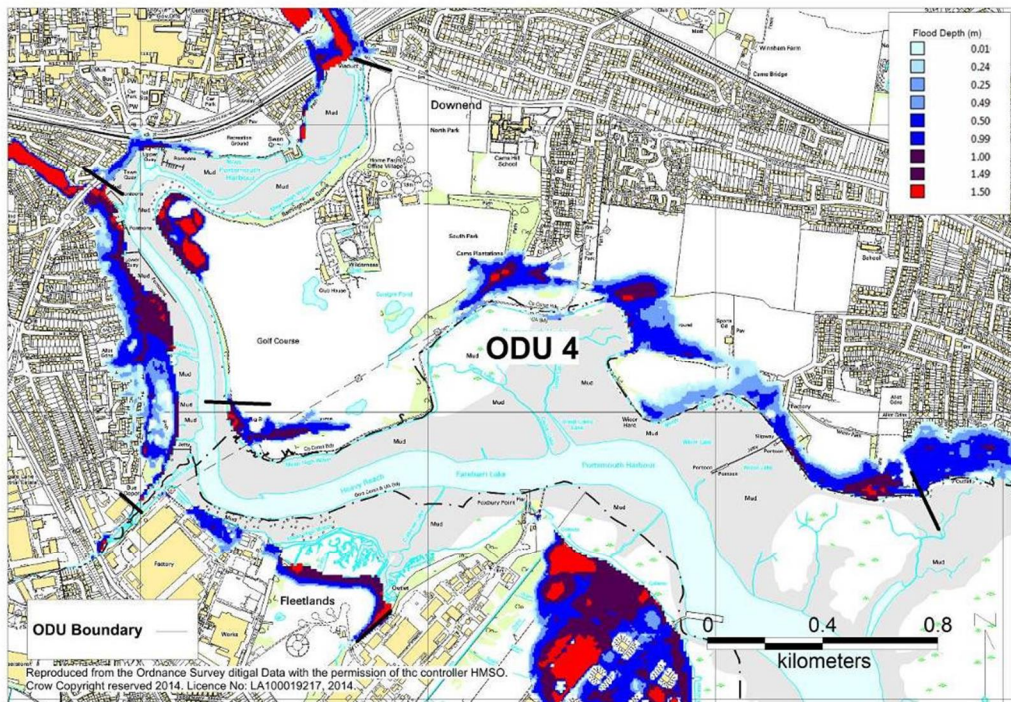
**ESCP Tuflow Model Mapping**



**ODU 4: Cadour Drive to Cams Pumping Station - 2015 (Maximum flood envelope from a 1:100 year (1%AEP) event)**



**ODU 4: Cadour Drive to Cams Pumping Station - 2015 (Maximum flood depth from a 1:100 year (1%AEP) event)**



## **APPENDIX T**

### **Borehole Logs**

