Isle of Wight
Strategic Flood Risk Assessment

November 2007

ISLE of WIGHT COUNCIL

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Document Revisions

No.	Details	Date
C011i1	Draft Report	26/10/07
Co11i2	Second Draft	28/11/07
C011i3	Final Report	07/12/07

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Isle of Wight Council

Isle of Wight Strategic Flood Risk Assessment

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Entec UK Limited

Certificate No. FS 13881
Certificate No. EMS 69090

Executive Summary

This report has been produced for the purpose of providing a Strategic Flood Risk Assessment (SFRA) for Isle of Wight Council. The SFRA has been produced by Entec in close consultation with the Environment Agency and the Isle of Wight Council. The SFRA has been prepared in accordance with the requirements of Planning Policy Statement 25 *Development and Flood Risk* (PPS25).

The Nature of the SFRA

The data interpretation and information processing undertaken in this SFRA has been geared towards the production of two digital GIS (Geographical Information Systems) datasets, these being the Attribution Database and the Site Specific Database. These two datasets, which are supplied as ESRI shapefiles on the accompanying CD-ROM, are the essence of the SFRA. The two datasets provide the information needed to inform the PPS25 Sequential Test and comprise:

- **Attribution Database**: This dataset contains every one of the identified potential development sites. These sites are attributed with the highest risk flood zone that poses a risk to them, providing a means of focusing the Council's attention on sites with significant flood risks. Each site is also assessed on the basis of whether it will be impacted by the anticipated impacts of climate change on tidal and fluvial flooding extents. Information on the requirements of an FRA, historic flooding, proximity to a Main River and any defences are also presented. The dataset also categorises the infiltration potential and runoff potential for each site.

- **Site Specific Database**: This dataset just contains those sites identified as being in Flood Zones 2, 3a or 3b (as defined by PPS25). The dataset details the variation of flood risk across each site, thereby identifying those parts of each site where PPS25 (Planning Policy Statement 25 – *Development and Flood Risk*) restricts the development of certain uses of land.

These datasets allow the Council to navigate to a particular potential development site and interrogate the Attribute Database and establish what the results of the SFRA are for that site. Should the site lie within one of the fourteen Key Development Areas, then the Council can turn to Section 6 in the report to obtain a more detailed description of the major flood related issues in the wider area.

Report Structure

The content of this report is designed to provide an evidence base for the flood risk, drainage and other classifications used to attribute each of the potential development sites with. The report is divided into the following sections:

- Section 1 – Introduces the SFRA and sets it within national planning policy.
- Section 2 – Provides an Island wide over view of all the main flood risks.
- Section 3 – Defines the flood risk zones used in the SFRA
- Section 4 – Discusses potential impact of climate change.
- Section 5 – Outlines the two key GIS datasets.
- Section 6 – Describes the three tired approach to the assessment of flood risk and a detailed description of flood risk in all of the Key Development Areas.
- Section 7 – Discusses surface water drainage.
- Section 8 – Outlines possible flood risk mitigation and management
- Section 9 – Presents the summary.

The Assessment of Flood Risk

The following sections briefly describe the nature of the assessments undertaken in this SFRA

Fluvial and Tidal Flood Risk

Fluvial and tidal flood risks have been assessed in the most detail in the SFRA because they present by far the greatest flood risk and there exists the greatest amount of available data on these sources of flooding. The Environment Agency Flood Zones form the focus of the guidance presented in PPS25. As such these datasets were used to form the main body of the assessment of flood risk as they enabled each potential development site to be attributed with information which is recognised by PPS25 and which can therefore inform the planning process.

Climate Change

The impacts of climate change on flooding are a serious issue recognised by National Government and this concern is reflected in PPS25. Climate change has been addressed in detail in this SFRA with fluvial sensitivity analysis being undertaken alongside tidal climate change modelling. Flood extents for the 1 in 200 and 1 in 1000 year extreme tide levels have been produced for the following time horizons, 2026, 2070 and 2115. The northern and

eastern coastline from Freshwater to Ventnor has been modelled as these represented the most strategically important stretches of coastline.

Surface Water Drainage

The SFRA has been able to provide classifications on runoff potential, infiltration potential and contamination potential for every potential development site due to the availability of Island-wide soil maps and groundwater vulnerability maps.

Other Sources of Flooding

Other sources of flooding are not used by PPS25 to determine the land use allocation process, but must be considered in SFRAs. As such, the SFRA for the Isle of Wight includes the assessment of groundwater and surface water flooding. Owing to the nature of the data available the assessment of other sources of flooding remains at the Island wide scale. The level of detail to which the other sources of flooding have been discussed is proportionate to the risks they pose and the fact that from a strategic level they cannot assist in the allocation of land use process as they cannot be quantified.

All the available data relating to groundwater and surface water was collated and it was found that the nature of these type of flooding are very site specific and arise from a complex collection of events that could not be easily predicted. The data available to the SFRA only allowed for the broad issues to be highlighted (for example blocked culverts and drainage systems with insufficient capacity), along with specific examples of historic groundwater and surface water flooding. It has been recommended that these sources of flood risk be considered in detail at the site specific Flood Risk Assessment stage.

Secondary Information

The historic flood outlines and the Main River Centreline dataset held by the Environment Agency were collated in order to attribute each potential development with any additional information that should be considered as part of a subsequent Flood Risk Assessment (FRA) on any particular site.

Key Development Areas

The Table 1.1 lists the fourteen Key Development Areas (KDA) and summarises the main issues identified in each.

Table 1.1 Key Development Area Issues Summary

Key Development Area	Key Issues Restricting planning
Bembridge	Embankment Road
Brading	No significant restrictions
Brighstone	Fluvial flooding in the Brighstone Brook and Shorewell Stream confluence area
Cowes and East Cowes	Tidal flooding along both sides of the Medina Estuary
Newport	All sites adjacent to watercourses have partial restrictions, but no significant areas of restriction. Tidal flooding in the Seaclose area represents a significant restriction to planning
Ryde	Significant restrictions identified in the tidally influenced area and adjacent to Monks Brook
Seaview	Two sites with potentially significant restrictions
St Helens	No significant restrictions
The Bay	Significant restrictions in the north east of the area and in the Culver Parade area
Ventnor	No significant restrictions
Wootton	No significant restrictions
Wroxall	Significant restrictions to portions of two sites owing to presence of fluvial flood zones
West Wight	Significant restrictions in the Freshwater area along the banks of the Western Yar
Yarmouth	Significant restrictions owing to the large tidal flood zone extents which encircle the town

Overall Implications of the Assessment

The SFRA has identified only 9% of the potential development sites face flood risks sufficient to restrict the use of the land. Furthermore, the site specific level of flood risk assessment revealed that for the most part only a small portion of these sites is affected. The overwhelming majority (91%) of the potential sites assessed in this SFRA are considered to be at a low enough risk of flooding so that under the guidance set out by PPS25, any type of development is appropriate.

The findings of the climate change assessments are presented for KDA in Section 6. In summary, that the impact of 100 years worth of predicted sea level rise is not as significant as might first have been expected. With only moderate (in the lower Eastern Yar floodplain) to low (around Shanklin and Ventnor) increases in extent being predicted. In most cases, sites affected by the potential impacts of climate change were already within the current Flood Zones. It is important though, that each site be considered independently as the degree of impact does vary.

The variations in impact are controlled by the topography of the coastline, areas of steep land gradients in the coastal regions exhibit smaller impacts than areas of gentle topography.

Contents

List of Acronyms

Acronyms	Definition
ABI	Association of British Insurers
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
CFMP	Catchment Flood Management Plan
DPD	Development Plan Document
ESS	Environmental Stewardship Schemes
FRA	Flood Risk Assessment
GIS	Geographical Information Systems
HOST	Hydrology of Soil Types
IFM	Indicative Flood Map
IfSAR	Infometric Synthetic Aperture Radar
KDA	Key Development Area
LDD	Local Development Documents
LDF	Local Development Framework
LiDAR	Light Detecting and Ranging
LPA	Local Planning Authority
RFRA	Regional Flood Risk Assessment
RPB	Regional Planning Bodies
SDF	Strategic Development Framework
SEEDA	South East England Development Authority
SFRA	Strategic Flood Risk Assessment
SPR	Surface Percentage Runoff
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems
UCS	Urban Capacity Study
UDP	Unitary Development Plan
WFD	Water Framework Directive

1. Introduction

1.1 Introduction

This Strategic Flood Risk Assessment (SFRA) has been undertaken to assess flood risks on the Isle of Wight, and in particular the flood risks associated with areas being considered for future development as part of the emerging Local Development Framework (LDF). National planning legislation and policy guidance have been considered throughout the SFRA.

Planning process is driven by legislation and guidance developed at a national, regional and local level. Flood risk is just one of many factors to consider when making decisions relating to land use. The challenge for a SFRA is to develop pragmatic principles for steering future sustainable development without conflicting with the requirements of the different planning policies. The '*Making Space For Water*' report published by Defra (2005), identifies the severe flooding experience by mainland Europe in 2000 as being one of the catalysts for the Government to shown an increased interest in flood risk management. This, in combination with recent high-profile flood events across the United Kingdom, has kept flood risk in the public eye and makes the need for effective consideration of flood risk in the planning process even more important.

1.2 National Planning Policy

The SFRA has taken place in a period during which planning authorities have been implementing the provisions of the Planning and Compulsory Purchase Act 2004 and accompanying planning guidance, including PPS 1 (*Planning Policy Statement 1- Delivering Sustainable Development*) and PPS 12 (*Planning Policy Statement - Local Development Frameworks*). These affect all tiers of the planning system and have necessitated major changes at both the regional and local level which will impact on the way in which planned development is reflected in the regional strategy and delivered locally.

The Government has set in motion changes to the planning policy process, which will see the Unitary Development Plan (UDP) replaced by a Local Development Framework (LDF). The LDF is a comprised of a framework of documents including the Core Strategy, Development Plan Documents (DPDs), Site Specific Policies and Proposal Maps, Statements of Community Involvement and Supplementary Planning Documents. The Core Strategy and the DPDs are the first documents that the Isle of Wight Council are producing, and will incorporate work already undertaken on the Bay and Medina Valley Area Action Plans. The documents forming the LDF will set out the Council's planning policies and proposals for meeting the community's economic and environmental needs in terms of spatial land use. The Planning and Compulsory Purchase Act 2004 requires the Isle of Wight Council to prepare a LDF to supersede the current UDP.

1.2.1 Planning Policy Statement 25: Development and Flood Risk

This SFRA has been undertaken in accordance with the guidance provided in Planning Policy Statement 25 – Development and Flood Risk (PPS25) and its accompanying Practice Guide (*Development and Flood Risk – A Practice Guide Companion to PPS25 "Living Draft*). Box 1 Presents a Summary of the guidance presented in PPS25.

Box 1 Summary of Guidance in PPS25

PPS25 Objectives

Through PPS25, the Government has sought to provide clarity on what is required at a regional and local level to ensure that appropriate and timely decisions are made to deliver sustainable planning for development. The key planning objectives as stated in PPS25 are that:

"Regional Planning Bodies (RPBs) and LPAs should prepare and implement planning strategies that help to deliver sustainable development by:

- APPRAISING RISK

Identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;

Preparing Regional Flood Risk Assessments (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans;

- MANAGING RISK

Framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;

Only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;

- REDUCING RISK

Safeguarding land from development that is required for current and future flood management e.g. conveyance and storage of flood water, and flood defences;

Reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SuDS);

Using opportunities offered by new development to reduce flood risk to reduce the causes and impacts of flooding e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SuDS; re-creating functional floodplain; and setting back defences;

- A PARTNERSHIP APPROACH

Working effectively with the Environment Agency and other stakeholders to ensure that best use is made of their expertise and information so that decisions on planning applications can be delivered expeditiously; and Ensuring spatial planning supports flood risk management and emergency planning.

This SFRA describes what land uses are permitted for each site based upon the vulnerability classification presented in Annex D of PPS25. However, it is not the intention of this SFRA to encourage the development in higher flood risk zones. It is considered that the most effective method of flood risk management is to avoid the risk. As such, it is recommended that sites in Flood Zone 1 be considered for development ahead of higher risk zones. The planning process will therefore be inline with the Sequential approach outlined by PPS25.

Planning Policy Statement 1: Delivering Sustainable Development

Published in February 2005, this document sets out the overarching planning policies for the delivery of sustainable development across the planning system. PPS 1 explicitly states that development plan policies should take account of flooding, including flood risk. It proposes that new development in areas at risk of flooding should be

avoided. Planning authorities are also advised to ensure that developments are sustainable, durable and adaptable. This should be achieved through taking into account natural hazards such as flooding.

PPS 1 also places an emphasis on *spatial planning* in contrast to the more rigid *land use planning* approach which it supersedes. LPAs will still produce site-specific allocations and a proposals map as part of Local Development Documents (LDDs). The Core Strategies will be more strategic and visionary in content and will take into account the desirability of achieving integrated and mixed use development, whilst considering a broader range of community needs than has historically been the case. It will be important for the Core Strategies and accompanying supplementary planning documents, to recognise the contribution that non-structural measures can make to effective flood management.

1.3 Regional Planning Policy

South East Plan (2006)

Identifies the economic base of the Island has been undergoing change over recent years resulting in employment decline in agricultural and related industries. This process has contributed to higher than UK average unemployment rates and over a quarter of the Island's population receiving means tested benefits. Along side this low employment the housing shortage issue is exacerbated by a high proportion of houses on the Island being owned as second homes. The South East Plan states that future development is expected to create wealth and a sustainable economy to address skills deficits, housing needs, provide improved public transport and to safeguard the landscape and biodiversity.

Future Housing on the Isle of Wight

In the years up to 2020 and beyond, the Isle of Wight is set to change. The Council are responding to the housing requirements of the emerging Regional Spatial Strategy (the South East Plan) which indicate an annual construction of 520 houses on the Island. This number is proposed to provide for housing to meet economic growth, an amount of marketable housing and a housing supply stock to meet local affordable needs. However, the scale of the need for affordable housing on the Island is estimated to exceed the total planned annual provision and the South East Plan notes that the figure is more likely to be in the order of 1,260 per annum. This will contribute towards the annual average of 28,900 new dwellings required to be developed across the South East region between 2006 and 2026.

The Isle of Wight Council, as part of the Core Strategy, has undertaken a Strategic Housing Land Availability Study. This was not intended to undertake the role of DPDs. Rather, it was to identify land without making a judgement on suitability for development. The role of the Core Strategy is not to allocate sites for housing or any other type of development, rather it is to identify broad areas or types of suitable land for development. The South East Plan indicates that the range, type and distribution of housing required will be developed through the LDF. Housing linked to employment will be concentrated, the South East Plan states, in the main urban areas of Cowes, Newport, Ryde, Sandown and Shanklin.

PPS3 (*Planning Policy Statement 3*) sets out a new approach for housing including the identification of sufficient land for the plan period of fifteen years, ensuring that the first five years are allocated and developable and that a five year supply is maintained as sites are developed out.

Urban Capacity Study (2005)

A total of nine Large Capacity Sites (over 1 hectare) have been identified, totalling 22.24 hectares of land. The Urban Capacity Study (UCS) notes that current trends show large housing sites are being developed at densities of approximately 40 dwellings per hectare (dph). The UCS makes the assumption of a minimum density of 30 dph and a maximum density of 50dph. PPG3 refers to densities of between 30 and 50 as being appropriate development standards, depending upon the nature of the area of development.

The Council will seek to provide greater intensity of development at places with good public transport accessibility, such as towns or local centres and along good quality public transport corridors. The Council is exploring the possibilities of rural exception sites and the requirement to meet affordable housing needs in the rural areas of the island.

Windfall Sites are less than 1 hectare and total just over 1300 sites which amount to 216 hectares. The average size of the plots was 0.15ha. The UCS assumes that the majority of these sites will only yield one dwelling. It was concluded that small windfall sites make up the largest proportion of capacity on the Island.

Over 50% of the Island is designated as Area of Outstanding Natural Beauty (AONB), and the requirements of the associated management plan are an important factor when considering development within the national designation.

1.4 PPS25 and Local Planning Authorities

PPS25 specifies that LPAs should adopt a risk-based approach to planned development through the application of a Sequential Test. This sequential process relates to the steering of new developments towards areas of lowest flood risk. PPS25 also sets out the need to consider other sources of flood risk (such as groundwater, overland flow and sewer) in addition to the main fluvial and tidal sources. The implications of climate change on flood risk are also requires to be considered in the interest of sustainable development.

PPS25 introduces the Exception Test which allows some scope for departures from the sequential approach where it is necessary to meet the wider aims of sustainable development. The criteria for exception include where the development makes a positive contribution to sustainable communities or redevelopment of brownfield land. Exceptions can be permitted where it can be demonstrated that the residual flood risks are acceptable and satisfactorily managed.

The Town and Country Planning (Flooding) (England) Direction 2006 has made the Environment Agency a Statutory Consultee on all applications for development in flood risk areas, including areas with critical drainage problems and for developments exceeding 1 hectare outside of flood risk areas. After discussion with the Agency

LPAs are required to notify the Secretary of State if they remain minded to approve a planning application contrary to a sustained objection from the Environment Agency.

1.5 The Purpose of the SFRA Report (PPS25)

The Isle of Wight Council appointed Entec to undertake a Strategic Flood Risk Assessment of the whole Island. The SFRA is intended to provide the Council with a better understanding of:

- Flood risks;
- The delineation of the PPS25 flood risk Zones, and;
- The implications of how the Flood Zones interact with the Council's Potential Development Sites.

The importance of the SFRA and its role as a strategic planning tool are well understood and the SFRA has been conducted and the results presented so as to best advise the planning process.

This SFRA was produced by working closely with the Environment Agency, who was consulted throughout the SFRA process.

1.6 The Structure of the SFRA Report

The structure of this report is designed around informing the key aim of providing information to perform the Sequential Test. This aim is strengthened through the three tiered approach that has been adopted to assess flood risk (see Section 6.1). The report is comprised of the following sections:

- Section 1 – Introduces the SFRA and sets it within national planning policy. The introduction is also designed to provide guidance on how to extract the most information from the SFRA.
- Section 2 – Provides an Island wide over view of all the main flood risks that have been identified.
- Section 3 – Defines the flood risk zones that are used by PPS25 to steer the location of new developments.
- Section 4 – Discusses the need to assess the potential impact of climate change and it presents the findings of the fluvial and tidal assessments.
- Section 5 – Outlines the two key GIS datasets that have been produced which form the *Key Stones* of the SFRA.
- Section 6 – Describes the three tired approach to the assessment of flood risk, from the Island wide assessment to the site specific level of detail. This section also includes a detailed description of flood risk in all of the Key Development Areas.

- Section 7 – Outlines the importance of Sustainable Drainage Systems (SuDS) and describes how the SFRA has provided recommendations for the suitability of different SuDS techniques.
- Section 8 – Outlines possible flood risk mitigation and management measures that could be implemented.
- Section 9 – Presents the conclusions and recommendations of the SFRA.

1.7 How to Use the SFRA

General

The SFRA report is not intended to be read from cover to cover. It should be looked upon as a reference facility, to be accessed when the Council are presented with questions or situations that require an appreciation of flood risk. An appreciation of the Island wide flood risk issues and a discussion of possible management and mitigation measures are presented in sections Section 2 and Section 9 respectively. For information on climate change, Section 4 should be looked at. The potential development sites have been grouped into 15 KDAs (see Section 6 for full details of these) and each has been addressed separately so as to offer a synopsis, at the KDA level, of all the data that has been collated and produced in this SFRA. A detailed discussion of sustainable drainage is outlined in Section 7, with more site specific information presented in Section 6.

Data Organisation

This SFRA is structured around two key databases that have been produced (see Section 5 for full details), the first being the Potential Development Site Attribute database, (hereafter referred to as the Attribute Database) and the second being the Site Specific Flood Risk Definition database (hereafter referred to as the Site Specific Database). These two databases are supplied on the accompanying SFRA CD-ROM, all the data on the CD-ROM needs to be installed onto a computer which has ESRI ArcMap capability. The digital datasets enable the user to visit any potential development site on the Island and access a whole array of attribute data about each site (see Section 5). Should the user simply want to view the flood risk facing one of the potential development sites in one of the KDAs then the maps in Appendix A should be consulted. To get an appreciation of the different flood risk zones present in each site then the Site Specific Database must be consulted. These two databases provide the information to support the Sequential Test as they depict the flood risks posed to each site and each is attributed with what PPS25 states as being appropriate uses of land for each flood risk zone. At the KDA level these databases and maps in Appendix A can be used to perform the Sequential Test. In that they can be broadly used to inform which sites are and are not suitable for particular developments. The flood risk assertions made in the Attribute Database are refined in the Site Specific Database, as a range of flood risks are defined for same potential site. This level of flood risk detail makes it possible to perform the Sequential Test at the site specific scale.

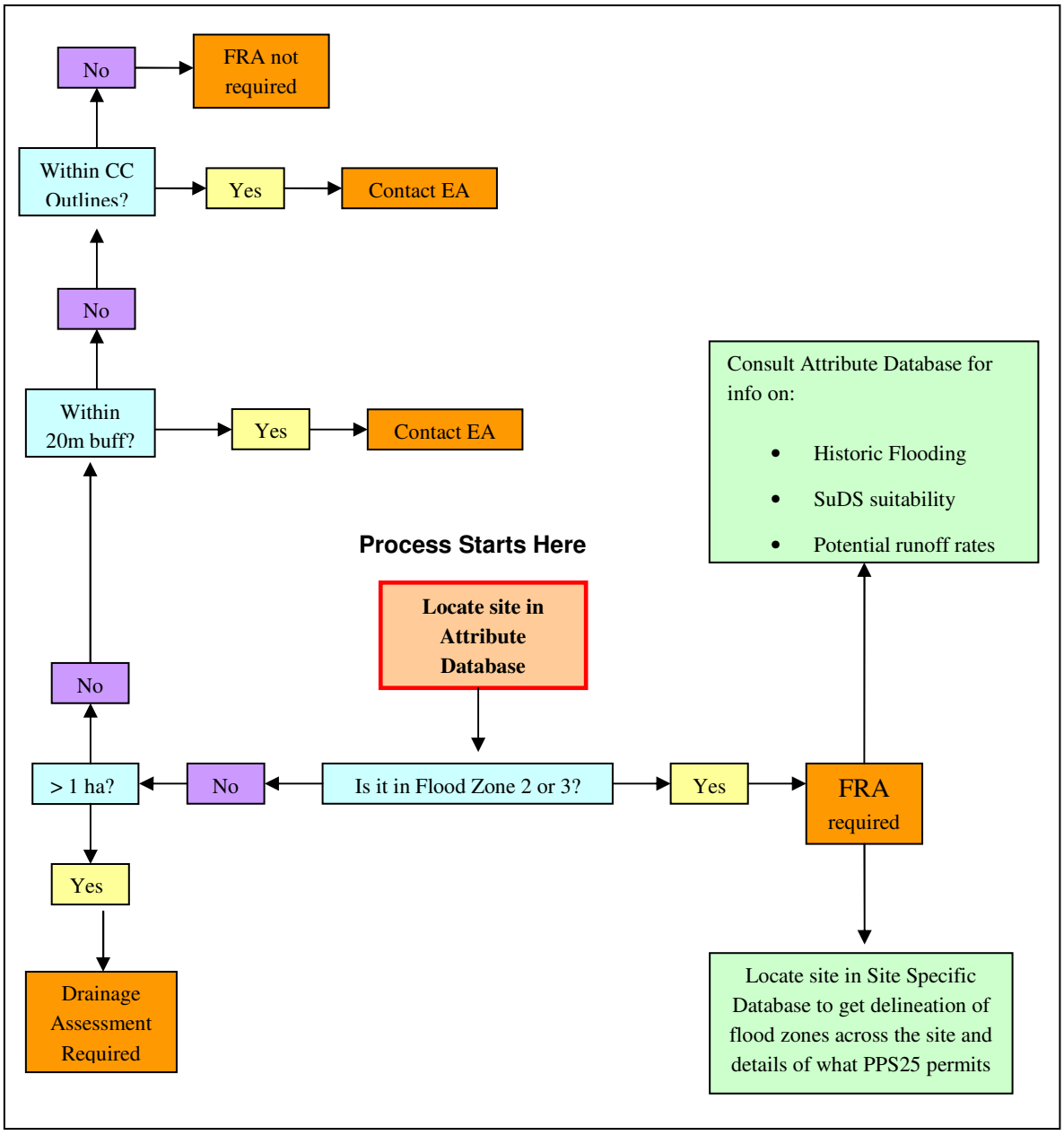
Sustainable drainage is a key requirement of PPS25's guidance as it states that surface water runoff from a given site cannot be increased as a result of development. This means that infiltration SuDS provide a viable alternative to mitigate runoff. There are, however, some situations where these techniques are not appropriate. The Attribute

Database indicates the locations where this surface water runoff management technique is and is not appropriate. Full details and methodology of this process can be found in Section 7.

Information Flow Diagram

The flow diagram (Figure 1.1) overleaf has been included to guide the user through the datasets to inform what action needs to be taken on a particular site. Please note that this approach is only applicable for sites in the Attribute Database and not windfall sites.

Figure 1.1 Using the SFRA Flow Diagram



Notes

Large amounts of detailed site specific information is presented in this SFRA, but it is insufficient to conduct a site specific Flood Risk Assessment with (FRA). This SFRA does however offer as much information as possible to inform where FRAs will be required and it provides an indication of what the necessary scope of FRAs might need to be. This information is presented in the Attribute Database and in each Key Development Area discussion in Section 6.

It is intended that the SFRA report and the maps, presented in Appendix A, are sufficient to provide a comprehensive package of data to enable the Council to differentiate areas and potential sites that are free from flood risks, from those that are at risk of flooding. To access the all the information that has been compiled for each site, the GIS datasets must be interrogated.

Much of the data is organised so that it can be accessed through the interrogation of the Attribute and Site Specific Databases. However, island wide maps for all the assessments carried out in this SFRA have been supplied on the accompanying CD-ROM and as paper maps in Appendix A. These two sources can be used when considering development proposals for windfall sites.

2. Overview of Flood Risks

2.1 Flood Risk Assessment Rationale

The SFRA must define the zones of flood risk so as to be able to appropriately inform the development site allocation process and thus meet the wider objectives of the Island Plan. To enable this SFRA to fulfil its function as a strategic planning tool, flood risk from all sources had to be characterised. The two primary sources of flooding on the Island are fluvial and tidal. The greatest amount of data also exists for these two sources. Flooding from groundwater and surface water are considered to be less significant and more localised and are dealt with in less detail which is proportionate to the amount of available data on these sources.

It is the intention of this SFRA that the data presented will form the basis of the Sequential Test. This SFRA is focused on being a useful planning tool and one which provides the Isle of Wight Council with relevant, accurate and consistent information on flood risk. Thus enabling the Council to best informed for allocating development land. To achieve this Island wide flood risk zones had to be delineated and then the focus of the SFRA had to shift from a general discussion of the flood risk zones and *drill down* to each of the potential development sites.

The ability to produce the level of site specific information presented in this SFRA is due to the fact that the Isle of Wight Council have prepared a large dataset of potential development sites identified by the Urban Capacity Study (2005) and a dataset of preferred employment site locations. It must be noted that these sites should not be inferred as being 'preferred' development sites nor should they be considered as sites which the Council necessarily wish to develop. Moreover, there is no possibility that all sites will necessarily be released for development. The sites addressed in this SFRA are plots of land identified as having potential for development. The SFRA will only address the suitability of the sites from a flood risk perspective. The wider sustainability and community issues are not considered in the SFRA.

2.2 Geographical Context

The variations in topographic elevation of the Island broadly reflect the underlying geology which consists of the main East-West monocline of chalk. This runs through the middle of the Island and forms the central highland attaining heights in the order of 250m AOD (Above Ordnance Datum). The central chalk ridge bisects the Island on a line from the Needles in the west to Culver Cliff in the east. To the north of this central chalk ridge, the underlying clays, silts and sands create a gently undulating topography which gives way to relatively low and flat coastal plains. By comparison, south of the central chalk ridge, more elevated topography and sea cliffs are characteristic and are the product of the relatively more robust sandstones and mudstone geologies. The European ice sheets of the Pleistocene (2 million years to 10 thousand years ago) did not extend as far south as the Isle of Wight and thus there are no glacial deposits. All superficial geology on the Island is either periglacial, which were eroded and deposited over the last few millions of years, or comprised of more recent fluvial sands and gravels. The detailed geology and sedimentary deposits are not directly relevant to the SFRA, and as such will not be documented in any further detail. A map of solid and superficial geology can be found in Figure 1 in Appendix A.

The distribution of the major urban settlements reflects topography, with the vast majority of settlements being on the flatter coastal fringes.

2.3 Fluvial Flooding

When a river's discharge exceeds the capacity of the channel, out of bank flow occurs and the river's floodplain is inundated. Flooding is an important ecological and geomorphological process. Over centuries man's relationship with the floodplain has changed. It has evolved from one where the seasonal inundation and formation of transient wetlands instigated cyclic shifts in land use and agricultural practice. This relationship has evolved into one of constant struggle to control the forces of nature in order to make way for more sedentary and permanent uses of our rivers' floodplains. This shift in floodplain use has necessitated the need to develop an understanding of the floodplain dynamics and flood risks. The implementation of measures to avoid flood risk are currently superseding the older more reactive approaches to flood management which tended towards defending against an identified risk.

The majority of watercourses are in the northern half of the Island and discharge in to the Solent. The Isle of Wight's largest river is the Eastern Yar and this discharges in to the Solent at Bembridge. A history of flooding is well documented along the lower reaches of this watercourse, the most recent significant events being during the autumn of 2000. Figure 4 (Appendix A) depicts the main rivers on the Isle of Wight and illustrates how the majority of them flow in a northerly direction. As a result of this drainage pattern, which is a function of the underlying geology, the main estuarine environments are on the northern shores of the Island, with the exception of the Eastern Yar Estuary.

The causes of flooding in the main catchments are being assessed by the Isle of Wight CFMP, the findings of the scoping report are outlined in Table 2.1.

Table 2.1 Causes of Flooding for Each of the Rivers in the Catchment

Location	Key Issues of Flooding
Eastern Yar	• Rainfall runoff events leading to surface water flooding • Structure blockages impeding drainage in the upper catchment • High groundwater levels imposing a high baseflow on the river • Overbank flooding as a result of insufficient channel capacity • Lower catchment is reclaimed and from the sea and land is below high tide level • Tide locked sluice • Surge Tide overtopping
River Medina	• Tidal flooding • Problems with intervention in the channel impeding free drainage • High levels in the Lukely Brook tributary • Flashy response if Merstone Brook

Location	Key Issues of Flooding
Western Yar	• Very flashy catchment with rapid response to rainfall • River flooding unable to drain • Tide locking
Gurnard Luck	• Tide Locking
Monkton Mead Brook	• Flashy urban catchment • Tides flap and supporting pumping during high flow • Sewer Flooding

The Source of this data is the 'Isle of Wight Catchment Flood Management Plan Scoping Report' (February 2007)

2.3.1 Historic Flooding

The CFMP Scoping Report for the Isle of Wight notes that prior to 2000 there are a limited number of records of fluvial flooding on the Island. Events affecting more than 10 properties appear to be fairly low, with the exception of Ryde which has a long history of flooding dating back over 100 years.

The Table 2.2 summarises the main areas of flood risk, the information is taken from the '*CFMP Scoping Report*' (February 2007)

Table 2.2 Key Flood Risk Locations on the Isle of Wight based on 2000/01 Flooding Event

Watercourse	Location	Cause	Properties Impacted	Previous recorded incidents
Monkton Mead Brook	Ryde	Pump failure / drainage	20, 74	1914, 1662, 1971, 1974, 1975, 1989, 1993, 1999
River Medina	Newport	Fluvial, drainage, tide locking	8	1934, 1951, 1960/61 (150 properties), 1993, 1999
Western Yar	Freshwater	Extreme rainfall, drainage	1	1954, 1968, 1999 (45 properties)
Eastern Yar	Small numbers at several locations	Drainage, fluvial	Less than 10 at 11 locations	1934, 1954, 1960

The Source of this data is the 'Isle of Wight Catchment Flood Management Plan Scoping Report' (February 2007)

Autumn 2000 Flood Event

The main cause of flooding was the prolonged rainfall in the months of September to November 2000. This had the effect of raising and maintaining high groundwater and river water levels. Once saturated, the watercourses are considered 'flashy' in that they respond quickly to intense rainfall events with levels and flow rates rising and

falling quickly. The result is short term flooding at times of peak rainfall. Other factors which the '*Isle of Wight Autumn 2000 Flood Investigation – Consultation Report*' (January 2002) identified as being significant factors in the Autumn 2000 floods included:

- The geomorphology and geology resulting in high groundwater levels and high levels of ground saturation.
- Inappropriate historic development in the floodplains.
- Insufficient drainage capacity and maintenance causing water to back up and flood property.
- Highway drains being blocked or where flows were in excess of drainage capacity; and
- A history of changes in water resource management and budgetary constraints

The Consultation report included an assessment of the return period for the October/November flooding of 2000 as being in the order of 1 in 20 years.

The information below, on individual settlements, has been obtained from the '*Flood Event – Final Report 24th December to 26th December 1999*' (September 2000). The number of properties flooded has been derived from questionnaires returned at the time of the event.

Gurnard

Gurnard Luck became tide locked and the increased river Levels caused five properties to be flooded. In Newport four properties were flooded from a main river and one was flooded by an ordinary watercourse. The tidal high water coincided with the rising river levels and when the two levels matched the tidal flaps closed and thus tide-locked the river. This caused the river levels to rapidly rise a further 300mm. Marsh Road was reported to have been covered by about 400mm of water.

Cowes

Cowes experienced some tidal flooding during December 1999, one property was reported as being flooded inside and a further six were flooded outside. Tidal flooding was abated by a sand bag wall constructed by Environment Agency contractors and by a change in the wind direction which reduced wave action.

Newport

An engineering team had been deployed since early in the morning of the 24th December to ensure that the three trash screens on the Lukely Brook were regularly cleared during the day. Lukely Brook responded rapidly to the heavy rainfall and levels soon rose to a dangerous level for workmen to clear the trash screens. Consequently, four properties were flooded from the main river and one was flooded from an ordinary watercourse.

Ryde

Ryde was identified as being the settlement which sustained the most severe damage during the 2000 floods. Investigations on Monkton Mead Brook have previously been carried out as there has been a history of regular flooding problems. Many of the properties were flooded from sewers being overwhelmed and because high water levels in the brook prevented free discharge of storm drains. The high river flow coincided with the high tide locking the Brook. One of the pumps which are designed to help alleviate the tide locking suffered a brief failure but was quickly returned to operation. Around seventy houses were flooded by the high groundwater and combined sewers overflowing. Basement flooding was a key issue.

Seaview

Flooding started around midnight on 24th December and lasted for around three to four days. The flooding was the product of two factors: high tide waters flooding over the sea wall; and flooding of the salt lake to the rear of the town due to poor drainage.

2.3.2 Tide Locking

The tide can have a direct impact on fluvial flooding. If high fluvial discharges coincide with mean high water in a river's estuary then discharge from the river is inhibited. Effectively, a high tide raises the downstream boundary of the river and when this occurs the fluvial waters are forced to back up and, depending on the discharge, spill out over the floodplain. The problem of tide locking river discharge is one that is frequently cited in the CFMP Scoping Study (February 2007) as being a key flooding concern. The tide locking of Monkton Mead Brook in Ryde caused some of the worst flooding on the Island during the 2000 flooding event.

2.3.3 Residual Risk

The CFMP Scoping Report identifies the greatest part of the Environment Agency's major flood defence work on the Island is on the tidal reaches of the rivers. The CFMP highlights the following alleviation schemes:

- The Schoolgreen area of Freshwater on the Western Yar;
- A 4km stretch of the River Medina through Newport;
- Luckely Brook between Towngate Bridge and Estminster Mill;
- A flood storage area in the centre of Newport; and
- The tributaries of the Lukely Brook, Gunville and Merstone Streams, include lined sections of channel, velocity weirs and culverts

The '*CFMP scoping Study*' (February 2007) notes that in 2001 the Environment Agency installed a new scheme at Ryde to more effectively release floodwaters into the sea. This was achieved by extending the concrete outfall pipes and by installing two new high capacity pumps. The report states that current flood risk management for the

Island has included improvements in flood forecasting. Forecasting on the Western Yar, is said to have been historically difficult due to the fast response times of a series of relatively. The Environment Agency have developed a new flood forecasting model in 2006 to improve the warning time that can be provided.

No flood defences have been identified on the Island which offer protection from the 1 in 100 year event or greater. As such there are no areas benefiting from defences to the level required by PPS25 in order to be of material planning concern and therefore no areas of Flood Zone 3 are considered to be at residual risk.

2.4 Tidal Flooding

Tidal related flooding can be subdivided into two broad categories; 1) When the sea level is raised during a severe meteorological event resulting in a storm surge; or 2) When a mean high water coincides with high river flows, thus tide locking the river discharge and instigating flooding (See Section2.3.2). The definition of tidal flood risk zones is addressed in Section 3.2.1.

2.4.1 Meteorologically Induced Raised Sea Level

Meteorologically induced sea level rise is the term used to describe the phenomena of deep low pressure weather systems causing the surface of the sea beneath the centre of the depression to dome upwards. The sea surface is raised because the centre of the deep low pressure system is applying less downward force on the sea surface than is being applied by the atmosphere outside the low pressure system. This *dome* of water advances with the progression of the storm and when the storm makes landfall so does the dome of water or 'storm surge'. If meteorological conditions coincide with astronomically controlled flood tides then the resultant water level can be even higher and thus the flooding can be even more extensive. One of the most notable examples of this type of flooding to have been recorded in the UK was the 1953 event which caused destruction along the coasts of Norfolk, Essex and in the Thames Estuary.

2.4.2 Residual Risk

No coastal defences have been identified which offer protection from the 1 in 200 year tide level. PPS25 therefore considers there to be no areas of residual risk. However, the Environment Agency considers any area behind a flood defence structure to be at residual risk and not only those with a high standard of protection. A recently constructed defence at Seaview, Duver is known to offer a high level of protection. The exact standard of protection has not been made available to the SFRA but implication of these defences should be considered in any site specific FRAs.

2.5 Groundwater Flooding

Groundwater flooding on the Isle of Wight is not considered by the Environment Agency as a significant issue and for the purposes of this SFRA, a summary of the available information has been agreed to be all that is required.

The ability of surface water to be absorbed is a function of the permeability of the soils and superficial geology deposits and of the porosity of the solid geology. Chalk and limestone are generally considered to be highly permeable and no flooding is reported to have occurred in the chalk areas, except along the spring line at the boundary between the chalk base and clay formations.

The 2002 Consultation Report into the Autumn 2000 floods states that in some cases it may not so much be groundwater causing the flooding, as impermeable bedrock restricting the infiltration of rain and thus leading to high rates of surface run-off. The following were identified in the Consultation Report as being the areas of geological formations noted on the Island as being flood affected. Figure 1 (Appendix A) broadly represents the major geological formations on the Island.

Wealden Beds

The Wealden beds are composed of two series, Marls and Shales. Both of which have very low permeability. The low permeability is a function of the rock being formed from fine particles of slit and mud. As such these beds present a barrier to the passage of groundwater, fractures within the lithology represent the only routes for the percolation of groundwater. The Wealden beds can be found in the Atherfield and Sandown areas

Lower Greensand

The Lower Greensand beds are composed of a series of sands and clay strata of varying thicknesses and permeabilities. Owing to these variations and discontinuities in the underlying rock, the formation's groundwater response to rainfall events is characteristically non uniform. The Consultation report concluded that it is not possible to predict groundwater levels for any location without further investigation. Although, where the Carstone and Sandrock beds are know aquifer bearing rocks. The Carstone formations can be found in the Allens, Redhill Lane and Sandford areas and the Sandrock beds are found at Newport, Whitwell and Stonebrook.

Upper Greensand with Chert layers

The permeability of this structure is dependant on the level of cementation between the composite grains. The formation is permeable and is noted as being one of the most important aquifer baring rocks on the Island as the sandstone is underlain with thick blue Gault clay which acts as an impermeable barrier and it creates a spring line. The Upper greensand has been identified in the Niton, Shorewell and Whitwell areas of the Island.

Osborne and Headon Beds

The Osborne and Headon Beds are a series of sands, silts, clays and marls with some limestone bands. The presence of low permeability clays and marls reduce the permeability of the sands within which they are inter-bedded. Groundwater has been known to rise to the surface at the old railway works in Newport. In order to ascertain the proportion of flooding attributable to groundwater, the Consultation report recommends the need for more detailed site specific information. Freshwater and Brading have been listed by the Consultation report as areas on the Island where the Osborne and Headon beds are located.

Bembridge Marls

The Bembridge Marls, which are present at Gurnard, Bembridge, Seaview and Wootton Bridge, are impermeable lagoon and freshwater blue and green clays.

Hamstead beds

Across a large part of the north of the Island lie the Hamstead Beds, they are composed of clays, loams, sands and shales. The permeability is thus highly variable, with the sand deposits being the most water bearing of the composite units. More detailed information at a site specific level is said to be necessary by the Consultation report in order to determine the proportion of the flooding attributed to groundwater

2.6 Surface Water Flooding

Surface water flooding has been linked to some of the flooded properties during the 2000 floods on the Island. A recurring theme has been drains not being able to discharge because of raised river levels and thus the capacity of the drains was soon exceeded resulting in surface water flooding. The localised and site specific nature of these flooding incidents does not lend them to being assessed at the strategic level. Section 8 of the report addresses surface drainage and surface run off in more detail through the assessment of the infiltration potential of the ground and the likelihood of run-off generation. A discussion of mitigation and management techniques that will potentially reduce the risk of surface water flooding for new developments is presented in Sections 8 and 9.

Surface water flooding results from excessive rainfall being unable to enter the local drainage system, due to blockages or capacity being exceeded or because the rainfall intensity is greater than the infiltration rate of the soils. Therefore the only route for rainwater to take is over the surface. Incidents are usually isolated and difficult to predict owing to the complex interaction of local infrastructure and circumstance, the impacts of which are often localised with potentially only low flood depths being attained. There is a likelihood of overland flow from one area of ponded surface water towards local low points in the topography, which is typically the river channel.

The occurrence of flooding caused by insufficient capacity of the drainage system is related to the probability of a given rainfall event over a given area. The likelihood of flooding is dependant on the condition of the surface drainage network, as well as the rates of surface water run off generation. The likelihood of flooding may change over time; due to increases in development, changes in impermeable area and climate change. As a result, flooding related to surface drainage may become more frequent in the future. Every new development proposal* must include an FRA inclusive of a consideration of surface water drainage and measures to mitigate against any potential increase run off. Any reported incidents of surface water flooding events are included in Section 6.

* Only if the site is within Flood Zones 2 or 3 or if it has an area of more than 1 hectare.

3. Definition of Flood Risk Zones

3.1 Overview of the Flood Zones

Flood Zones are described throughout this SFRA and they refer to flood extent datasets held by the Environment Agency. The Flood Maps are the successor to the Indicative Flood Plain Map (IFM) and have been in the public domain in their current format since October 7th 2004. Since their initial publication the Agency has worked with consultants to refine these maps through the commissioning of detailed hydraulic modelling projects. Updates to the published datasets are made on a quarterly basis. Box 2 outlines the different Environment Agency Flood Zones.

Box 2 Introduction to the Environment Agency's Flood Zones

Flood Zone 1

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)

Flood Zone 2

This zone comprises land assessed as having a 1 in 100 and 1 in 1000 annual probability of river flooding (1% 0.1) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

Flood Zone 3a

This zone comprises 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.

Flood Zone 3b

This zone comprises land where water has to flow or be stored in times of flood. This Flood Zone is land which would flood with an annual probability of 1 in 20 (5%) or greater in any year.

Additional Information

- The Flood Zones are mapped using a 'no defences' scenario which has necessitated areas of floodplain know to be defended to be identified on the Flood Map as benefiting from defences.
- The Flood Zone extents, regardless of whether the area benefits from a defence, are used to determine when Flood Risk Assessments are required to support a planning application.

3.2 Flood Zones, PPS25 and the SFRA

The Flood Zones are spatial datasets indicating the area of land likely to be inundated in the event of an extreme flooding event with a given probability of occurrence. The four zones described in Box 2 are listed in order of decreasing extent but of increasing probability of occurrence. PPS25 defines development types on a basis of vulnerability to flooding. The aim of PPS25 is that the most vulnerable development types should be located in the lowest flood risk zones. Vulnerability classifications are specified in Table D.2 – Annex D PPS25. The alignment of vulnerability and risk is detailed in Table D.3 – Annex D PPS25. For ease of reference, Annex D of PPS25, including tables; D.1 *Flood Zones*; D.2 *Flood Risk Vulnerability Classification* and; D.3 *Flood Risk Vulnerability and Flood Zone 'Compatibility'* are reproduced in Appendix B of this report. It is advised to reference the notes

attached to Table D.2 in Appendix B. Despite a potential development being able to *tick* the appropriateness of use in a particular Flood Zone, available areas of lower flood risk should be encouraged for consideration in preference.

3.2.1 Fluvial and Tidal Flood Zones

The Agency supplied the published Flood Zones 2 and 3 for use in this SFRA. These datasets were divided into their respective tidal and fluvial components (see Figure 12), enabling the source of flood risk (fluvial or tidal) to be identified. The only alteration to these datasets has been the inclusion of the output from the Agency's detailed hydraulic model of the Western Yar. The current (August 2007) Environment Agency Flood Zones 2 and 3 do not include the output from the Western Yar model because the model was completed after the latest edition of the Flood Map was issued.

The Flood Zone extents supplied by the Environment Agency in August 2007 (with the addition of the Western Yar model outlines) were used to define the flood risk classification in the Attribute and Site Specific Databases. The year 2000 Flood Zone 2 and 3 extents produced as part of the tidal climate change modelling were not used for this purpose.

Development and Flood Zones

Flood Zone 1

PPS25 states that all uses of land are appropriate in this zone.

Flood Zone 2

The appropriate uses of land specified by PPS25 for this zone include, water-compatible, less vulnerable, more vulnerable and essential infrastructure. The vulnerability classifications are detailed in Table D.2 of Annex D – PPS25 which is reproduced in Appendix B. Highly vulnerable uses of land are only appropriate in this zone subject to the Sequential Test, which is detailed in Section 8, being passed and only if the Exception Test is passed.

Flood Zone 3a

PPS25 states that water–compatible and less vulnerable uses of land (as defined in Table D.2 of Annex D PPS25, see Appendix B) are appropriate in this zone. The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

3.2.2 Functional Flood Plains (Zone 3b)

Functional floodplain extents have been produced for the Western Yar and the Monkton Mead Brook. These were the only two watercourses that the Environment Agency held detailed hydraulic models for and as such no other

watercourses in other Key Development Areas could have their functional floodplains' mapped. The Monkton Mead Brook Isis Model was run for the 1 in 20 year fluvial event in order to map the functional floodplain. The model was run in a '*without pumps working*' scenario, which is representative of the history of the failure of the flood alleviation pumps on the Monkton Mead Brook.

The Agency were already in possession of a 1 in 25 year flood extent outline for the Western Yar and it was agreed with the Agency that the 1 in 25 year extent could be used to represent the functional floodplain along this watercourse. The Monkton Mead Function Floodplain is illustrated in Figure 3.1 and the Western Yar functional floodplain is illustrated in Figure 3.2.

Figure 3.1 Monkton Mead Functional Floodplain

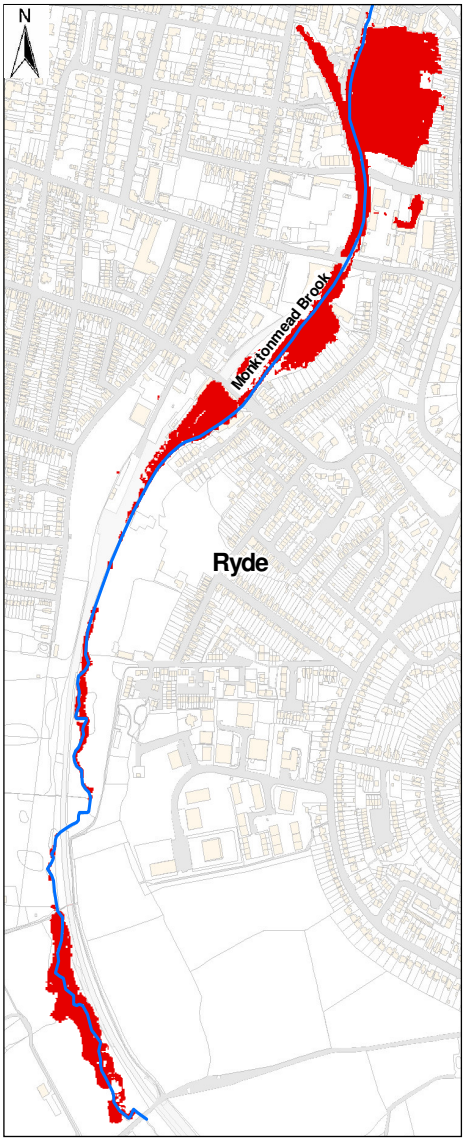
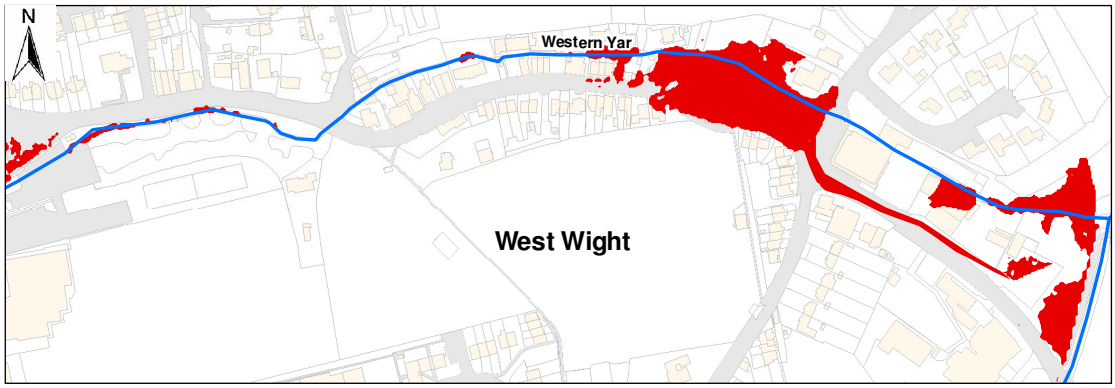


Figure 3.2 Western Yar Functional Floodplain



The definition of functional floodplains is important from a planning viewpoint as they represent the areas of land upon which PPS25 imposes the most stringent planning constraints. Indeed PPS25 states that only water compatible uses and essential infrastructure (listed in Table D.2 in Appendix B). Developments of the permitted nature must be designed to:

- Remain operational and safe for users in times of flood;
- Results in no net loss of floodplain storage;
- Not impede water flows; and
- Not increase flood risk elsewhere.

Essential infrastructure in this zone is required to pass the Exception Test.

The functional floodplain of the Eastern Yar will be incorporated into the SFRA when the Environment Agency's modelling project has been completed. It is expected that this will occur at some point in 2008.

4. Climate Change

4.1 Rationale for Assessment

Climate change is frequently cited as being one of the most significant threats to the long term sustainability of our environment. A fluctuating climate is not a modern phenomenon. It is well documented that the earth's climate has been through a repeating cycle of warmer (interglacial periods) and colder (glacial periods) for the last 2 million years. Climatic records indicate that there has been a huge transition in the climate over the last 10,000 years (a period of time know as the Holocene) following the end of the last glacial period.

Despite there existing, within academic debates, an element of disagreement about the precise impacts climate change will have on the environment. It is widely accepted that the climate in Northern Europe is becoming warmer and there is little evidence to suggest this trend will not continue. It is essential that the likely impact of climate change on the extent of the future Flood Zones is considered if development is to be sustainable over the long term. The Isle of Wight Council is unique in the UK in being the only LPA, to be bordered by the sea on all sides, thus making the issue of sea level rise one of critical concern.

PPS25 and Defra Guidance

Defra stated in October 2006 in their '*Supplementary Note to Operating Authorities – Climate Change Impacts*' that climate change impacts on flooding are a challenge to Local Authorities. The impacts are stated to include sea level rise and the potential increase in intensity and frequency of coastal storms. It is also predicted that rainfall events affecting flooding in fluvial catchments and urban surface water systems will increase in regularity and intensity. Defra's October 2006 supplementary note to Operating Authorities is designed to support the publication of PPS25 and states that; Defra's response to climate change impacts is to promote policy guidance based on appropriately precautionary allowances and sensitivity testing to enable Operating Authorities to take climate change impacts into account in planning appraisal, decision making and operations.

Sustainability Implications

The current extent of Flood Zone 2 and 3 is critical to the site allocation process, but a view as to how these extents may change in the future is of importance. PPS25 (Paragraph B10) notes that the implications of climate change could mean that a site currently located within a lower risk zone could be reclassified as lying within a higher risk zone at some point in the future.

4.2 Sensitivity of the Fluvial Domain to the Impacts of Climate Change

It was the intention of this assessment to determine how sensitive the fluvial domain on the Isle of Wight is to increased river flows. This involved an uncomplicated Island wide approach that utilised all the available data.

4.2.1 Approach and Methodology

Climate change is predicted to increase the magnitude of the 1 in 100 year flood. To model this, a larger fluvial flow would have to be simulated along each of the Island's watercourses. The objective of climate change modelling is to ascertain whether increased flows will have a significant impact on the extent of the Flood Zones. The approached adopted in this SFRA utilises existing data without requiring need for additional modelling work.

Flood Zone 2 outlines were produced for the Environment Agency by modelling a 1 in 1000 year fluvial flow in each watercourse and Flood Zone 3 was produced using the same methodology but with a 1 in 100 year fluvial flow. The two different flows used to produce Flood Zones 2 and 3 were used to identify areas of fluvial floodplain that are potentially sensitive to an increase in fluvial flow. In doing so it is possible to assess the sensitivity of the fluvial flood extents to climate change.

If there is little or no difference between Flood Zones 2 and 3, then the flooding extent in that area of floodplain can be considered to insensitive to an increase in fluvial flow and thus insensitive to the impacts of climate change. Floodplain topography controls how sensitive the flood extent is to an increase in fluvial flow. Along reaches where the valley floor is narrow and the sides are steep, there will be little lateral expansion of the flood extent. The depth and velocity will increase more significantly in areas where the extent increases the least. Accordingly, areas where the valley floor is wide and flat and not bounded by steep valley sides, the flood extents are large and expand laterally more significantly as a consequence of increased in fluvial flows.

To assess the sensitivity of the Island's floodplains to increased fluvial flows, the smaller extent of Flood Zone 3 was clipped from the larger extent of Flood Zone 2 within a GIS software package. This produced a dataset which represented all the locations where the extent of Flood Zone 2 is larger than the extent flood Zone 3. Tiny fragments of this dataset were removed to leave only areas considered to be significant. The value of 750m² was used as the threshold of significance. This is the threshold used by the Environment Agency when editing the Flood Map. Areas of flooding less than 750m² which are not connected to the main body of flooding are deleted from the Flood Map.

4.2.2 Fluvial Climate Change – Conclusions

Areas of fluvial floodplain identified as being potentially sensitive to the impacts of climate change are illustrated in Figure 15 in Appendix A. This figure shows that, for the most part, the extents of Flood Zone 2 and 3 are very similar as there are not many large areas of black on the map. This is due to the fact that the majority of the Island's rivers flow in well defined floodplains. Every potential development site which intersects the *Areas of*

Fluvial Floodplain Potentially sensitive to Climate Change dataset is attributed accordingly in the Attribute Database. This is so that the Council can be alerted as to whether climate change might present long term sustainability issues to a site.

Two locations where there are significant differences between the extent of Flood Zone 2 and 3 have been highlighted for further discussion. These are the lower Eastern Yar Floodplain and Monkton Mead Brook through Ryde.

Lower Eastern Yar

The area of floodplain downstream of Alverstone is the widest expanse of fluvial floodplain in on the Isle of Wight. The largest differences between Flood Zone 2 and 3 can be found here, as shown in Figure 4.1. For the purposes of the SFRA, only one area requires identifying, and that is the area of land to the north and east of Sandown and near Yaverland as there are a large number of potential development sites in the area. It is recommended that any subsequent FRAs should assess the implications.

Monkton Mead Brook - Ryde

Flood Zone 2 appears to be significantly larger than Flood Zone 3. It is though that some of this difference may be attributed to different modelling methods used to produce the two Flood Zone extents. Flood Zone 3 in Ryde appears to be the product of the detailed Monkton Mead model whereas Flood Zone 2 appears to be the product of a more generalised modelling.

Figure 4.1 Lower Eastern Yar Floodplain

The black areas represent the significant parts of Fluvial Flood Zone 2 that extend beyond the extent of Fluvial Flood Zone 3 and the orange areas are the potential development sites.

This high level assessment intended to establish whether the potential impacts were extensive or restricted to a few locations. It is found that Island wide fluvial climate change modelling is not necessary to inform the SFRA. It can be concluded that small areas of the Island's fluvial floodplains contain small areas where climate change may have an impact on the extent of the Flood Zones. The '*Areas of Fluvial Floodplain Potentially Sensitive to Climate Change*' dataset (see Figure 15 – Appendix A) should be used as an indication of where the impact of climate change on the fluvial Flood Zones should be considered in more detail as part of site specific FRA's. Any development proposals for sites which fall within the *Areas of Fluvial Floodplain Potentially Sensitive to Climate Change*' dataset must account for climate change allowances in their accompanying FRAs, to be inline with advice offered in PPS25.

4.3 Impact of Climate Change on the Coastal Domain

The extensive tidal Flood Zones and the perceived risk posed by sea level rise necessitated the need to carry out detailed tidal climate change modelling along the coastline of the KDAs. The methodology adopted is detailed in Section 5.3.1.

4.3.1 Approach and Methodology

The existing tidal Flood Zone polygons were derived by projecting an extreme sea level onto a digital terrain model (DTM). The DTM used for this original mapping was Interferometric Synthetic Aparture Radar (IfSAR) data. Higher resolution more accurate Light Detecting and Ranging (LiDAR) data is held by the Environment Agency for the whole of the Isle of Wight coastline and so was used in the modelling process for this SFRA. LiDAR topographic data is known by the Agency to produce flood outlines of a superior quality to those produced from using IfSAR.

The extreme sea level values used in the original flood mapping project have also been superseded in the SFRA's coastal modelling. The coastline of the Island was subdivided into discrete coastal zones by the Environment Agency (Flood Risk Mapping – Winchester) each being assigned a 1 in 200 year and 1 in 1000 year tide level for the year 1990. The '*Extreme Sea Levels – Kent, Sussex, Hampshire & Isle of Wight Updated Summery Report'* (2004) and PPS25 were used to calculate what the extreme tide levels for the years 2000, 2026, 2070 and 2115. The year 2000 levels had to be calculated so as to provide a like for like extent, against which the 2026, 2070 and 2115 could be compared. The existing Flood Zones could not be used for this purpose as they were derived using different methodologies. The net sea level rise allowances incorporate thermal expansion of the oceans, melt from ice caps and land glaciers and vertical adjustment of the land (isostatic rebound and subsidence). PPS25 recommends that the allowances for the regional rates of sea level rise shown in Table 4.1 should be used as a starting point for considering flooding from the sea.

The stretch of coastline between Ventnor and Freshwater Bay has not been modelled as this stretch of coastline was not considered to be of strategic importance. The gaps in the modelling along the northern coastline between Yarmouth and Cowes are the result of there being holes in the LiDAR coverage.

Table 4.1 Recommended Rates of Net Sea Level Rise

Administrative Region	Net Sea Level Rise (mm/yr) Relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, East Midlands, London, SE England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South West	3.5	8.0	11.5	14.5
NW England, NE England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Reproduced from Table B.1 '*Recommended contingency allowances for net sea level rise*' – Annex B in PPS25.

The extreme sea levels used in the modelling are detailed in Appendix C. They are calculated from adding the incremental sea-level rise figures specified by PPS25 (see Table 4.1) to the base 1990 extreme levels issued by the Environment Agency. These extreme sea levels are derived from probabilistic storm surge heights, but do not account for wind or wave action.

Horizontal Projection Modelling

Extreme flood extents for the following horizons were modelled

- 2000 – to represent the current Flood Zones in order to allow for direct comparisons
- 2026 – Regional Spatial Strategy time horizon
- 2070 – covers the 60 year consideration required from the development of commercial land uses
- 2115 – covers the 100 year consideration required for the development of residential land uses

The 100 year residential development horizon would have been 2107, but the Council requested that the horizon be extended to 2110 to extend the lifespan of the outline. However, it was decided that the 2115 horizon be mapped instead as it resents the upper limit of the Defra sea level rise predictions and thus the longest available time horizon.

The extreme tidal flood extents for the years 2000, 2026, 2070 and 2115 were produced by performing a series of calculations within the GIS software package ESRI ArcGis. The calculations turned a polygon assigned with a tide level into flood depth grids which were then turned into flood extent polygons. The nature of Horizontal Projection

Modelling results in all areas of the DTM, within the calculation area, which have elevations less than the tide level becoming part of the resultant flood extent. As such it is possible for a topographic depression completely separated from the coastline to become part of the flood extent. To eliminate these potential errors from the results, a process of manual cleaning of the data was required. This involved the removal of a small number of tiny areas of the flood extent which were considered not to be hydrodynamically linked to the sea. This was established through an assessment of the topography and the Master Map data.

The methodology used to produce these outlines is in accordance with guidance prepared by the Environment Agency. The outlines are unique to the SFRA and should be used as indicative extents of future flood risk zones rather than be considered Agency Flood Zones. However, the Environment Agency has agreed that the SFRA output are more than adequate to inform the SFRA.

4.3.2 Sensitivity to Climate Change – Tidal

Maps of the years 2000, 2026, 2070 and 2115 Flood Zone 2 and 3 outlines for each of the KDAs can be found in Appendix A. The full extent of the coastal modelling is presented in Figures 13 and 14 in Appendix A. If significant differences exist between the year 2000 and the year 2115 extents, they are discussed in the Climate Change sections in Chapter 6. The impact which climate change has potentially got on the extent of the tidal Flood Zone extents is expressed numerically in table 4.2.

Table 4.2 Impact of Climate Change on Extent of Tidal Flood Zone Extents

Food Risk Zone	Climate Change Horizon	Estimated Current Area (km²)	Predicted Future Area (km²)	Percentage increase (%)
1 in 200 year	2000	22.4		
	2115		25.2	11.7
1 in 1000 year	2000	23		
	2115		25.7	12.5

Figures presented relate to the areas of coastline displayed in Figures 13 and 14 (Excludes coastline between Freshwater and St Catherine's Point)

There are no areas covered by the tidal climate change modelling which exhibit large increases in area, which implies that the tidal floodplains are well defined. A well defined tidal floodplain is bounded by steep topography meaning that an increase in surface water level does not dramatically increase the extent of flooding. Although the extent of flooding does not always increase by much, the depth of flooding will increase.

The tidal climate change flood risk zones should be used to provide an indication of the likely possible extent of future flood zones, however they are not definitive. The outlines are considered to be sufficient to inform the Council of where the long term sustainability of developments may potentially be compromised. Moreover, these

datasets can be used to draw the Council's attention to where site specific FRAs should include mitigation measures to demonstrate how the risk of flooding will not increase as a result of the impacts of climate change. The potential development sites which are intersected one of the tidal climate change polygons are attributed with details of the time horizon outline which is predicted to impact the site first. For example, if a potential site is within the extents of the 2070 and 2115 then it will be attributed as being included within the flood risk zone in the year 2070.

5. SFRA GIS Datasets

5.1 Source Data Discussion

Many datasets were requested for use in this SFRA, and these were primarily received from the Isle of Wight Council and the Environment Agency. These geographic data had various formats by which they were made available and originated from different sources (e.g. digitised paper maps, survey data and satellite data). Data that were not in the desired format and/or projection had first to be manipulated.

5.1.1 Data Precision

Each data source has an associated level of precision. The groundwater water vulnerability mapping has a reference scale of 1:100,000. Whereas LiDAR data has a 2 metre resolution, which means that each 2m by 2m area of land is assigned a single elevation value. Much of the Island wide data (e.g. Groundwater Vulnerability Mapping, Source Protection Zones and Soils Data) come from national data sets, the spatial precision of which is low, but appropriate for strategic Island wide assessments. The individual potential development sites are attributed with values derived from these low precision national datasets (e.g. the generalised classifications of infiltration SuDS suitability, groundwater vulnerability and runoff potential). It must be noted that the precision of the data does not increase despite the analysis being performed on the smaller site specific scale.

It is important that the site specific detail of the datasets covered in the following section be considered in respect to the level of accuracy of the source data. The reference scale of any of the original source data should be deemed as the maximum scale at which the data is considered accurate. A detailed description of each of the source datasets is presented in Appendix D.

5.2 Interactive GIS Datasets – 'The Planning Tools'

For the SFRA to fulfil its role as a strategic planning tool, the Council have to be able to abstract the conclusions of the flood risk and drainage assessments for each potential development site. There are over 1,400 potential development sites assessed in this SFRA and it is not possible to discuss each of these in turn in the report. The only way of delivering the conclusions of the flood risk and drainage assessments for each of these sites is through the use of a GIS datasets. As described in Section 1.6 the SFRA report is accompanied by a series of digital datasets on a CD-ROM. Key among which are the Attribute Database and the Site Specific Database which are detailed in Sections 5.3 and 5.4 respectively. Through the use of GIS software the Council can interrogate each of the potential development sites and ascertain details of; Flood risks; Climate change implications; Historic flooding and; the drainage assessment. Moreover, the Site Specific Database provides details of how the flood risks vary across all those sites identified as being at risk of flooding in the Attribute Database.

5.3 Attribution Dataset

An encompassing dataset for all the potential development sites, supplied for analysis in this SFRA, was created. Table 5.1 lists the attribute fields contained within the Attribute Database. The table is divided into four sections. The topmost section identifies the site and the KDA in which it falls, including the site area. The second section identifies current flood risk to the site and the appropriate uses based on this flood risk. The third section adds detail to the flood risk of the site by identify historical flooding, the sites positioned near a main river and the influence of climate change on the site. The final (forth) section includes those attributes relevant to the drainage of the site, and include the suitability of infiltration SuDS.

It is intended that this database, which can be navigated around in a GIS package will represent a key tool in the site allocation process as it provides a complete overview of flood risk for each of the development sites. This dataset is an initial flood risk assessment tool. It uses a precautionary approach, such that the highest risk of flooding impacting the site is recorded, the maps illustrating this assessment are presented in Appendix A. The intention is to highlight to the user which sites are in Flood Zones 2 and 3 and then guide the user to the Site Specific Database for an appreciation of the definition of different Flood Zones across each site. Sites in Flood Zone 1 should be considered first for all developments.

5.4 Site Specific Flood Risk Definition

This dataset contains some of the same attribute fields as the Attribute Database – for example *SITE_ID* is the unique identifier by which this and the Attribute Database can be cross referenced. This dataset's primary purpose is to provide additional detail about the current flood risk to each site. The Site Specific Database divides a site up according to the flood risk zones in which each part of the site falls. Unlike the Attribute Database, this more detailed dataset has multiple records for a single site. This level of assessment is important as some sites are only fractionally within a Flood Zone and the Council needs to be informed which parts of the site are outside Flood Zones 2 and 3 and thus increase the development potentials on the site.

The field names in the GIS Datasets are unfortunately restricted to a limited number of characters by ArcGIS and as such they may be less than clear as to what the field is describing, therefore Tables 5.1 and 5.2 defines what each fields in the Attribute Database and Site Specific Database are.

Table 5.1 Field Descriptions for the Attribute Database

Field	Description
FID	Feature ID
SITE_ID	Unique identifier for each site
DEV_AREA	The development area within which the site falls
AREA_HA	The size of the area in hectares (ha)
FRA_REQ	Whether or not an FRA is required, further divided according to flood risk and size of the site
FUNC_FP	Identifies whether a site is intersected by the Functional Floodplain (Zone 3b)
FZ3_T	Identifies whether a site is intersected by the Tidal Flood Zone (Zone 3)
FZ3_F	Identifies whether a site is intersected by the Fluvial Flood Zone (Zone 3)
FZ2_T	Identifies whether a site is intersected by the Tidal Flood Zone (Zone 2)
FZ2_F	Identifies whether a site is intersected by the Functional Flood Plain (Zone 2)
PROB_Y	A qualitative assessment of the flood risk posed to each site as defined by PPS25
SOURCE	Describes the likely sources of flooding (tidal, fluvial, name of river)
PATHWAY	Identifies the likely pathway of flooding (breach, overtop, channel capacity exceedence)
APP_USES	A basic assessment of the appropriate use of each site as either without restriction or requiring further investigation
HISTORIC	Identifies past historic flooding on the site and lists the month and year of the past flood event
RIV_20_BUF	Whether the site is within 20m of a main river
DEFENCES	Identifies sites that might potentially benefit from flood defences
TIDAL_CC_2	The first year in which a site is affected by the future extent of tidal flood zone 2 due to climate change
TIDAL_CC_3	The first year in which a site is affected by the future extent of tidal flood zone 3 due to climate change
FLUVIAL_CC	Whether or not a site is likely to be in flood zone 3 in the future as a result of climate change
SUDS_SUIT	Identifies the suitability of infiltration SuDS techniques
SUDS_VUL	Identifies the risk of infiltration SuDS adversely affecting groundwater due to contaminants
RUNOFF_POT	A qualitative assessment of the likely runoff potential for each site, derived from SPR_HOST
HOST	Attributes each site according to the Hydrology of Soil Types (HOST) classification
SPR_HOST	The standard percentage runoff as derived from the HOST classification

Table 5.2 Field Descriptions for the Site Specific Database

Field	Description
SITE_ID	Unique identifier for each site
DEV_AREA	The development area within which the site falls
PPS25_FZ	The flood risk zone in which that portion of the site fall in as defined by PPS25
PROB_Y	A qualitative assessment of the flood risk posed to each site as defined by PPS25
APP_USES	A basic assessment of the appropriate use of each site as either without restriction or requiring further investigation
S_E_TESTS	Pps25 guidance as mentioned in table D.1 of the guide and reproduced in Appendix B of this document

6. Flood Risk in Key Development Areas

6.1 Introduction

This section of the Report addresses each of the fourteen Key Development Areas (KDAs) which were established through consultation with the Council. The KDAs (See Figure 3 in Appendix A) is the term used in this SFRA to broadly define the main centres of development. In most cases the KDAs take their name from the principal town in the area but 'The Bay' for example, encompasses the towns of Sandown, Lake and Shanklin. 'Potential Development Sites' is the term used in this SFRA to describe plots of land on the Island that the Urban Capacity Study (2005) identified as being potential development sites. The sites discussed in this section should not be inferred as being 'preferred' development sites nor should they be considered as sites which the council necessarily wish to develop. Furthermore, there is no certainty that all sites will be released for development.

The potential sites are comprised from several different datasets supplied to Entec by the Isle of Wight Council, these included '*Sites*', '*Large Sites*' and '*Employment Sites*'. There was an element of overlapping between the constituent datasets, to overcome this, the three datasets were merged together to produce one site outline per location.

6.2 Rationale and Methodology

A three tiered approach to the assessment of flood risk has been undertaken in this SFRA, these are outlined in Box 3. This section only assesses the tidal and fluvial flood risks that were identified in Section 3. The subsequent sections will as a result, refer to a potential site being either at *flood risk* or not at *flood risk*. The two classifications are based on whether the site is within / partially within the extents of Flood Zone 2 or 3 or whether the site falls completely inside Flood Zone 1. This terminology is adopted for the purposes of best representing the planning policy guidance outlined in PPS25. Flood risk need only be considered for sites, less than 1 hectare in size, if the proposed site falls within Flood Zones 2 or 3. This is not to say, however, that the sites outside Flood Zones 2 and 3 are not at potential risk of flooding from other localised sources, but from planning and flood risk purposes, it is only Flood Zones 2, 3a and 3b that determine the allocation of sites for development purposes.

Box 3	**Three Tiered Approach to the Assessment of Flood Risk**
Level 1	Island Wide – Involves the broad appreciation of the distribution of flood risk zones
Level 2	Key Development Area – Involves a qualitative assessment of flood risk at the Key Development Area scale
Level 3	Site Specific – Involves the assessment of absolute flood risk in line with PPS25 definitions

The three levels of assessment will prove to be very useful in the planning process. Level 1 assessment identified all the potential sites which are suitable for all types of development. Level 2 identified all the potential sites that are impacted by a flood risk zone and the level 3 assessment identified the exact flood risk present at each site.

Each part of each potential site has been attributed with what Table D.1 (Annex D of PPS25) states as appropriate land uses and what land uses may be accepted by PPS25 should the Exception test be passed. A summary of the attributes applied to each site is outlined in Table 6.1.

Table 6.1 Summary of attributes for – PPS25 Site Specific Flood Risk Definition

PPS25 Flood Zone	Appropriate Land use	Sequential / Exception Test Requirements	FRA Required?
No Flood Zone	All uses of land are appropriate in this zone	N/A	FRA required if site is larger than 1 hectare in area
Flood Zone 2	Water Compatible, less vulnerable, more vulnerable (inc residential) uses of land and essential infrastructure in Table D.2 (PPS25) are appropriate in this Zone	Appropriate uses are subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 (PPS25) are only appropriate in this zone if the Exception test is passed	All development proposals in this zone should be accompanied by a FRA.
Flood Zone 3a	The water-compatible and less vulnerable uses of land in Table D.2 (PPS25) are appropriate in this zone. Highly vulnerable uses in Table D.2 (PPS25) are not permitted in this zone	The more vulnerable and essential infrastructure uses in Table D.2 (PPS25) should only be permitted in this zone if the Exception Test is passed. Essential Infrastructure permitted in this zone should be designed and constructed to remain operational	All development proposals in this zone should be accompanied by a FRA
Functional Floodplain - Zone 3b	Only water-compatible uses and the essential infrastructure listed in Table D.2 (PPS25) which has to be there is permitted in this zone	Structures should not result in loss of flood plain storage, impede flows or increase flood risk elsewhere and structures should remain operational and safe in times of flood	All development proposals in this zone should be accompanied by FRA

Information presented in this table has been sourced from Table D.1 in Annex D of PPS25

Level 2 Assessment – Qualitative Flood Risk Assessment

Sections 2 and 3 of this report address the first level of the assessment of flood risk, as they describe flood risk at the Island wide scale. Once the flood risk zones, which PPS25 recognise, were defined (see Section 3) it was possible to assess the spatial distribution of these zones against the distribution of potential sites. It was the objective of this level of assessment to divide the potential sites into two groups, those that were outside Flood Zones 2 and 3 and those that were inside or partially within the flood risk zones. Those sites identified as not being at risk of flooding are discussed in Section 6 and are attributed with information from other sources that can be used to guide the necessary scope of future site specific FRAs. Section 7 discusses the methodology used to assign the sites infiltration SuDS suitability, groundwater contamination potential and runoff potential classifications. Figure 5 (Appendix A) provides an Island wide view of the potential development sites, which clearly shows that the vast majority of the sites highlighted by the Urban Capacity Study (2005) fall outside the extent of Flood Zones 2 and 3.

Methodology for Qualitative Classification of Flood Risk

The Flood Zone polygons were interrogated within a GIS to attribute all of the 1,470 sites with a qualitative probability of flooding ranging from Highly Likely to Highly Unlikely. Table 6.2 details the classification process.

Table 6.2 Qualitative Flood Risk Classifications

Classification	Flood Zone Intersection	Definition
Highly Likely	Site intersects with Functional Floodplain (3b)	Events of common occurrence that an individual may experience a few times in their lifetime. This corresponds approximately to an annual exceedance probability of 10% - 4% (i.e. return periods of between 10 and 25 years)
Likely	Site intersects with Flood Zone 3a but not 3b	Events that an individual may experience once in a lifetime, approximately equivalent to the 1% to 0.5% annual exceedance probability event (i.e. return periods of 1 in 100 years to 1 in 200 years)
Unlikely	Site intersects with Flood Zone 2 but not 3a or 3b	Events that are of a low order of likelihood, approximately 0.1% annual exceedance probability.
Highly Unlikely	Site does not intersect with either Flood Zone 2, 3a or 3b	Extreme flood events with an annual probability of less than 0.1%.

If a potential development site fell within a range of flood risk zones, the whole site was attributed with the highest probability of flood risk. This attribution process can be seen in Appendix A, where figures illustrate the qualitative flood risk classification for each of the sites in all the Key Development Areas. All the sites that are not dark green will form the basis of the Level 3 assessment

The adopted methodology is in line with the guidance outlined in PPS25 for the application of the Sequential Test. PPS25 describes the test as a tool to steer development to Flood Zone 1. This level of assessment aims to highlight all the potential sites identified by the Urban Capacity Study (2005), which fall within Flood Zone 1. In doing so, the attribution process has highlighted which sites are appropriate for the consideration of all types all types of development.

Level 3 Assessment – Site Specific Definition of Flood Risk

Level 2 of the assessment established which sites were at no risk of flooding and which sites were at risk from flooding to a greater or lesser degree. It is the aim of the Level 3 assessment to refine the flood risk posed at each site. Of the 1470 sites assessed in Level 2, only 138 sites are partially or fully within Flood Zone 2, 3a or 3b. Each potential site was divided up using the extent of the PPS25 flood risk zones defined in Section 3 and separately attributed. Figure 6.1 illustrates how this process has worked in Cowes and East Cowes.

Figure 6.1 Cowes Example – Site Specific Definition of Flood Risk

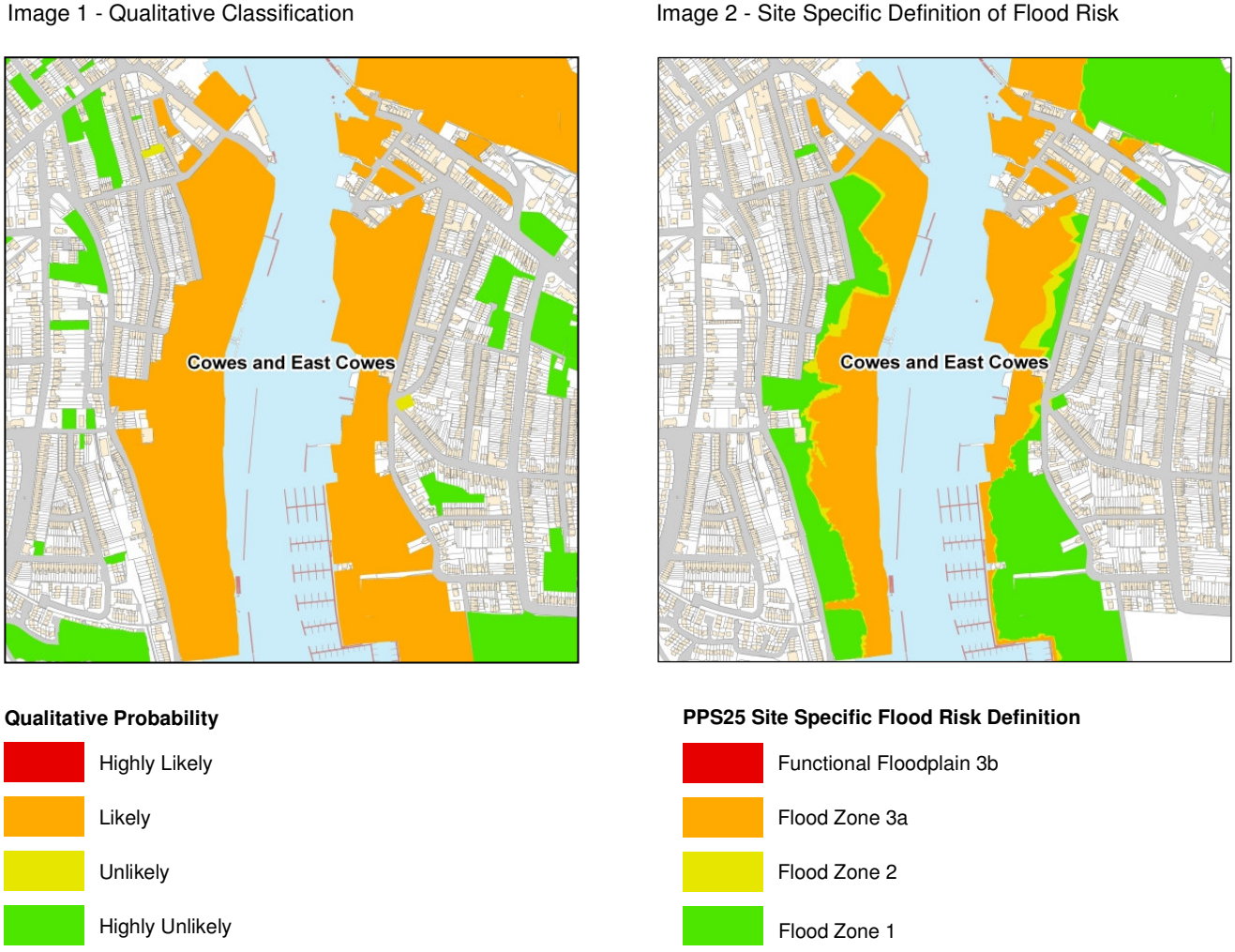


Figure 6.1 depicts how the potential sites, attributed with the highest flood risk which they intersect (Image 1), were reclassified at the site level to define the varying flood risks across each site (Image 2).

6.2.1 Surface Drainage in the Key Development Areas

In order to provide guidance on surface drainage and infiltration SuDS suitability in each of the KDAs, it was necessary to consult the soils dataset for the Island, which include HOST values. Some coastal areas are not included in this dataset. The Groundwater Vulnerability map (leaching potential) was used in these lactations to inform the runoff potential classifications.

It must be noted (as described in Section 7) that areas of high surface water infiltration potential often coincide with areas of high groundwater contamination potential. This is not to say that infiltration SuDS are not suitable. But

precaution must be taken in the design of any SuDS to avoid and potential contamination of groundwater contamination. The Drainage Sections also provide a summary of the Surface Percentage Runoff (SPR) classifications.

6.3 Bembridge

Overview

Figure 4.1 in Appendix A shows that the proposed sites in Bembridge are not in Flood Zones 2 or 3. This is despite the town having a coastline to the south and east and Eastern Yar Floodplain to the north. Sites to the immediate south of the Eastern Yar tidal floodplain have been identified as being potentially within Flood Zone 3 when the influence of climate change is accounted for. The town is surrounded by tidal Flood Zones on three sides, but no watercourse with a fluvial Flood Zone passes through the town. The risk from the sea rapidly diminishes with distance from the coast as the town is built on a headland which reaches over 40m AOD in elevation in the centre of the headland.

The Isle of Wight Autumn 2000 Flood Investigation Study – (*Bembridge Parish Council Report*) identified several site specific flooding incidents, these are detailed below:

- 71 High Street is a small craft shop, adjacent to the shop is an access track to some yards and business premises. Flooding of the craft shop due to poor maintenance of the yard drainage causing water to overflow in to the shop. By way of mitigation, the shop owners have undertaken some drainage works.
- 33 Steyne Road is said to be a known problem to the Isle of Wight Council. This bungalow is built in a dip in the land and below the road level, excess surface water flows off the recreation ground and playing fields into the property. Water also is said to accumulate in the road at this point due to under capacity of the road drains. Extensive drainage works are required to resolve the problem.
- Behind 84 Steyne Road is a farmland drainage ditch, during the heavy rains the capacity of the ditch was exceeded and the property was flooded.

Sites at Risk of Flooding

See Figures 41 and 42 in Appendix A

The Flood Zones (2 and 3) do not intersect with any of the proposed sites and as such, all the sites in Bembridge have been attributed as being appropriate for all types of development. However, tidal outlines produced in this SFRA for the 1 in 200 and 1 in 1000 year extreme tide levels for the year 2000 (as detailed in Section 4.3) indicate that potential site (ID = Bembridge115) on the estuary side of Kings Road, might lie within the tidal floodplain. This finding suggests that if this site is put forward for planning, then the extent of the Environment Agency's Flood Map should be evaluated in the FRA.

Climate Change

The impact of climate change on the extents of Flood Zones 2 and 3 (Figures 43 and 44) are small along the south and east coasts of Bembridge. These small increases do not extend to include any of the potential development sites. The insensitive nature of this stretch of coastline to increasing sea levels is due to the topography quickly becoming elevated landward of the high water mark. The northern coast of Bembridge, which faces on to the Eastern Yar Estuary, is more sensitive to climate change owing to the much flatter topography of this shoreline.

Surface Drainage

The town is built on Bembridge Marls which comprise of a series of blue and green clays. The Isle of Wight Autumn 2000 Flood Investigation Study – (*Bembridge Parish Council Report*) states that this will result in high surface runoff rates and high levels of ground saturation, which is of significance to the recorded flooding in the Steyne Road area. Soils in Bembridge have a high SPR (50%) in the south west, with decreasing values towards the north east (15%). Therefore, runoff potential is high in the south west and lower in the north east. The north and eastern portions of the town have been classified as having medium infiltration potential and the south and west parts of Bembridge have been classified as having low infiltration potential.

A wide range of SuDS techniques can be considered in Bembridge. Although infiltration SuDS are likely to be less suitable in the south west and only of moderate suitability in other areas. The volume of discharge into the estuary, either through SuDS or conventional drainage systems, need not be restricted. This is because the volume of drainage waters would be insignificant in comparison to tidal volumes. The coastal and estuarine areas of the town are associated with ecological designations (SSSIs, SACs and SPAs). These ecologically designated areas suggest that the use of SuDS techniques which attenuate or remove pollutants would be advisable.

Additional information to inform Site Specific FRAs

The assessment of Bembridge indicates that for the most part the development of sites within the town will not be restricted from a flood risk perspective. FRAs should be carried out on those sites which are larger than 1ha as PPS25 requires surface drainage to be assessed for sites larger than 1ha. The Attribute Database includes area details and indicates which sites require an FRA to be conducted.

6.4 Brading

Overview

Brading is situated on the north western side of the Eastern Yar floodplain on the eastern limb of the Brading Downs. The Brading Downs follow the central ridge of chalk which runs across the Island. This chalk stratum is present under the middle of the town. Despite the Brading's inland location, flooding from extreme tides is a real risk to the settlement. Historic flood outlines are held by the Agency for two events which occurred in 2000 and 1974. The 2000 outline shows the floodwaters not to have crossed the railway line, which runs between the edge of

the floodplain and the town. However, the 1974 event was more extensive and a couple of the potential development sites lie within this extent. The Attribute Database indicates which of the potential development sites are affected.

The Isle of Wight Autumn 2000 Flood Investigation Study – (*Brading Town Council Report*) identified several site specific flooding incidents. These are listed below:

- Groundwater inundation from the Bagshot Beds is attributed for the cause of basement flooding at 63a High Street, Brading as no other method of flooding was obvious with the threshold being well above the road level.
- Nicholas Close is built on a peat marsh at a low elevation of between 1.5 to 3m AOD. A ditch is described to run parallel to the railway bank, which is culverted under the railway and then joins the Eastern Yar. Flooding is caused by excess water levels in the ditch and water backing up through the culvert from the Eastern Yar.

Sites at Risk

See Figures 37 and 38 in Appendix A

Potential sites in the east of the town on the lower land are the ones at greatest potential risk. The current tidal Flood Zones are significantly smaller in extent than those modelled for the year 2000 as part of this SFRA's tidal modelling exercise (see Section 4.3). For the purposes of assigning flood risk to potential development sites, the Flood Zone outlines supplied by the Agency have been used. As a result, only one site is impacted, this is in the south of the settlement between the railway line and the A3055. This small site (ID Brading629) is only partially within Flood Zone 2, with the remainder being in Flood Zone 1.

Climate Change

The climate change outlines, modelled with LiDAR topographic data, are more extensive and indicate that a number of the potential sites situated between the railway line and the A3055 may become within a flood zone over the next 100 years. The sites which have been identified are attributed, in the Attribute Database with details of which climate change horizon is likely to impact each site.

Surface Drainage

Soils in the south of Brading have a high SPR (50%), whilst soils in the north have much lower SPR values in the order of 2%. The area around the sewerage works in the north east of Brading has SPR values of around 25%. Therefore, runoff potential is low in the southern half of the town and higher in the north part of the town. The potential for infiltration SuDS in the Brading is low in the south and higher in the north. To areas of medium suitability exist near the sewerage works and in the Morton Old Road area in the south west of Brading. The groundwater vulnerability map reflects this suitability distribution.

The volume of discharge, through SuDS or conventional drainage systems, into the tidally influenced river need not be strictly controlled. Although the levels of drain outfalls need to take into account high tide levels and consider the implications of discharge being inhibited by high tides.

Brading Marshes SSSI and Solent and Southampton Water SPA are the only ecological designation in the immediate vicinity of the town. The location of ecologically designated areas suggests that the use of SuDS techniques which attenuate or remove pollutants would be aspirational.

Additional information to inform Site Specific FRAs

Despite only one site being identified as being within either Flood Zone 2 or 3 and thus requiring a FRA, it is recommended that the Environment Agency be consulted if the potential site which falls within the year 2000, 1 in 1000 year tidal outline. (See Figures 39 and 40) as this indicates that the tidal floodplain is potentially larger than that presented in the Environment Agency's Flood Map. Sites which are attributed as being over 1ha should also have a drainage assessment carried out. Any ensuing FRA should consider the events of 1974 and 2000.

6.5 Brighstone

Overview

Brighstone is located on the confluence of Brigstone Brook and Shorwell Stream, both of which are Environment Agency Main Rivers. The main issue in this town is that the Flood Zones do not extend the full length of the watercourses. As such potential development which may be in a flood plain are attributed in the Attribute Database as being in Flood Zone 1 and thus appropriate for all development types. Therefore the Main River 20m buffer dataset is very important and it is recommended that this dataset be consulted should any of the potential sites be released for development. If a site is within 20m of a main river then it will be stated in the Attribute Database.

Sites at Risk

See Figures 25 and 26 in Appendix A

The sites that were identified by the Level 2 assessment form a cluster around the 'New Road' area of Brighstone. The area between the recreation ground and Brighstone Brook is largely within Flood Zone 3.

Climate Change

The fluvial climate change assessment outlined in Section 4.2 indicates that sites (ID Brighstone1334 and Brighstone1203) are potentially susceptible to the impacts of climate change as there is a significant difference between the extents of Flood Zone 2 and 3. It is therefore recommended that, should either of these sites be put forward for planning, the impact of climate change on the extent of Flood Zone 3 be assessed as part of a site specific FRA.

Surface Drainage

Soils on the site have a low to very high runoff potential with SPR values between 15% and 60%. The steeper parts of the Brighstone, in the north east, have been classified as having a low runoff potential, while the flatter areas in the south west is underlain by soils with a very high runoff generation potential. Groundwater vulnerability in Brighstone is characterised by a major aquifer in the north east and a non-aquifer in the south west. An area of minor aquifer is identified in the area around Brighstone Brook and Shorewell Stream. Infiltration potential is classified as medium in the north east and low in the south west.

The application of infiltration SuDS techniques in Brighstone are only constrained by the low infiltration potential classification assigned to the south western part of the settlement.

Additional information to inform Site Specific FRAs

A site specific FRA is required for all those potential sites which are within the extent of either Flood Zone 2 or 3. If the Attribute Database states that the site is within 20m of a Main river (in field *'Riv_20_Buf'*) then the Environment Agency should be consulted.

6.6 Cowes and East Cowes

Overview

Cowes and East Cowes have been grouped together as one KDA as the towns are geographically close and are connected by Medina Estuary. Cowes is located on the western side of the Medina Estuary and represents one of the main transport connections to the mainland, via ferry services to and from Southampton. Cowes' waterfront is dominated by detached and semi-detached properties and a number of maritime related services and supply businesses. The water front of East Cowes is characterised by industrial activity.

There exists a belt of land along either side of the estuary which is relatively flat and this area is currently within the Flood Zones. Beyond this coastal belt, the land quickly rises in elevation, which explains the small difference between Flood Zones 2 and 3.

Sustainability and Regeneration Objectives

Both Cowes and East Cowes are set to be main beneficiaries of the Cowes Waterfront Initiative, which is intended to attract investment in new facilities, residential development and job creation.

Sites at Risk

See Figures 65 and 66 in Appendix A

The level 2 assessment identified a string of potential sites that are located along the coast of the Solent and down both sides of the Medina Estuary. The Level 3 Assessment refined the classifications and showed there to be a marked decrease in flood risk in the flood risk with distance from the mean high water mark. This distribution of flood risk is a function of the local topography.

Those sites coloured in orange on Figure 66 in Appendix A represent the portion of the potential sites occupied by Flood Zone 3. A flood Zone 3 classification dictates, according to PPS25, that the only appropriate uses of land in the orange portions of the potential sites are water compatible and less vulnerable uses. However PPS25 states that more vulnerable and essential infrastructure uses should only be permitted in this zone if the Exception Test is passed. Development should first be considered in all areas not in flood Zones 2 or 3.

Climate Change

The published Environment Agency tidal Flood Zone polygons covering the Medina estuary were produced using LiDAR topographic data and more recently derived sea level values. So, unlike, many others areas on the Island the year 2000 tidal Flood Zone 2 and 3 extents modelled as part of this SFRA (see Section 4.3) are very similar to the Environment Agency's flood map. Figures 67 and 68 depict the Flood Zone 2 and 3 extents with a climate change allowance in the Cowes and East Cowes region of the Medina Estuary. The areas potentially most susceptible to the impact of climate change in Cowes are:

- The area behind the marina, by the high speed ferry terminal, at the lower end of Denmark Road and St Mary's Road, covering the area of The Cut and Cross Street.
- The area behind the Medina Road Boat Yard and the Langley Road part of town
- Parts of the High Street

The main area susceptible to climate change in East Cowes is behind the industrial units along Clarence Road extending down to Marina Close and Britannia Way. Those potential sites which fall within the modelled climate change extents are identified in the Attribute Database.

Surface Drainage

Both Cowes and East Cowes are underlain by soils with a SPR of between 47% and 50% resulting in relatively high runoff rates. A distinctly different soil classification covers the sides of the estuary where the SPR value is more in the region of 15% which means in these areas the runoff rates will be lower. The area around Cowes and East Cowes is underlain by minor aquifers. Infiltration potential is classified as being medium along the high land and low nearer sea level. A particular point of interest Cowes is the presence of a small area classified as SPZ 1. This area is located at the water treatment works between The Moorings and Windmill Chase.

SuDS in this KDA are only constrained with respect to the low infiltration potential of the south west half of the town. It could be possible to discharge unrestricted volumes uncontaminated surface water into the Medina Estuary. Before infiltration SuDS are implemented, the potential for contaminated land must be considered.

Additional information to inform Site Specific FRAs

Site specific FRAs will be required for all those sites larger than 1ha. The Site Specific Database can be used to identify which portion of the sites are at a flood risk and can inform the distribution of development across the site through the application of the Sequential Test at site level.

6.7 Newport

Overview

Newport has the greatest density of watercourses of any town on the Island, all of which are classified as Main Rivers and a significant number of these have got Agency Flood Zones. There exists both tidal and fluvial flood risks in Newport. The tidal flood risk, as defined by the Flood Zone extends as far up the Medina Estuary as the bridge where the A3020 crosses the River Medina. However, the tidal mapping of the Medina Estuary carried out for this SFRA indicates that the tidal flood risk may extend further upstream. This discrepancy is likely to be due to different methodologies used. Section 4 details the flood mapping methodology used in this SFRA and notes how the extents were determined solely on the basis of the LiDAR topographic data and the extreme sea levels. No site specific information relating to the location of weirs or other control structures was included.

Fluvial Flood Zones exist for the River Medina, Lukely Brook, Pan Stream and Gunville Stream. Parkhurst Stream and the tributaries of Pan Stream however, which are designated as main rivers, do not have Flood Zones. The watercourses of Newport are detailed in Figure 6.2.

The Isle of Wight Autumn 2000 Flood Investigation Study –(*Newport Isle of Wight Council Flood Report*) found that although parts of Newport are in the Medina and Luckley Brook floodplains, only St Cross Mill was reported as flooding due to high river levels. Through Newport channel improvement works designed in the 1960s were sufficient to prevent more extensive flooding, although the standard of protection will diminish with time. No tidal flooding was reported during the winter of 2000 / 2001.

The Isle of Wight Autumn 2000 Flood Investigation Study – (*Newport Isle of Wight Council Flood Report*) identified several site specific flooding incidents. These are listed below:

- 47 Garden Way was flooded due to excess water coming down the slope off adjacent Downside School playing fields and pooling against the side of the house.
- 185 Fairlee Road was flooded due to water pooling of water in the road and overflowing the driveway and into the property. This location is a low point in the road that will accumulate water from both sides. In addition surface water would come down from Mews Lane. Insufficient capacity of road and footpath drains has been attributed as the cause of the flooding.
- 2 New Close Farm Cottages, Nunnery Lane. This property lies at the base of a short valley with high ground on three sides. The accumulation of excess runoff entering the property from the slopes must have resulted from saturated areas or areas of low permeability.

- Lukely Mill which is situated adjacent to Lukely Brook flooded when the capacity of Lukely Brook was exceeded.
- 239 Gunville Road, Gunville. The capacity of Gunville Brook was exceeded which caused flooding of the property

Sustainability and Regeneration Objectives

Newport is the main employment centre on the Island with almost all public sector employers based there. Newport is set to benefit from the Cowes Waterfront Initiative, which is a holistic regeneration project for the whole of the Medina Valley. It is intended to create jobs, attract investment and bring new facilities to the communities of Cowes, East Cowes and Newport Harbour. The initiative is being promoted by a collaboration of English Partnerships, the Isle of Wight Council, the Isle of Wight Economic Partnership and SEEDA (South East England Development Authority). The partners have agreed a Strategic Development Framework (SDF) to carry forward the Initiative based on a comprehensive review of the area. This review sets out recommendations to make the best use of available land to give the greatest, most beneficial impact to the economy and the environment.

The assessment of flood risk in Newport, Cowes and East Cowes and the classification of flood risks for each of the proposed sites will aid in the land allocation decision process due to take place as part of the Cowes Waterfront Initiative.

Sites at Risk

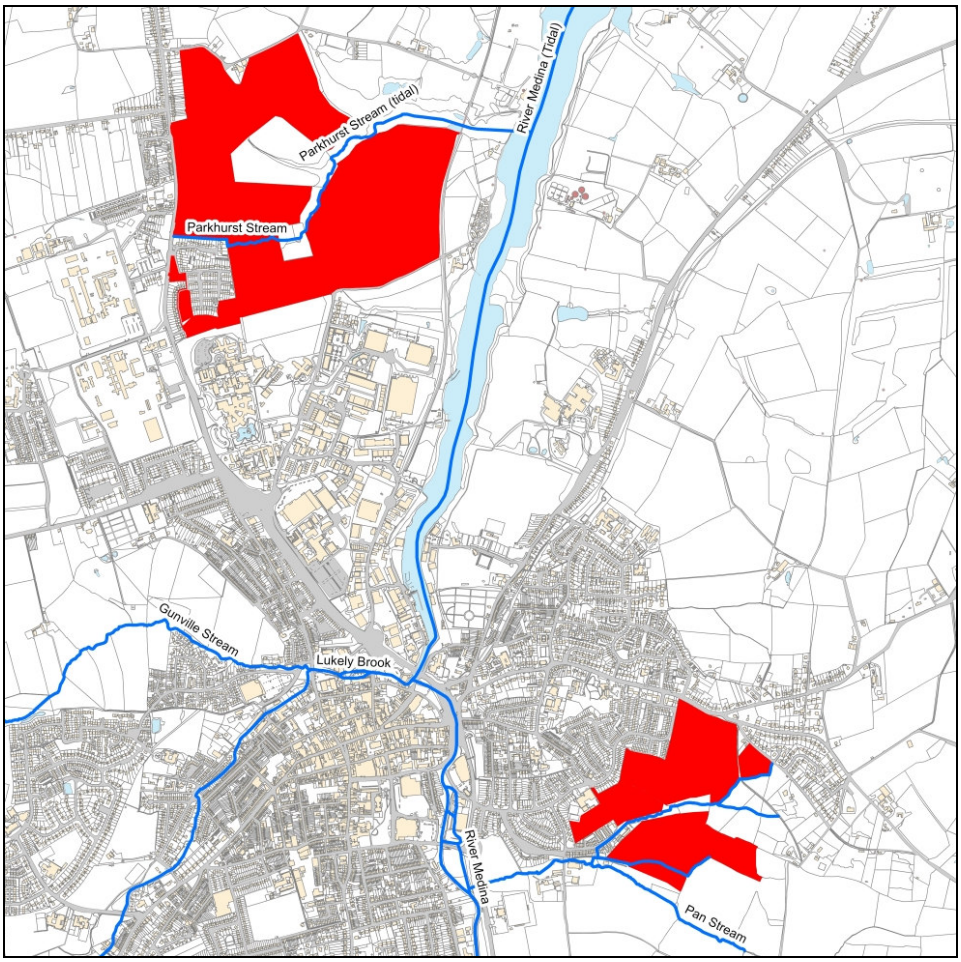
See Figures 61 and 62 in Appendix A

The site assessed to be at risk are those which intersect the Flood Zones of Newport's rivers and the sea Figure 61 in Appendix A, highlights quite a number of large sites that are at risk of flooding, but Figure 62 in Appendix A illustrates that only a small portion of each of these sites are at risk. The site specific classification can enable the PPS25 Sequential Test to be performed at the site level.

The sites most significantly impacted by the Flood Zones are those along side the Medina Estuary downstream of where the A3020 crosses the river.

Parkhurst Stream, which flows down Horsebridge Hill to the North West of Newport, and the tributaries of Pan Stream to the east of the town have no Flood Zones. Figure 6.2 identifies the sites adjacent to a Main River but with no Flood Zone. This means that the sites adjacent to these watercourses are not attributed as being at any risk of flooding. (please note, the lower reaches of Parkhurst Stream are influenced by the tidal Flood Zones of the Medina Estuary and as such the potential sites on the banks of Parkhurst Stream are attributed with a flood risk). The potential sites affected are all attributed in the Attribute Database in the *Riv_20_Buf*' field with the name of the Main River watercourse that flows adjacent to the site. An update to the Flood Map to include Pan Stream is expected in the near future when the model is signed off by the Environment Agency.

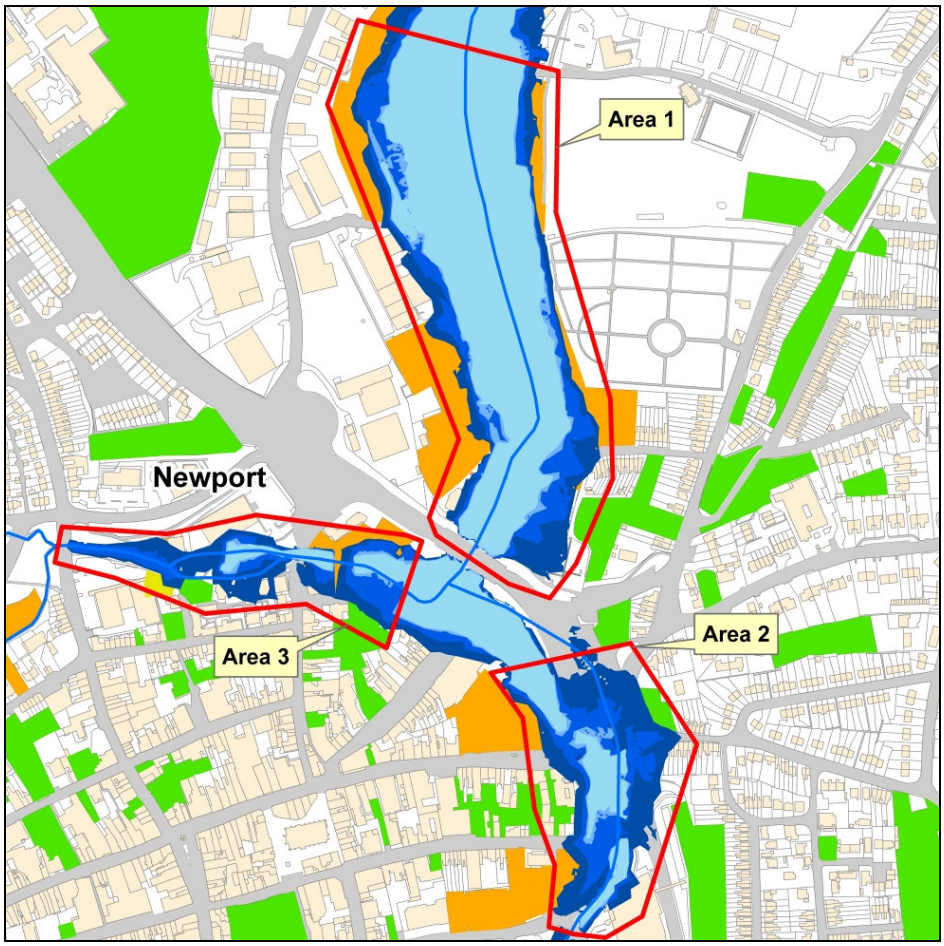
Figure 6.2 Potential sites in Newport which are adjacent to Agency Main Rivers with no fluvial Flood Zones



Climate Change

The potential sites most vulnerable to the impact of climate change, and the associated increase in sea level, are those on both banks of the Medina between Seaclose Park and the crossing of the A3020 (Area 1 Figure 6.3). These sites are in areas where the outlines for years 2070 and 2115 are significantly more extensive than the Flood Zones for years 2000 and 2026. Potential Development sites *Newport1275*, *Newport1234* and *Newport1325* are all within Area 1. The region of Newport (Area2 - Figure 6.3) adjacent to the River Medina in the Coppins Bridge and East Street area is also highlighted as being an area where the year 2115 Flood Zone outlines are significantly more extensive than the 2000 and 2026 extents. The final significant region of Newport potentially susceptible to the impacts of climate change induced sea level rise is in Area 3 (Figure 6.3). Area 3 defines the area along the lower reaches of Lukely Brook just upstream of its confluence with the River Medina.

Figure 6.3 Predicted Tidal Flood Zone 2 extents for the years 2026, 2070 and 2115 in Newport.



Flood Zone 2 extents displayed in this image are for the 2000, 2026, 2070 and 2115 time horizons.

Surface Drainage

Newport's soils for the most part, have a high runoff potential with SPR values between 47% and 50%. Only the southern edge of town has low SPR values of between 15% and 30% (low/medium runoff potential). The southern edge of the town associated with lower runoff potential soils is also underlain by a major aquifer with soils of an intermediate leaching potential. The majority of the rest of the town is predominantly underlain by a minor aquifer with intermediate to high leaching potential. Infiltration Potential is classified as being medium in the centre of the town and low around the edges. Figures 8, 9 and 10 in Appendix A should be consulted.

A small area covered by SPZ 1, 2 and 3 (See Figure 7 in Appendix A) is located in the Lukely Brook area of the south western part of Newport. This area is coincident with a major aquifer and the potential for groundwater contamination requires additional consideration. Infiltration SuDS techniques should be avoided in areas where land contamination is identified as being an issue. The impact of sea level rise on the high water level should be

considered when designing the outfall levels of any future surface drainage systems. The Environment Agency will be pushing for an integrated urban drainage scheme is the Pan Extension Project in Newport.

Additional information to inform Site Specific FRAs

The potential sites identified on Figure 61 are all partially within Flood Zones 2 or 3 and therefore must be accompanied by a FRA should the site be released for development. Although sites outside the flood risk zones should be considered for development first. Subsequent FRAs should ensure that proposals are in line with the existing Newport approach to watercourse management.

Should any of the sites identified in Areas 1, 2 and 3 of Figure 62, be released for development it is advised that the impact of climate change on the possible future extents of Flood Zones 2 and 3 be assessed as the long term sustainability of any development may be compromised by predicted sea level rise.

In addition to all potential sites within the Flood Zones, all sites greater than 1ha are required by PPS25 to be accompanies by a FRA should they be put forward for planning. The sites larger than 1ha are identified in the Attribute Database and attributed as requiring an FRA.

6.8 Ryde

Overview

Ryde is located on the north eastern coast of the Island and is a Georgian and Victorian resort town with a significant year round residential community. The main flood risks in this KDA are from the Monkton Mead Brook and the sea. Importantly, the Environment Agency do not have Flood Zones for the Binstead Watercourse which flows through the western part of the town. The implications of this are discussed in the *Additional Information for Site Specific Flood Risk Assessment* section of this Ryde discussion. It is expected that Food Zones for Binstead Watercourse will be incorporated into the Flood Map during the next update when it is signed off by the Environment Agency.

Sustainability and Regeneration Objectives

A Public Realm, Strategy has been prepared for Ryde to establish a locally distinctive framework to guide future regeneration proposals in the area. A major new interchange has also been planned, offering enhanced transport facilities for ferry, rail, bus and taxi users. It is intended that Ryde builds on its role as a hub for high speed trans-Solent connections and an Island public transport interchange to strengthen its role as a residential community, centre for small business and as gateway for tourists.

Sites at Risk

See Figures 53 and 54 in Appendix A

Flood Risk in Ryde is dominated by the threat of tidal flooding and fluvial flooding from Monkton Mead Brook and has historically been a problem with the most significant recent events taking place in the winter of 1993, winter 1999 and autumn 2000. It was stated in the *Monkton Mead Brook Flood Risk Mapping Report* (2005) that the coincidence of high tidal events, failure of pumps, debris in the channel and inadequate surface drainage exacerbated the flooding in these recent events.

The town of Ryde is built along the coast and on the sides of the valley through which Monkton Mead Brook flows. The floodplain of the Monkton Mead brook is only partially developed. Several of the potential development sites are located in this floodplain and along the seafront. Figure 53 highlights these potential sites in red and orange. A detailed hydraulic model is held by the Environment Agency for the Monkton Mead Brook and this was used in the SFRA to define the functional floodplain (Flood Zone 3b – see Section 3.1). The existence of this model has enabled three flood risk zones to be defined through Ryde, these being Flood Zones 2, 3a and 3b. The sites highlighted in Figure 53 are sites where FRAs would be required as they are partially within the extents of Flood Zone 2 and 3. To remain in line with the Sequential Test though, sites outside the flood risk zones 2 and 3 should be considered first.

Figure 54 defines the exact flood risk across each of the potential sites. This detailed flood risk classification reveals that although the flood risk close to the Monkton Mead Brook is high, it becomes very low with distance away from the river and up the valley sides. The two large potential large sites to the south of Ryde either side of Rosemary Lane in the Rosemary Vineyard are good examples of this zonation of flood risk (See Figure 6.4). This shows that although parts of the potential sites are in either Flood Zone 2 or 3 the vast majority of the area is in Flood Zone 1.

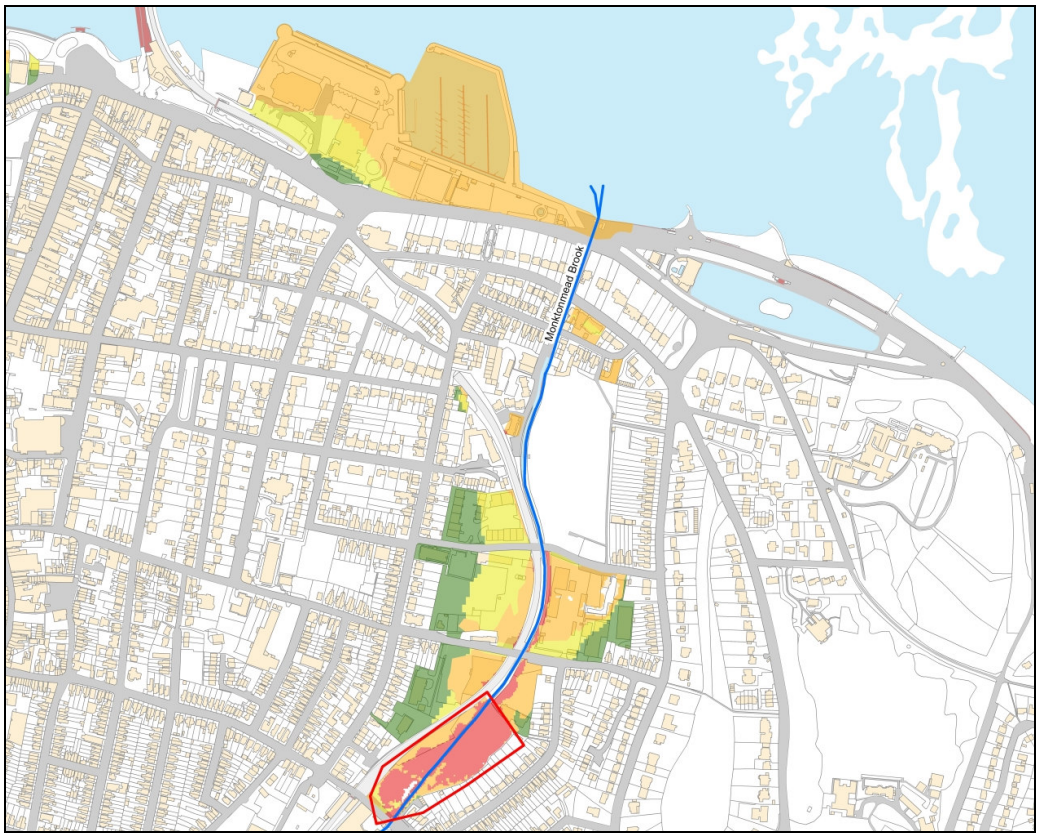
The Monkton Mead Flood Alleviation Study (2000) identified that the tunnelled section of railway under Ryde runs below sea level and has two pumps to drain it. These pumps exit to the sea near the hovercraft terminal. It took almost three days for the pumps to drain the tunnel following the event of 9th October 2000. Some of the flooding problems which arose on the 9th were the result of large amounts of debris in the channel. As the flows increased the debris was washed downstream and when an obstacle to flow was encountered (e.g. a culvert) a blockage was caused leading to flooding.

Figure 6.4 Zonation of flood risk in south Ryde (Rosemary Vineyard area)

Red = Functional Floodplain, Orange = Flood Zone 3a, Yellow = Flood Zone 2 and Green = Flood Zone 1

Figure 6.5 illustrates the flood risk classification of smaller potential sites located nearer the mouth of Monkton Mead Brook and along the sea front. These potential sites occupy flatter land than those in the Rosemary Vineyard area and as such more of each site is occupied by higher flood risk zones. Only a small proportion of these higher risk sites are classified as being in Flood Zone 1. The site outlined in red in Figure 6.5 is almost completely within the functional floodplain of the Monkton Mead Brook. Development of this site should be avoided. PPS25 only permits essential infrastructure and water compatible land uses, which are designed to not impede the conveyance of water, to be proposed for this site. Sites to the north have more diverse flood risk classifications and details of the flood risks are presented in the Site Specific Database.

Figure 6.5 Flood Risk Zonation in the Coastal Region of Ryde



Red = Functional Floodplain, Orange = Flood Zone 3a, Yellow = Flood Zone 2 and Green = Flood Zone 1

Climate Change

The impact of climate change on the extent of the tidal Flood Zone polygons is an issue that should be considered if and when any of the potential sites currently identified as partially being at risk of flooding are released for planning. Climate change has the potential to increase the extents of the Flood Zones and as such plots of land, or parts of sites, currently outside the Flood Zone envelope may become included within the next 100 years. The extent to which Ryde is affected by Climate change is illustrated in Figures 55 and 56. Sites *Ryde1156, Ryde1269, Ryde1280* and *Ryde1217* have been identified as being the potential development sites where climate change could threaten the long term sustainability of future developments.

Surface Drainage

Ryde has varied topography, with part of the town located on topographic highs and other parts of the town being located in the bottom of river valleys.

Soils in Ryde have SPR values of between 15% and 50% with. The areas of Haylands and Elmfield are where the lower SPR and runoff potentials. These areas of lower runoff potential are characterised by minor aquifer geology

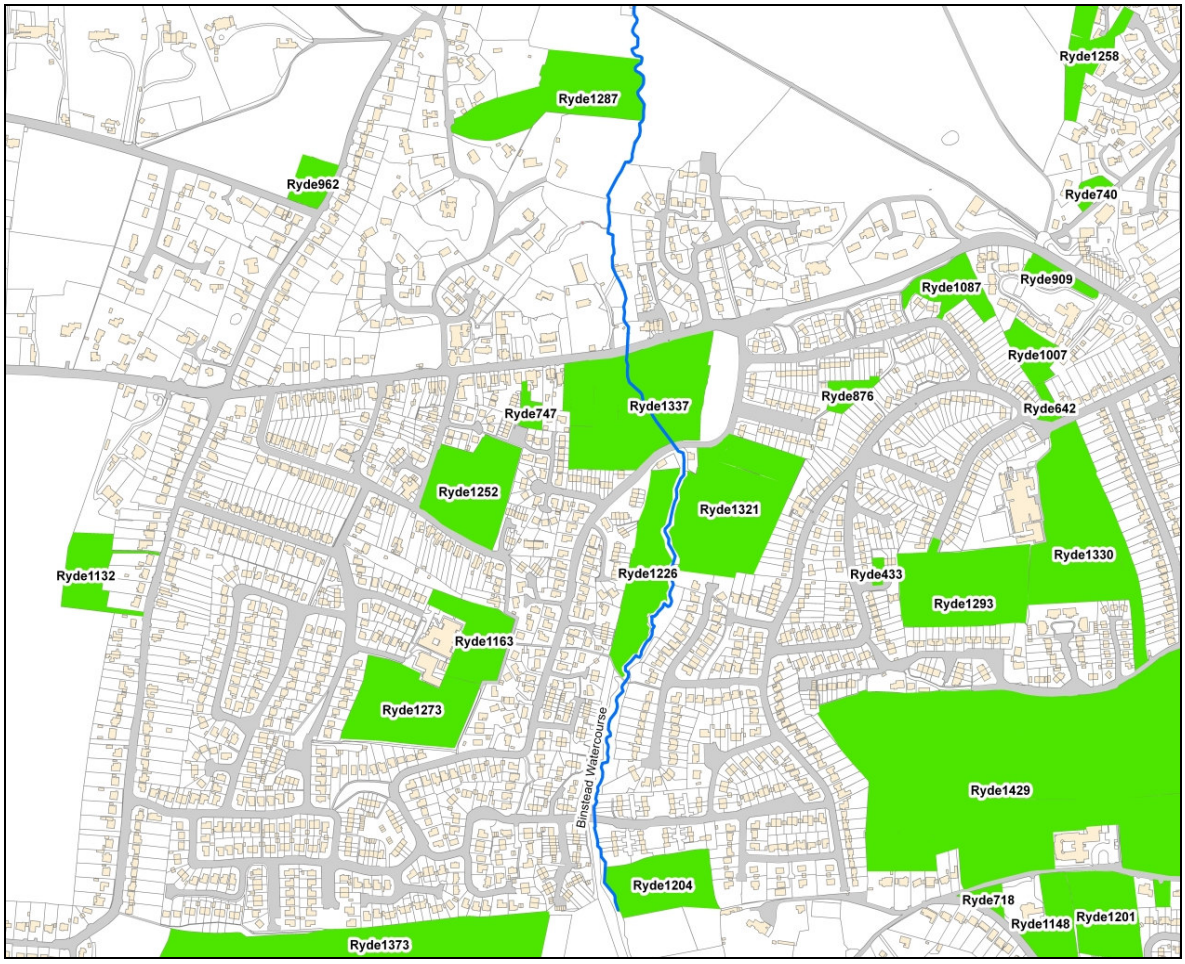
and soils with a high leaching potential. The remainder of the town is comprised of minor aquifers with low leaching soils and areas of non-aquifer. SuDS infiltration potential is classified as medium for the areas with high leaching soils over a minor aquifer. A SAP is located on the northern edge of town, adjacent the coast. The presence of this ecological designation means that care should be taken not to introduce pollutants into the environment. Around coastal areas, surface water could be discharged into the sea with out restriction, providing the surface water was not contaminated.

Additional information to inform Site Specific FRAs

Any FRA's that are commissioned in Ryde should consult the tidal climate change extents presented in Figures 55 and 56 as the implication of these outlines are important for the long term sustainability of any development. The Attribute Database should be used to guide the Council as to which sites will require an FRA, based either on the flood risk or because of the size of the plot of land. The Agency hold information about the historic flood events that were recorded in Ryde, it is advised that these sources of information be considered as part of any FRA.

Binstead Watercourse, which flows northwards through the western end of the town, does not currently have any Flood Zones. As such potential development sites *Rdye1287, Rdye1337, Rdye1226, Rdye1321* and *Rdye1204* (see Figure 6.6) are attributed as not being at risk of flooding. The FRA for any of these potential sites should assess the risk posed by Brinstead Watercourse. The impacted sites are all attributed in the Attribute Database as being within 20m of and Agency Main River which should help in identifying the sites that require the Agency's consultation if any of the sites are released for planning. A model for Binstead Watercourse is being produced and will be included into the Flood Map in due course.

Figure 6.6 Binstead Watercourse in Western Ryde



Rdye1287, Rdye1337, Rdye1226, Rdye1321 and *Rdye1204* are sites attribute as not being at flood risk because of there being no Flood Zones along this watercourse, despite it being a Main River. The Environment Agency must be consulted if these sites are put forward to planning as they are within 20m of the Main River

6.9 Seaview

Overview

Seaview is located to the east of Ryde on the north eastern coast of the Island. The majority of the town is built on a headland which reaches elevations of over 40mAOD. Parts of the town are however nearer sea level. In general, the potential development sites in the town are not at risk of fluvial or tidal flooding as there are no fluvial flood zones and no Main Rivers flowing through the town. The small differences between the year 2000 and year 2115 tidal flood extents show there to be little sensitivity to climate change.

Sites at Risk

See Figures 49 and 50 in Appendix A

Figure 49 illustrates the qualitative flood risk classification of the potential sites in Seaview. Only a couple of the potential development sites have been identified as being at risk of tidal flooding and these are located on the edge of the nature reserve.

Climate Change

As with the other coastal towns, climate change and the associated sea level rise will increase the extent of the tidal Flood Zones. The climate change modelling indicates only a small degree of potential change in the flood zone extents. This is because of the steep coastline to the north and east of the town. The area where the tidal climate change modelling has indicated there to potentially be the greatest increase in Flood Zone extent is at the western end of Bluett Avenue and Fairy Road.

Surface Drainage

Runoff potential in Seaview is high with SPR values around 50%. Infiltration potential in the town is predominantly low, with moderate areas corresponding to the areas of high leaching potential soils in the south. Due to the absence of any SPZs or areas of mass movement, the groundwater contamination potential classifications reflects the infiltration potential.

A SPA has been delineated along parts of the coast, there is a potential for polluted surface water drainage to adversely impact upon this designated area. Infiltration SuDS are more suitable to the southern portion of the town. Surface waters could potentially be discharged without restriction into coastal waters assuming they are contaminant free.

Additional information to inform Site Specific FRAs

This KDA, like Bembridge is relatively free of flood risk restrictions on development. FRAs only need to be carried out should sites *Seaview665* and *Seaview706* and those over 1ha in size be released for development. These sites are all attributed in the Attribute Database.

6.10 St Helens

Overview

St Helens is situated in the north western corner of Bembridge harbour on the reasonably steep South Facing slope of the high ground between St Helens and Seaview. Owing to the mostly elevated topography (above the extent of the tidal Flood Zones) and absence of any Main Rivers running through the town, the flood risk posed to the potential development sites is minimal. Only a couple of site on the lowest land and nearest to the river are at risk.

Sites at Risk

See Figures 45 and 46 in Appendix A

The tidal Flood Zones from Bembridge harbour represent a more extensive flood risk than the River Eastern Yar. Only two of the potential development sites in St Helens have been identified as being at risk of flooding and both of these are at risk of tidal flooding. The first is adjacent to St Helens Mill near Sewlyn Court and the second is to the west of the town and south of the B3330 at Carpenters Farm. Only a very tiny proportion of the Carpenters Farm site is within either Flood Zone 2 or 3, the vast majority of the site being is in Flood Zone 1 and thus suitable for any type of development. The site near St Helen's Mill is much the same, with only a quarter of the site being in either tidal Flood Zone 2 or 3.

Climate Change

There is very little difference in the extents for the modelled year 2000 and year 2115 flood zones. This implies that the increased sea level associated with climate change will only really have an impact on the depth of flooding in those areas already covered by the flood map, and not cause the flooding extents to increase significantly. Only two sites become partially affected by the modelled climate change flood extents, these are *St Helens1018* and *St Helens1170*. The exact implications of climate change should be assessed for these two sites at the FRA level if they are released for planning.

Surface Drainage

Surface runoff potential in the town of St. Helens is varied. The lower half of the town is characterised by a SPR of 25%, while in the north west the SPR is in the order of 15%. This increases to 50% in the far north eastern corner

of St Helens. The north and south of the town are characterised by soils with high leaching potential, underlain by a minor aquifer. Infiltration potential is classified as medium in the north west and south and low in the north east.

The south and eastern parts of the town fall within the SPA and SSSI designations which cover the Eastern Yar Estuary. This potentially sensitive environment requires discharge of surface water be contaminant free. It is therefore appropriate that SuDS with, an ability to remove or attenuate pollutants, be considered. SuDS are less suitable for those areas of low infiltration potential around the centre of the town.

Additional information to inform Site Specific FRAs

The Agency have a flood event outline for the October 2000 event that occurred on the Eastern Yar, this does not extend to cover any of the potential development sites, nonetheless it represents a useful source of information which should be considered in the FRA for either of the two potential sites that have been identified as being at flood risk, should they be put forward for planning. As with all sites over 1ha a FRA will be required and many of the proposed sites in St Helens are over the threshold, the Potential Development Site Attribution dataset details these sites and defines the area of each.

6.11 The Bay

Overview

The Bay KDA is comprised of the towns of Sandown and Shanklin and it extends from Yaverland in the north to Shanklin in the south. They are located along a stretch of coastline in the south east of the Island. The settlements have developed into a linear urban centre. Tourism and leisure are the main commercial activities in Sandown and Shanklin. Topography changes from low lying areas north east and west of Sandown, to higher lying areas south of Shanklin. Flood risk to development sites in The Bay area is associated with tidal flooding along the coast and fluvial/tidal flooding in the low lying areas in the north of the KDA. Fluvial flooding from Scotchells Brook in the west of The Bay is also a potential issue

Sustainability and Regeneration Objectives

The key objectives for The Bay area are to encourage regeneration of Sandown and Shanklin for tourism, while adding a more diverse business base and strengthening of the community. This will be achieved through a focus on tourist facilities and markets, development of services including transport links to other parts of the Island, encouraging development on brownfield sites, and supporting residential growth.

Sites at Risk

The Isle of Wight Autumn 2000 Flood Investigation Study – (*Sandown Town Council Report*) identifies the following to have been flooded during the Autumn of 2000:

- South Wight Housing Association on East Yar Road was flooded as a result of on site drainage capacity being exceeded.
- Fort Holiday Park is in the floodplain and water is described as having backed up the ditches in East Sandown and the surrounding areas causing an overflow into the holiday park.
- Booker Cash and Carry suffered flooding due to what was described as poorly designed on site drainage.

The Isle of Wight Autumn 2000 Flood Investigation Study – (*ShanKlin Town Council Report*) attributed heavy rainfall exceeding the capacity of surface drainage systems as the cause of isolated surface water flooding incidents.

The Level 2 assessment highlights two key areas at risk of flooding, the north of Sandown in the Yaverland area and to the west of Sandown adjacent to Scotchells Brook. These two areas will be assessed separately of each other:

North Sandown: The Eastern Yar has recorded historic flood events. In January 1974 and October 2000, flooding occurred north of Sandown. In both instances the historic flood outlines held by the Environment Agency impact upon some potential development sites. The affected sites are attributed as such in the Attribute Database. The Level 3 assessment showed that much of large site between Sandown and Yaverland is in fact predominantly within Flood Zone 3. This presents significant restrictions to the land use types permitted by PPS25, without the passing of both the Sequential and Exception Tests. Many smaller sites in the region are completely within Flood Zone 3 which highlights potential access and egress routes that might restrict the types of developments permitted by PPS25.

East Sandown: The level 3 assessment of the large site adjacent to Scotchells Brook, reveals that most of the site is actually in Zone 1 with only a narrow band along the banks of Scotchells Brook being at a higher flood risk.

In line with the Sequential Test and the principal of risk avoidance, sites in Flood Zone 1 should be considered before sites in higher flood risk zones.

Climate Change

Along the coast, the impact of climate change is minimal. Only two potential development sites, near Eastcliffe Promenade, possibly fall within the future 2115 Flood Zone 2 extent. To the north of Sandown in the Eastern Yar floodplain, climate change is predicted to bring about a moderate increase in the extent of Flood Zone 2 and 3 (see Figures 35 and 36 in Appendix A). This will have the impact of increasing flood risk to some of the potential development sites, as well as existing properties.

The site on the corner of Avenue Road and St Johns Crescent is one example where flood risk status is predicted to turn from highly unlikely to likely (flood zone 1 to flood zone 3) within the next 100 years. No other potential development sites that are currently not impacted by the Flood Zones have been identified as being impacted within

the next 100 years. Many of those sites currently within the tidal Flood Zones are predicted to experience a reduction in the amount of land currently within Flood Zone 1.

The impact of fluvial climate change has been assessed to be of less significance, as the few areas of fluvial floodplain highlighted as being potentially sensitive to the impacts of climate change, are currently within the extents of tidal Flood Zones 2 and 3.

Surface Drainage

The soils underlying The Bay area have a low SPR of around 15%. In the north of Sandown and in a small area south of Shanklin there are soils with higher SPR values of about 60%. Much of The Bay is underlain by a major aquifer with high leaching soils. The southern half of Sandown comprised of a non-aquifer and a minor aquifer with soils of a high leaching potential. The western edge of The Bay and the southern end of Shanklin are underlain by a major aquifer with an intermediate leaching potential.

In the far south of The Bay, areas of mass movement have been identified, which causes the infiltration potential to be set as low. The infiltration potential is high for most of The Bay KDA. The only exception is along the western edge and in small areas in the south, where infiltration potential is classified as medium and low respectively.

Surface water can be discharged into the sea without restrictions on volume. The release of pollutants would need to appropriately mitigated. The urban areas of Shanklin and south Sandown have the potential for infiltration SuDS, but the high groundwater contamination potential must be considered.

Additional information to inform Site Specific FRAs

There are a number of sites over 1ha in The Bay area, while two sites in particular are very large at 85 and 63ha. All sites over one hectare will require an FRA / Drainage Assessment to assess the drainage implications of the development. Historic records show surface water flooding to be an issue in Shanklin. It is advisable that any ensuing FRAs provide a detailed assessment of the local surface drainage network. A tributary of the Eastern Yar is located to the east of Scotchells Brook, and is recorded as a main river by the Environment Agency. No flood risk is associated with this river's headwaters. Any sites within 20 metres of the river and would require consent from the Agency in advance of any development proposals.

6.12 Ventnor

Overview

Ventnor is built on a relatively steep south east facing slope, elevation which rises quickly from the shoreline. Flood risk in the town is considered to only be small.

Sustainability and Regeneration Objectives

The Isle of Wight Council seek to strengthen the town of Ventnor in its capacity as a local centre for communities in the south of the Island. This will be achieved through the support of services, and the encouragement of development on brownfield sites. Public transport connections to other major centres on the Island will also be strengthened, while tourism will be promoted.

Sites at Risk

See Figures 27 and 28 in Appendix A

Ventnor has no fluvial Flood Zones and little in the way of tidal Flood Zones. Two potential development sites have been identified as being at risk of tidal flooding. These are identified in Figure 27. Of these two, the one in the east has marginal flood risk along its southern edge, only just clipping flood zone 3 as illustrated by Figure 28. The west site is only fractionally in flood zone 2. The majority of both sites are therefore in Flood Zone 1.

Climate Change

Figures 29 and 30 in Appendix A, illustrate that the potential impact of climate change does little to increase the flood risk in Ventnor. This is due to much of the ground being above the predicted future extreme tide levels.

Surface Drainage

The central area of Ventnor is characterised by soils with an SPR of about 47%, while the fringe areas of the town have a much lower SPR of about 2%. A minor aquifer with an intermediate leaching potential follows the coastline through the town with a width of approximately 350m. A thin band of major aquifer overlain by soils of intermediate leaching potential lies adjacent the minor aquifer. The north of the town, up towards Lowtherville, is underlain by a major aquifer overlain with soils of high leaching potential. A substantial area of mass movement is identified in the town which is associated with clay strata. Due to the presence of this band of mass movement and the minor aquifer, infiltration potential over much of the town is classified as low. Due to the soils and mass movement along the coast, the use of infiltration SuDS techniques on any potential Development sites is considered unsuitable. The impact that surface water drainage might have on areas of geological instability should be considered. The presence of a SAC, along the coastline, requires precautions be taken to ensure that contaminants are not introduced into the environment in these areas.

Additional information to inform Site Specific FRAs

Of the two sites currently within Flood Zone 2 or 3, only the eastern site has any real degree of flood risk. Four potential development sites in Ventnor are over 1ha and any development proposals would need to be accompanied by a FRA / Drainage Assessment to deal with surface water management.

6.13 Wootton

Overview

The KDA of Wootton covers the towns of Wootton and Fishbourne. The KDA is located on the coast between East Cowes and Ryde, with the Wootton Creek dividing the two towns. Site topography is such that despite the presence of tidal and fluvial flood risk areas, there are only a few sites at risk of flooding.

Sites at Risk

See Figures 57 and 58 in Appendix A

Flood risk to potential development sites is relatively minor, with only four sites at risk of fluvial or tidal flooding, while another three sites are over 1 ha. Only one site, near the sewage pumping station, is significantly within Flood Zones 2 and 3. The development of this site for more vulnerable land uses will requires the Exception Test to be passed. The other potential sites highlighted in Figure 57 are only marginally within Flood Zones 2 and 3, with the majority of each being in flood zone 1. In addition to these four sites, there are three sites within flood zone 1 which are over 1 hectare and will require an FRA / Drainage Assessment to address surface water management should the sites be put forward for development.

The Isle of Wight Autumn 2000 Flood Investigation Study – (*Wootton Bridge Parish Council Report*) noted that two properties were flooded between the 15th September and 13th December. Large rainfall amounts prior to and during the flood event resulted in high volumes of runoff and an overcharging of the combined foul and storm sewer.

Climate Change

Figures 59 and 60 in Appendix A, show that climate change is predicted to have a relatively small impact. Flood risk is only predicted to become more severe for those sites already at risk of tidal flooding. This is a consequence of the topography in the KDA which rises steadily away from the river and estuary.

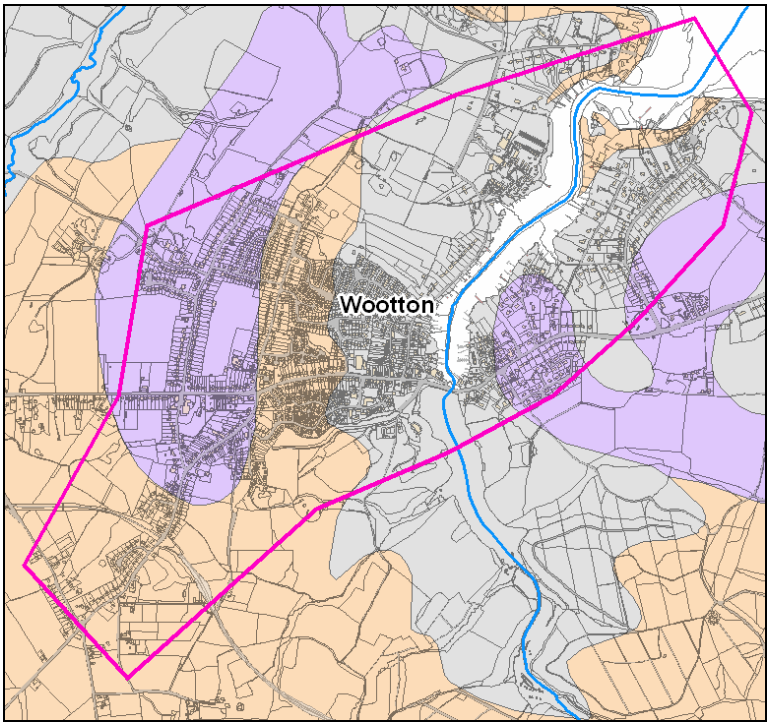
Surface Drainage

Soils in the Wootton KDA are characterised by an SPR of 50%, and consequently surface runoff potential is high. As figure 6.7 illustrates, Wootton KDA is underlain by areas of minor aquifer (peach and purple) and non-aquifer (grey). Infiltration potential is classified as predominantly low, with areas of medium infiltration potential associated with the high leaching potential soils (purple areas). Each potential development site in the Attribute Database is assigned a classification for infiltration potential, groundwater contamination and runoff.

Wootton Creek Estuary is designated as an SPA. The presence of a SPA in the estuary necessitates the need for careful mitigation of contaminants in surface water drainage waters. Volumes of discharge into the estuary are

likely to be permitted without a limit assuming appropriate mitigation measures for pollution are taken where necessary.

Figure 6.7 Wooton Aquifer Map



Additional information to inform Site Specific FRAs

Wootton has only a few sites at risk of flooding. Of these two have significant areas of the site falling within flood zone 3. Consequently, an FRA for the sites will either require allocation of less vulnerable / water compatible land uses, or suitable mitigation. Sites not at risk of flooding should be considered for development before those in flood risk zones 2 and 3, to remain in accordance with the Sequential Test.

6.14 Wroxall

Overview

Wroxall is situated in the upper catchment of the Eastern Yar, it is located in a valley with hills to the east and west. Flood risk in Wroxall is limited to areas immediately adjacent the river, with only 2 sites seriously affected.

Sites at Risk

See Figures 31 and 32 in Appendix A

Flood risk in the town is fluvial, which affects areas adjacent to the watercourse. The Flood Zones through Wroxall are narrow, owing to the narrow valley floor which is bounded by relatively steep topography. Only three development sites in the town are directly influenced by fluvial flooding as illustrated by Figure 31. Of these three, only the very large site on the western bank and the smaller site to the north of this have a significant flood risk. Substantial areas of both these sites fall into flood zone 3a. Owing to the topography and size of the larger site, much of it remains in Flood Zone 1 (see Figure 32).

The significant flood risk at the two sites suggests it might be worth considering placing the most vulnerable land uses (according to table D.3 of Annex D PPS25, reproduced in Appendix B) furthest away from the river and on the higher land and leave the lowest portion of each site, if possible, for less vulnerable land uses. Moreover, development should only be considered in the higher risk zones once areas and sites in lower risk zones have been assessed for suitability.

Surface Drainage

The runoff potential in the Wroxall is varied, with four SPR classifications covering the town. In the north east, SPR values are about 15%, and in the south east the value is 29%. The north west has SPR values around 47% while the south west has SPR values of 60%. Soil leaching potential in the town is slightly more uniform, with the west and far east parts having intermediate leaching potential associated with a major aquifer, while the north of the town is characterised by a minor aquifer with intermediate leaching potential soils. The south is underlain by non-aquifer. The areas of major aquifer are classified as having a medium infiltration potential while the other areas of the town has been assigned a low infiltration potential. An area potentially susceptible to mass movement associated with clay strata has been identified in Wroxall this zone has been classified as having low suitability for infiltration SuDS Techniques. Each potential development site in the Attribute Database is assigned a classification for infiltration potential, groundwater contamination and runoff.

Wroxall is one few towns on the isle of Wight without a coastline and consequently unconstrained discharge of surface waters is not possible. Infiltration potential is therefore a potential limiting factor in the use of infiltration SuDS. The western side of Wroxall and the areas along its eastern margin have been assigned a moderate suitability for infiltration SuDS techniques. The remainder of the town has been classified as having a low suitability for infiltration SuDS.

6.15 West Wight

Overview

The West Wight KDA is comprised of the towns of Totland and Freshwater. Totland lies on a raised area of land adjacent the coast, while Freshwater is built at a lower level, with a significant area of the town under 10 mAOD. Flood risk in the two centres is contrasting with minimal flood risk posed to sites in Totland, yet both tidal and fluvial flooding present a flood risk in Freshwater. The town of Freshwater has a history of flooding relating to the

Western Yar. The Western Yar presents a fluvial risk and a tidal risk by acting as a conduit for tidal flood waters. A few of the potential development sites in Freshwater are consequently at high risk of flooding.

Sustainability and Regeneration Objectives

Both the towns of Totland and Freshwater are set for expansion in the future, in order to support communities in West Wight. This will be achieved through a strengthening of services and the public transport connection to Newport. Development will be encouraged on brownfield sites, and tourism will be promoted.

Sites at Risk

See Figures 17 and 18 in Appendix A

West Wight has both fluvial and tidal flood risk. Freshwater has the most severe flood risk of the two towns, with historical flooding recorded in 1974 along the headwaters of the Western Yar towards Freshwater Bay. The Agency has also issued two flood reports for the town of Freshwater, both for fluvial flood events from the Western Yar as a result of high rainfall events prior to flooding which saturated the soil and consequently flooding occurred. The two flood events occurred on the 2 June 1999 and on the 9th of October 2000. The Isle of Wight Autumn 2000 Flood Investigation Study – (*Freshwater Parish Council Flood Report*) identified one site specific example of flooding. West Wight Printers, located on the small industrial estate adjacent to Afton Marsh was flooded by surface water and not from the Western Yar.

Fluvial flooding is therefore of concern in Freshwater due to the close proximity of properties to the main river. The sites identified in Figure 17 as being 'Highly Likely' are the product of a functional floodplain (Zone 3b) being defined for the Western Yar. This designation only permits water compatible land uses and essential infrastructure to be developed, providing they do not impede the conveyance of flood waters. Figure 18 illustrates that the functional floodplain is only narrow and it is only the parts of the potential sites nearest the river that are actually within the functional floodplain. Moreover, the majority of the Stroud playing field site is within Flood Zone 1. Whereas the site in the north western corner of Afton Park is well within Flood Zone 3, with only a small portion being in Zone 1. Development should be steered to the areas of lowest risk.

In contrast, very few potential development sites have been identified as being within Flood Zones 2 or 3 in Totland. This is due to the absence of any main rivers running through the town, as well as the land quickly becoming elevated with increasing distance from the shoreline.

Climate Change

The impact of climate change on extreme tidal levels to Totland is not likely to have a significant impact. The predicted extent of future flood zones is close to that of the present zones. Only the two development sites already identified as being at risk of flooding marginally affected by the impact of climate change.

Figures 19 and 20 in Appendix A show the extent of the predicted change in extent of Flood Zones 2 and 3 over the next 110 years. Of the available potential development sites, severity of future tidal flooding is likely to increase particularly for sites about the Western Yar confluence. Fluvial areas potentially susceptible to climate change are predominantly confined to areas along the western reach of the Western Yar, and in particular, north of the Stoud playing fields. The area south west of the Western Yar confluence is also a potentially susceptible area. Other than currently affected sites, no new sites are identified as being affected by fluvial climate change.

Surface Drainage

The Freshwater Flooding Feasibility Report (1999) notes that the surface drainage network of Freshwater and many of the culverts in the river channel being at or under capacity.

The soils map of the town shows consistent distribution of soils with an SPR of about 47%. This means that runoff potential in the area is likely to be high. This consistent soil distribution is mirrored in the map of groundwater vulnerability which shows the site as lying predominantly over minor aquifer with an intermediate leaching potential. Except for the area the south of Freshwater which has a few small areas of non-aquifer and major aquifer associated with intermediate and high leaching potential soils. Infiltration potential in the area is therefore mostly low, except of the south part of Freshwater which is divided into areas of medium and high infiltration potential. The area immediately along the coast of Totland is also associated with an area of mass movement and consequently infiltration SuDS are considered to be unsuitable. Groundwater contamination reflects the infiltration potential classifications except for a small area to the far south of Freshwater which overlies a zone 1, 2 and 3 SPZ.

Due to the high runoff and a low soil leaching potentials in much of West Wight, infiltration SuDS techniques are considered to have a low suitability. This excludes a small area to the south of Freshwater which has high infiltration potential but is defined as lying over a SPZ, which makes contamination mitigation of any infiltrated water an important concern. Volumes of surface water can be discharged into the sea without restrictions. The presence of a SSSI to the east of Freshwater and a SAC south of Freshwater Bay require extra precaution be taken to prevent pollutants from entering the environment in these locations

Additional information to inform Site Specific FRAs

The historic flood event information held by the environment Agency should be used to inform any subsequent FRAs should any of the potential sites be put forward for planning.

6.16 Yarmouth

Overview

The topography of Yarmouth is relatively flat and western parts of the town are below 3 mAOD. Flood risk in the town is complex with the tidal risk from the sea along the northern edge of the town, and a combination of tidal and fluvial risk from the estuary to the south and west.

Sustainability and Regeneration Objectives

As with West Wight, the objectives for Yarmouth include expansion in the future, in order to support neighbouring communities. This will be achieved through a strengthening of services and the public transport connection to Newport. Development will be encouraged on brownfield sites, and tourism will be promoted.

Sites at Risk

See Figures 21 and 22 in Appendix A.

Flood risk at Yarmouth appears to be significant with only 5 of the 14 potential development sites identified as being not being in Flood Zones 2 or 3. The level 3, site specific, assessment of flood risk (shown in Figure 22) illustrates that most of the sites are only partially affected. Tidal Flood Zone extents are more extensive than the fluvial extents on all sides of the town.

Although not exactly related to a particular potential development site, the current Environment Agency Flood Zones appear to completely encircle the town. This potentially presents serious problems relating to access and egress routes for existing and proposed developments and emergency planning. In the event of the 1 in 200 year tidal event, the A3054 is shown to be flooded, see figure 6.8. The tidal climate change mapping presented in Figures 23 and 24 (in Appendix A) does not show the A3054 to be flooded and an escape route is maintained even in the event of a 1 in 1000 year event in the year 2115. The differences can be attributed to the different digital terrain models that were used to produce the two outlines.

Figure 6.8 Current Flood Zone 2 and 3 Outlines in Yarmouth

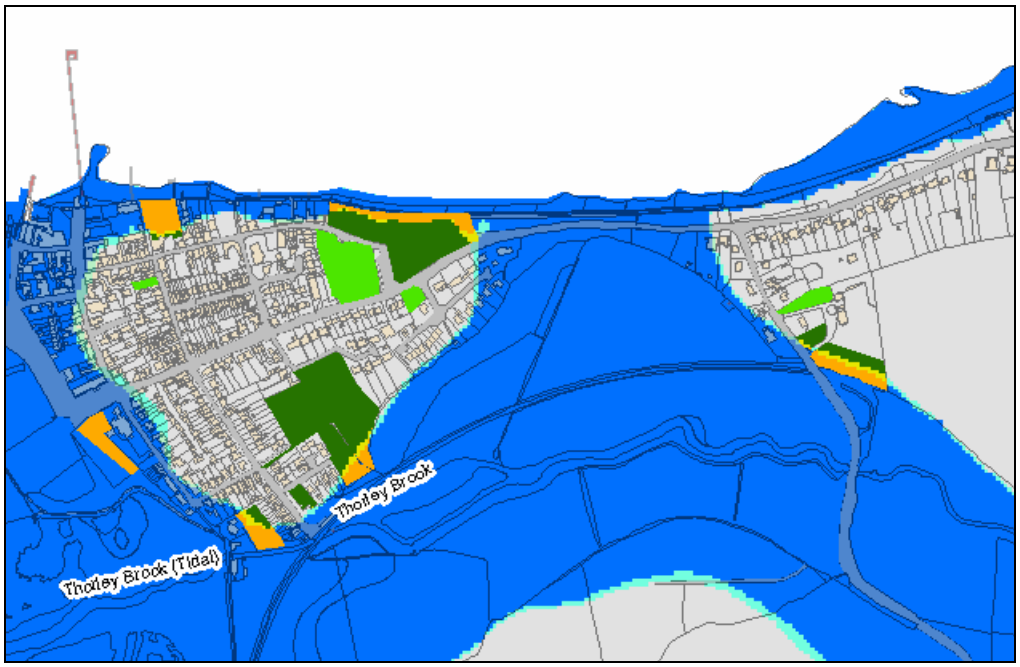


Figure illustrates the current (August 2007) Environment Agency Flood Zones, produced using IfSAR digital terrain data.

Climate Change

Increasing sea levels as the result of climate change have the most significant impact in the west of the town, where the topography is the flattest. The extent of the flood zones in 2115 do not include any additional potential sites that are not already included by the current flood zone extents. More significant impacts are noticed between the year 2000 and year 2115 tidal outlines modelled for the SFRA. This would suggest that if any of the potential development sites in Yarmouth are released for development an establishment of the actual Flood Zone 2 and 3 extents and

Surface Drainage

The runoff potential of soils in Yarmouth are only available for the east of the town which has a SPR of approximately 50%, thus indicating a high runoff potential. The groundwater vulnerability map of the area also shows much of Yarmouth overlying a non-aquifer, expect for the south west edge of the town which is characterised by a minor aquifer with a high leaching potential, and the east of the town which is associated with a minor aquifer of low leaching potential. Infiltration potential is classified as low for Yarmouth other than for the south western edge of the town which has a medium infiltration potential. The low infiltration potential of the town makes infiltration SuDS techniques unsuitable except of the south west of the town, that is under the assumption that appropriate precautionary measures are employed to prevent pollution of the underlying aquifer.

The sea north of Yarmouth and the Western Yar estuary, west of the town, are designated as a SAC. Thornley Brook is associated with a SPA and SSSI, which extend towards the coast between The Mount and Thornley Road. The close proximity of a SAC, SAP and SSSI around the town means it is important that measures be considered to mitigate against pollutants entering the estuarine environments through surface water discharges. The estuarine and coastal waters around Yarmouth allow for an unconstrained volume of runoff discharge, assuming water is free of contaminants.

Additional information to inform Site Specific FRAs

Due to the low elevation of much of the town, tidal flooding presents a significant risk. Consequently it is advisable that site specific FRAs focus on recommended Environment Agency tide levels for flood zone 3 and project these over detailed elevation data. LiDAR was used in this SFRA study and it is recommended that any further work uses this topographic data source in combination with local topographic survey data. The tidal climate change flood extents for flood zones 2 and 3 for the year 2000 will provide a good indication of the likely tidal flood zone extents. But should only be used as an indication of flood risk extents. The definition of flood risk for the purposes of PPS25, will remain the Environment Agency Flood Map.

7. Sustainable Drainage Systems

7.1 Introduction

PPS25 states that surface runoff is an important consideration in the assessment of flood risk and must be addressed at the SFRA and FRA level. Historically, surface water drainage in developed areas uses underground piped systems in order to remove excess water as rapidly as possible. This convention is suggested by PPS25 to potentially result in an increase of flooding problems downstream. Moreover, it may reduce the natural recharge of groundwater. Additionally, pipe systems may become blocked or overwhelmed, resulting in surface water flooding. Examples of which on the Isle of Wight are presented in Section 6. These drainage systems also create direct pathways by which pollutants from urban areas may discharge directly into watercourses or percolate into aquifers. When considering the present emphasis on sustainable development and the requirements of the Water Framework Directive (WFD), different approaches to past drainage conventions are required. PPS25 identifies the opportunity to reduce flood risk, manage water quality and provide integrated amenity and ecological benefits.

Site Drainage Assessments are required for all sites in Flood Zone 1 which are greater than one hectare in size. This is to ensure that downstream flooding problems are not aggravated by increased runoff post development. The planning system therefore represents an effective means of ensuring that new developments manage water in a sustainable manner. As a minimum requirement of PPS25, the negative environmental impacts of development on surface water runoff need to be mitigated against. PPS25 states that post development rates of runoff must not exceed pre-development runoff rates. The Environment Agency and the Isle of Wight Council have an aspirational target of reducing the runoff rates wherever possible. Particular attention should be paid to the use of sustainable drainage systems given the wider sustainability aims of Planning Policy 1 – '*Delivering Sustainable Development*' (PPS1) and the specific requirements of PPS25.

7.1.1 SuDS Suitability Determination

The applicability of SuDS techniques for use on a potential development sites should based on an assessment of the following key influences put forward by CIRIA (2007):

- **Land use characteristics** – favour different SuDS techniques. Industrial sites where pollution is an issue are best managed with attenuation SuDS over infiltration SuDS, with multiple treatment stages.
- **Catchment characteristics** – may have a bearing of the choice of SuDS, as particular catchments may be regulated for a sensitivity to flooding or pollution and may potentially be aggravated by one SuDS technique compared to another.
- **Quantity and quality performance** – would guide the choice of a particular SuDS technique and is dependant upon the requirements.

- **Amenity and environmental requirements** – flood risk mitigation is the primary aim and when satisfied, options to add ecological value could be considered.

Chapter 5 of the SuDS Manual by CIRIA (2007) provides further details regarding these key influences, and is recommended as a supporting document to this SFRA. Land use is considered to be a dominant factor, as it influences the volume of water required to be attenuated, the likelihood of pollution and contaminants and the potential for infiltration to occur. Indications of the most suitable techniques for each site cannot be made as part of a strategic level assessment. Site specific FRA's and Drainage Assessments will provide the required recommendations. Therefore the applicability of SuDS techniques in the SFRA can only be assessed through the consideration of regional characteristics relating to the hydrology and geology. Sections 5.2.2 and 5.2.3 of the SuDS manual provides an indication of the various catchment characteristics that restrict or preclude the use of a particular SuDS technique.

Once it has been established that SuDS are suitable for use on the site, the selection of the appropriate technique(s) is/are dependant on various factors. The following are presented by (CIRIA, 2007):

- ***Soils*** – soil permeability has a significant bearing on the choice of infiltration SuDS techniques.
- ***Groundwater*** – infiltration techniques require at least 1 metre of soil depth between the base of the device and the maximum expected groundwater level.
- ***Area draining to single SuDS component*** – vegetative or filtering SuDS can attenuate smaller volumes of runoff, than ponds which can handle larger volumes generated from a bigger area.
- ***Slope of drainage area*** – steeper slopes reduce the suitability of some SuDS techniques, such as infiltration, which require longer residence times.
- ***Head*** – SuDS that require gravity to operate will require a positive head between inflow and outflow.

Table E2 (in Appendix E) CIRIA (2007) provides a summary of influential site characteristics which should be assessed at the site specific level.

7.2 Recommendations of Infiltration SuDS Techniques

The section describes how the SFRA has provided an assessment of the suitability of infiltration SuDS techniques for each site. Infiltration SuDS are the preferred option of PPS25 (paragraph 4.11 PPS25, 2006) and as such it is the applicability of this technique which forms the focus of this assessment. The assessments have been performed using Island wide datasets and the findings of which are presented for each site in the Attribute Database. Two key factors had to be considered:

- The infiltration potential
- The potential for groundwater contamination.

It should be noted that the 'potential for groundwater contamination' assesses the potential for contaminants to enter groundwater. No assessment has been made of the presence of contaminants or contaminated land.

7.2.1 1 - Infiltration Potential

Infiltration techniques generally requiring an infiltration rate of above 10mm/hr for the upper soil layers (Parrett, 2005) and are thus partially controlled by soil characteristics. The combination of the soil and geological characteristics enable the potential use of infiltration techniques on the site to be assessed. The most useful dataset made available for use in the SFRA to determine the infiltration potential was the Groundwater Vulnerability mapping (scale 1:100,000) see Figure 8 in Appendix A. This dataset subdivides soils into those with a high, medium and low leaching potential. Leaching potential is proportional to infiltration potential. In that high infiltration potential equates to high infiltration potential and *vice versa*.

Figure 9 in Appendix A, presents the assimilation of this assessment and can be consulted for regional overview of the applicability of infiltration SuDS techniques. For all sites in the Attribute Database, an infiltration potential has been assigned. Figure 9 (in Appendix A) will potentially be of use when processing windfall sites.

Aquifer assessment

The Groundwater Vulnerability map of the Island also provides details on the aquifer type. It provides an indication of the ability of the underlying rocks strata to absorb water which infiltrates from the overlying soil layer. Without knowledge of site specific soil types and depths, it is not possible to fully assess the infiltration potential. As such, the underlying aquifer type (and its permeability) is may limit the infiltration potential and thus the applicability of infiltration SuDS. Three aquifer types exist as defined by the Groundwater Vulnerability map (NRF, 1995):

- Major Aquifers (Highly Permeable);
- Minor Aquifers (Variably Permeable); and

- Non-Aquifers (Negligibly Permeable).

A matrix relating soil infiltration (leaching) potential and aquifer type (permeability) to infiltration potential is presented in Table 7.1

Table 7.1 Infiltration Potential Derived from Aquifer Vulnerability Classification

Aquifer Vulnerability Classification	Description	Infiltration Potential
Minor_L	Variably permeable groundwater with low leaching potential	Low
Minor_I	Variably permeable groundwater with intermediate leaching potential	Low
Minor_H	Variably permeable groundwater high leaching potential	Medium
Major_L	Highly permeable groundwater with low leaching potential	Low
Major_I	Highly permeable groundwater with intermediate leaching potential	Medium
Major_H	Highly permeable groundwater with high leaching potential	High
Non_Aquifer	Regarded as containing insignificant quantities of groundwater. No soils data.	Low

It should be noted that those parts of the Island are classified as '*Non_Aquifer*' by the Groundwater Vulnerability map and have no soils information on which to assess infiltration potential. These areas have been considered for the purposes of this SFRA to have a low Infiltration potential. Site Specific FRAs should assess this generalisation at the site specific level.

Mass Movement Consideration

Mass movement was also considered during the assignment of assessment of the suitability of infiltration SuDS. The process by which mass movement occurs on the Island is through slippage as defined by the BGS map for the Island (Figure 7 – in Appendix1). Thus additional water in areas defined as being prone to slippage may further lubricate the rock strata, thereby potentially inducing a slippage event. Three rock types are associated with areas of slippage on the Island. These are:

- Clay (undifferentiated);
- Sandstone (undifferentiated) and Mudstone; and
- Rock (Undifferentiated).

Mass movement is an important factor in the areas where infiltration SuDS are otherwise suitable, since the addition of water into the soil profile or underlying rock strata has the potential to trigger a mass movement event.

It has been considered inappropriate to implement infiltration SuDS techniques in these areas. The Attribute Database accounts for this by assigning a low suitability to sites which overlay any of these geologies.

7.2.2 2 - Groundwater Contamination Potential

The use of SuDS, although a preferred method of managing surface water, has the adverse potential to contaminate groundwater with surface pollutants. Groundwater is known to be vulnerable to contamination from diffuse and point source pollutants through indirect discharges into or onto land. Aquifer remediation is difficult, prolonged and expensive and thus the prevention of pollution is important. The map of Groundwater Vulnerability provides a useful indication of those areas where the implementation of infiltration SuDS techniques has the potential to contaminate the aquifer below through the transfer of pollutants from the surface. It is not a map of contaminated land, rather it is an indication of where there is the potential for groundwater to be polluted.

Source Protection Zones (SPZ's) are defined by the Environment Agency and delineate the risk of groundwater contamination. Figure 7 in Appendix A shows the location of SPZ's on the Island. Generally, the risk is greatest nearest to the abstraction point. The dataset is made up of three main zones, which are the inner, outer and total catchment. A forth zone is sometimes included, and applies to a groundwater source of special interest. The Environment Agency website (Environment Agency, 2007), provides the following definition for each of the SPZ's:

- ***Zone 1 (Inner protection zone)*** – Any pollution that can travel to the borehole within 50 days from any point within the zone is classified as being inside zone 1. This applies at and below the water table. This zone also has a minimum 50 metre protection radius around the borehole. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.
- ***Zone 2 (Outer protection zone***) – The outer zone covers pollution that takes up to 400 days to travel to the borehole, or 25% of the total catchment area – whichever area is the biggest. This travel time is the minimum amount of time that the Environment Agency believe pollutants need to be diluted, reduced in strength or delayed by the time they reach the borehole.
- ***Zone 3 (Total catchment)*** – The total catchment is the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.
- ***Zone of special interest*** – This is usually where local conditions mean that industrial sites and other polluters could affect the groundwater source even though they are outside the normal catchment area.

The Assessment of Groundwater Contamination Potential

The potential for groundwater contamination was assessed by combining the infiltration potential classifications made in Section 7.2.1 and the Source Protection Zones. It was considered important to compile a dataset which utilised the most useful available information to provide broad classifications to give an island wide appreciation of the potential to contaminate groundwater resources.

Non-aquifer were assigned a low contamination potential, unless they were over a Zone 1 or 2 SPZ, in which case it was given a rating of 'high' or 'medium' respectively. Areas of high infiltration potential were all assigned high contamination risk values as were areas of medium infiltration potential were they were in SPZ zones 1 and 2. The remaining areas of medium infiltration potential were assigned medium contamination potential values. Three classifications, high, medium and low were created. The resultant contamination potential map can be seen in Figure 10 (Appendix A). Table 7.2 presents the results of the classification process. Please note, that the impact of mass movement on the infiltration potential has been omitted from this classification process.

Table 7.2 Classification of Groundwater Contamination Potential

		Contamination Potential			
		SPZ 1	**SPZ 2**	**SPZ 3**	**No SPZ**
Infiltration Potential	**High**	High	High	High	High
	Medium	High	High	Medium	Medium
	Low	Medium	Medium	Low	Low

The information presented in this section is intended to highlight areas were the simplest of SuDS techniques (infiltration SuDS) are and are not considered suitable. Box 4 provides a hypothetical breakdown of how the SuDS information could inform the site allocation process.

Box 4 Hypothetical example of how the SuDS information can be used

Proposal: An essential industrial development needs to be constructed. Due to the nature of the industry, it is preferable that it is not located within an urban environment. The size of the site required also limits the potential development sites in urban areas. The results of a selection process, in which the flood risk zones, area requirements of the site and wider sustainability objectives were assessed, was the production of a handful of potential greenfield sites for the industrial unit.

Potential Sites: The handful of site selected by the initial assessment all appear to be equally suitable. To differentiate between the sites the suitability of infiltration SuDS could be used. PPS25 stipulates that runoff can not increase from a site as the result of development. The selected sites for the industrial development are all Greenfield so any form of development is going to produce runoff that must be mitigated against. Infiltration SuDS represent an appropriate mitigation measure. Owing to the scale of the development and the assumed high levels of runoff from the development, it would be desirable to select the site which has the highest infiltration potential and the lowest groundwater contamination potential.

Site Selection Process Result: The site with the highest infiltration potential and the lowest groundwater vulnerability classification was selected.

Please note: This is a hypothetical situation

The Island wide SuDS and drainage assessments can also be used by the council to potentially allow for the formation of regional SuDS policies and the implementation of sub-regional SuDS Management Trains (Figure E1 Appendix E) to act as surface water management techniques for a collection of new developments. It must be noted that where sites are potentially contaminated it may not be appropriate to consider infiltration methods for the disposal of surface water.

7.3 Runoff Potential

An Island wide assessment of runoff potential was undertaken so that each potential development site could be attributed with a qualitative likely runoff potential. The SFRA sought to establish a preliminary categorisation of runoff potential to inform subsequent site specific FRA's and to indicate where surface water flooding may be considered to be more likely. At the strategic level a simplified qualitative assessment was considered appropriate as any subsequent FRA's will have to provide drainage assessments.

The runoff potential categorisation was based upon *SPR_HOST* (the standard percentage runoff, derived from hydrology of soil types classification – as defined by The Flood Estimation Handbook 1999). HOST values for the Island were defined by a national soils map made available for use in the SFRA by the Environment Agency. This map divides the UK into a 1km x 1km vector grid of 29 HOST classes. This dataset shows the dominant HOST class for each 1km square, and is a reproduction of the HOST dataset used by the Flood Estimation Handbook (FEH, 1999). However, it must be noted that the soil classifications in the HOST dataset do not necessarily match up, in all instances, with the Groundwater Vulnerability.

SPR_HOST values can be assumed to be approximately equal to the greenfield runoff resulting from the rainfall falling onto a greenfield site (Kellagher, 2004). Thus, they only provide a baseline indication of the percentage runoff, and do not necessarily represent developed or brownfield sites accurately. It should also be noted, that the HOST dataset is a coarse representation of reality, with uniform 1km grids that indicate the dominant HOST values for each cell. It is therefore intended for the runoff potential classification to be used as an indicator and not a definitive assessment. Where necessary, specific site analysis will be undertaken to refine the calculations.

The Isle of Wight has nine unique HOST classes, and seven corresponding and unique SPR_HOST. Figure 16 in Appendix A shows an Island wide distribution of HOST values. Each of the sites in the Attribution Database were attributed with a potential runoff classification of very low, low, medium, high or very high. The SPR_HOST qualitative classifications are presented in Table 7.3**.**

Table 7.3 SPR_HOST qualitative classifications

SPR_HOST	Qualitative Runoff Potential Classification
-999	Unknown
0.02	Very Low
0.145	Low
0.253; 0.292	Medium
0.472; 0.496	High
0.6	Very High

7.4 Results

Table 7.4 provides an example of the attribution of drainage data for a selection of potential Development Sites.

Table 7.4 Example data from the Attribute Database illustrating Drainage attribution process

Name of Filed in Attribute Database	SITE_ID	DEV_AREA	SUDS_SUIT	SUDS_VUL	RUNOFF_ POT
Field Description	Unique Site Identification number	Key Development Area	Suitability of Infiltration SuDS	Vulnerability of Groundwater	Runoff Potential classification
	Ryde1340	Ryde	Low	Medium	High
	Newport575	Newport	Medium	Medium	High
	St Helens1446	St Helens	Low	Medium	Low

The data presented in this section are qualitative and therefore should not be considered absolute due to the generalisations made during the interrogation and manipulation of the supporting GIS datasets.

8. Flood Risk Management and Mitigation

8.1 Planning Process

The SFRA has identified which potential development sites are outside the flood zones and what land uses are considered appropriate for each site based on the guidance specified in PPS25. Sequential approach of avoidance of risk in PPS25 attempts to direct planned development towards Flood Zone 1. There will however, be occasions where planning permissions will be sought in higher flood risk zones, particularly with respect to the redevelopment of brownfield sites in urban areas, to remain inline with sustainability objectives. If a development, with a vulnerability classification (see table D.2 in Appendix B), is sought in a flood risk zone with a higher probability of flooding than that stated in Table D.1 (See Appendix B) then the Exception Test must be passed as part of the site specific FRA. This is providing that at the site allocation stage, appropriate justification was given to prove over riding reasons of consideration in line with the PPS25 Exception Test. Flood mitigation measures should be considered as early as possible in the development process to reduce and manage the flood risks associated with development.

Furthermore, development in Zone 1 must still consider other flood risks, particularly secondary sources of flooding and the potential impact that the development's drainage and surface water runoff may have on flood risk elsewhere It is advised that the Development Control planners at Local Authorities can use to respond to low flood risk applications. This can be found at http://www.pipernetworking.com/floodrisk/index.html.

The Environment Agency has standard paragraph is uses to respond to planning applications, for reference these are provided in Appendix F. Please note that the comments provided in this Appendix F are the latest versions (June 2007) and are subject to change.

8.2 Drainage

All planned development, whether in the floodplain or not, must consider the implications for its drainage on flood risk. In particular, this applies to development of greenfield sites, for which the significant increase in impermeable area can considerably increase runoff volumes and rates from the site. A strategic approach to the drainage of new urban areas is necessary to ensure that drainage and flood risk management proposals effectively manage runoff changes whilst reducing the flood risks associated with new development. A strategic approach will reduce the chance of cumulative piece-meal additions to drainage systems causing future problems, and allow for the identification and betterment of existing systems with known issues. The CIRIA report C635 – 'Designing for Exceedance' provides detailed guidance for engineers and planners on the design of urban surface water management systems to mitigate the impacts of these systems being overwhelmed during extreme rainfall events. Methods include the design of buildings with raised thresholds above road level and the use of controlled flooding of designated spaces as temporary storage areas.

8.2.1 Integrated Drainage Strategy

Integrated Drainage, describes the collusion of all stakeholders (typically the LPA, Highways Agency, Environment Agency and the Water Company) to produce a scheme in which surface water drainage is addressed at a more strategic level. Opportunities for developing an Integrated Water or Drainage Management Strategy across development site boundaries is recommended, and ideally a catchment-led approach should be adopted. This has been recognised in the recent consultation paper by Defra, '*Making Space for Water*'. Experience shows that integrated approaches often lead to a much more efficient and reliable surface water management system because it enables a wider variety of potential flood mitigation options to be used, and a better overall design can be achieved. Integrated management of surface water has potential benefits in addition to flood risk, and can include improved water quality through the use of. Once the site allocation process had been executed on the Isle of Wight, consideration should be given at an early stage as to the best way to manage drainage to maximise benefits. The Environment Agency will be pushing for an integrated urban drainage scheme is the Pan Extension Project in Newport. SUDS will be vitally important to ensure no detriment to water quantity or quality in the receiving watercourses. The river corridors should also be maintained across the site.

There currently exists no formal guidance on *Best Practice* or *Preferred Methods* for the implementation of SuDS. Defra are in the process of co-ordinating 15 pilot studies across the UK, the findings and recommendations of which will be used to formulate a policy. The pilot studies are due to be completed towards the end of 2008. Integrated drainage strategies have wider sustainability benefits but the SFRA only recommends future consideration of this emerging concept for the purpose of reducing flood risk. It is recommended that Appendix F of PPS25 or Chapter 4 of the Practice Guide from PPS25 are referred to. The Defra, '*Making Space for Water Integrated Urban Drainage Pilot*' at http://www.defra.gov.uk/environ/fcd/policy/strategy/ha2.htm is also a useful source of information.

8.3 Runoff Management Measures

8.3.1 Agricultural Runoff

Agriculture is the predominant land use on the Isle of Wight. Land use exerts a strong control on the response of upstream catchments to rainfall in generating flooding and overland flows that pose a flood risk to development downslope. Where this is the case, measures can potentially be implemented to manage runoff and reduce risks. However the link between agricultural practices and flooding is not straightforward, even with improved land management practices, flooding will still occur after periods of prolonged/extremely heavy rainfall. Betterment is more likely in a reduction in smaller flood events generated by more common storms of lower return periods. At a strategic level, this can occur through the identification of and incorporation of agricultural land into schemes such as Defra's Environmental Stewardship Scheme (ESS) allowing surface runoff to be reduced through improved management practices. Examples of these practices include:

- Buffer strips (thicker established vegetation aids sediment removal/slows flow);

- Counter ploughing (ploughing across slopes rather than top to bottom);
- Reduced stocking levels (reduces soil compaction, allowing more infiltration);
- Detain excess flows in throttled depressions;
- Reduced autumn sowing of grain crops (reduction in 'sealing' of freshly tilled ground by heavy rain); and
- Improvements to hedgerows, ditches and gate locations.

These methods can all reduce the volume of agricultural runoff reaching watercourses, or flowing overland into developed areas

8.3.2 Construction Site Runoff

Construction site runoff is an important but often over-looked area of catchment hydrology, causing local short-term but potentially significant changes in local flood risk.

The clearance of vegetation (and modifications to drainage infrastructure on brownfield sites) may lead to increased runoff above pre-construction rates. The management of runoff during the construction period is an important consideration particularly for large sites and details of measures to mitigate for this phase of development are required as part of an FRA. The WFD places specific requirements on the management of non-point source pollution such as that from construction site silts. Methods to reduce the volume of solids (and runoff) leaving the site include:

- Phased removal of surface vegetation at the appropriate construction phase;
- Provision of a grass buffer strip around the construction site and along watercourses;
- The covering of stored materials;
- Ensuring exposed soil is re-vegetated as soon as feasibly possible;
- Protection of storm water drain inlets; and
- Silt fences, siltation ponds and wheel washes.

8.4 Flood Risk Management

The Insurance Industry standard for accepting flood risk is 1.33% (which represents the percentage probability of the 1 in 75 year event). Potentially, in undefended areas at greater (significant) risk of flooding, insurance against flooding may not be available or will include a significant excess.

National guidance (PPS25) aims to ensure that new greenfield development is located in areas with less than a 1% probability of fluvial flooding and less than a 0.5% probability of coastal flooding in a given year, both at present and with climate change. In addition, brownfield development should be designed in order to avoid flood damage up to the 1% flood event plus climate change threshold.

There are areas of existing historical development located in areas at greater flood risk (for example along the Lower reaches of the Monkton Mead Brook in Ryde, along both banks of the Medina Estuary, and in the North and Eastern areas of Sandown). Where feasible, opportunities should be taken to provide protection to existing undefended properties at risk of flooding. However due to the limited cost effectiveness of flood protection schemes for isolated properties the onus may be on property owners themselves. In these cases, flood resilience and resistance options may be appropriate and the Development Control process should be used to encourage the uptake of these methods when and if redevelopment occurs.

8.5 Flood Resistance and Resilience

Where buildings must be located in areas with medium to high levels of flood risk, the incorporation of flood resistance and resilience at the design stage can reduce the impacts should inundation occur. Standard measures include the provision of a minimum freeboard above ground or predicted flood level, and the use of resilient fixtures and fittings within. CIRIA and the Association of British Insurers (ABI) produce guidance on suitable measures of flood protection.

Flood resistance measures include:

- Buildings constructed with extra freeboard[†] to be above the flood level;
- Fitting one way valves to sewage pipes, or the use of temporary bungs;
- Sump and pump systems to remove water from buildings faster than it enters;
- Temporary door or air vent flood boards to stop the entry of flood water.

Flood resilience measures include:

- Use of concrete floors rather than timber;
- Design of buildings such as townhouses with lower floors occupied by garages and utility areas, minimising the damage caused when flooded;
- Location of boilers, and electricals above the possible flood level;

[†] Freeboard = additional allowances to cover uncertainties.

- No chipboard or MDF kitchen units, instead using plastic and metal alternatives;
- Lime plaster or cement render rather than conventional gypsum plaster.

Flood resilience measures also provide a means for individuals in the local community with properties at risk, to protect their property. An array of products such as door and window boards and air brick covers specifically designed to make these openings watertight are commercially available. Given sufficient notice these can markedly reduce the ingress of flood water into properties. It is however recommended that a professional survey is carried out to identify the key ingress points for flood water into properties. Some degree of water ingress may still occur due to the multiple pathways for floodwater to enter an individual property.

Retrofitting flooded properties during the repair procedure with these is common practice. These measures are not necessarily more expensive than conventional techniques, but over repeated flood events will reduce damages, cost and time to repair if properties are flooded. Comprehensive guidance on incorporating flood resilience measures in the repair of flooded building is available from CIRIA at: http://www.ciria.org/flooding/ . Adopting these measures can reduce future flood damages and the disruption caused by flooding, uptake should therefore be encouraged. The ABI gives details of potential cost savings at:

http://www.abi.org.uk/Display/File/Child/553/Flood_Resilient_Homes.pdf

Importantly these costs do not include the indirect costs of disruption and temporary accommodation whilst repair occurs.

8.6 Flood Warnings

The Environment Agency provides flood warnings for on the Isle of Wight for the following areas that include:

- Eastern Yar from Whitwell to Bembridge including the Scotchells Brook and Wroxall Stream;
- River Medina from Whitwell to Newport and Lukely Brook from Carisbrooke
- All around the coast of the Isle of Wight;
- Monkton Mead Brook at Ryde;
- Coastal areas at Wootton, Ryde, Spring Vale, and Bembridge;
- Coastal area at Cowes and East Cowes, and tidal areas of Newport;
- Coastal area at Yarmouth, Isle of Wight;
- Western Yar, Thorley Brook and Caul Bourne;
- Western Yar from Schoolgreen and Freshwater Bay to Yarmouth; and

- Coastal area at Sandown

It is important to note that the Environment Agency flood warnings will not be able to provide advance warning for all different flood mechanisms. Warnings will not give advance notice of flooding from structural failures, culvert blockages or from groundwater. Intense rainfall events may also generate localised and severe rapid onset floods that are very difficult to predict.

The Agency's flood warnings are provided for existing developments at risk from flooding. They should not be considered as a mitigation measure for new and planned developments.

8.7 Emergency Planning

In light of this SFRA the council should take the opportunity to review its Emergency Planning procedures in the event of widespread flooding on the Island (similar to the Autumn/Winter 1999/2000 flood events). In the event of flooding it is the Council's role, supported by the emergency services, to coordinate procedures and responses. Key issues that should be covered in an emergency plan are:

- Responsibilities and roles of key services and communication protocols;
- Susceptibility of key emergency response centres (council offices, fire and police stations and hospitals) to flooding;
- Evacuation routes and reception centres; and
- Contingency plans for the loss of power and/or water.

There is likely to be several days notice of meteorological predictions of prolonged frontal rainfall that could cause major flooding along the larger catchments like the Eastern Yar. But other watercourses and urban area flood events may exhibit a more 'flashy' response due to convectional storms and rapid runoff rates.

Residents in areas of flood risk should be encouraged to sign up to the Environment Agency's Flood Warning System, particularly those identified as living in isolated properties in Flood Zone 3b (functional floodplain), where waters would likely rise most rapidly and access routes may become cut off.

The SFRA can be considered to be a refinement of the Environment Agency Flood Map / Flood Explorer. For example the tidal modelling work in the SFRA does not show Yarmouth to be cut off by flood waters in the event of the 1 in 1000 year flood like it is in Flood Explorer. As such, the SFRA could be used to locate emergency infrastructure and emergency services depots. Where potential development sites are adjacent to these structures and utilities options to reduce the flood risk posed to them could be explored.

8.8 Future Proofing

It is important that new developments, particularly in the higher risk flood zones, are designed in a precautionary manner, given the possible range of potential climate change impacts that may occur. Proposed flood mitigation measures should be reviewed at the detailed FRA stage, paying particular attention to the potential implications of future changes in climate and of land use. The application of the precautionary principle and the provision of freeboard and flood resistance and resilience in buildings can mitigate future increases in flood risk at relatively low cost if incorporated at the design and construction stage.

Measures to mitigate the risks of flooding both to and from development are not necessarily limited to those above. Depending on the specific risks relating to a site, the following investigations/options may need further consideration at the detailed FRA stage of development planning:

- Provision of a suitable, dry access/evacuation route (above the level of the 1% annual probability flood);
- Flood resistance/resilience measures specific to the potential for groundwater flooding;
- Management of surface 'run-on' (i.e. overland flow and runoff entering the site from upslope areas) as part of the development's drainage strategy;
- Maintenance/improvement of watercourses, culverts, drains and sewerage networks to reduce associated flood risks.

Detailed guidance on site design in terms of surface water management is provided in "*Sewers for Adoption*" (6th Edn.), CIRIA C635 *"Designing for Exceedence"* and CIRIA C697 "*The SUDS Manual*". The recently published CLG document "*Improving the flood performance of new buildings - flood resilient construction*" provides detailed guidance on the design or new buildings to maximise their flood resilience.

8.9 Surface Drainage

PPS25 states that the surface runoff from a site should not increase post development. Therefore any increase in hard standing and the potential increased runoff rates must be mitigated against. There is however, no requirement to reduce runoff from a site. The Isle of Wight Council and the Environment Agency are however supportive of an aspirational target of reducing runoff rates wherever possible.

Sustainable Drainage Systems (SuDS) are a preferred option for the management of surface water since they manage runoff close to its source and have benefits other than flood prevention. These include the ability as identified by Parrett (2005);

- To control the quantity of runoff from a development;
- To improve the water quality of runoff;

- To enhance the nature conservation, landscape and amenity value of the site and its surroundings.

Table E1 (in Appendix E) provides a summary of options for SuDS and their suitability according to subdivisions of water quality, water quantity and environmental benefits. SuDS include a number of techniques such as green roofs, permeable paving, rainwater harvesting, swales, detention basins, ponds and wetlands. SuDS techniques can be implemented in most urban settings, from hard-surfaced areas, to soft landscaped features as a variety of design options are available. This allows designers and planners to consider local land use, future management and the needs of local people, when undertaking drainage design.

LPA's are required to promote the application of SuDS, the preferred option in PPS25 being infiltration techniques as opposed to discharging into watercourses. Where this is not possible, preference should be given to the discharge of surface water into watercourses rather than foul water drains. As the PPS25 *Practice Guide* states, these options enable the preferences of the different stakeholders to be balanced, and the risks associated with each option to be weighed during the decision making process. There is no single correct technique. Rather a combination of drainage techniques often can be implemented to most effectively manage site drainage. To simulate the natural hydrological processes in a catchment through engineered drainage, a management train of SuDS is required. The following are four objectives of a SuDS treatment train that were presented by Greater Dublin Strategic Drainage Study (2005):

- **Pollution prevention** – spill prevention, recycling, public awareness and participation.
- **Source control –** conveyance and infiltration of runoff;
- **Site Control –** reduction in volume and rate of surface runoff, with some additional treatment provided; and
- **Regional Control –** Interception of runoff downstream of all source and on-site controls to provide follow–up flow management and water quality treatment.

Table 8.1 classifies SuDS according to their suitability to each of the management train objectives. Regional control is of the most significance to this SFRA, since the remaining management train objectives are site specific and require participation from developers for their implementation. By considering regional SuDS control, the Council can be proactive in planning for SuDS on a regional level. It should be noted at this point that most drainage systems are gravity fed and thus require a negative gradient in order to operate. SuDS management trains are therefore highly likely to be limited to common drainage areas. Figure E.1 (in Appendix E) illustrates two likely implementation scenarios of a SuDS management train.

If SuDS are to be fully effective, they need to be managed properly. It is the responsibility of the developer to ensure that the development drainage is maintained for the lifespan of the development. There are a range of maintenance routes the developer might want to pursue but ultimately the developer has to demonstrate that there is a drainage maintenance plan presented. Section 106 of the Town and Country Act 1990 provides a suitable mechanism whereby properly designed SuDS components can be transferred into the management and maintenance responsibilities of the local authority. This is providing the Council wish to enter into such an agreement and there is no legislation which states they have an obligation to.

The '*Interim Code of Practice for Sustainable Drainage Systems*' (NSWG, 2004) endorsed by the Environment Agency can be consulted for further guidance.

Table 8.1 (modified after CIRIA, 2007)

Technique	Management train suitability					
	Prevention	Conveyance	Pre-treatment	Source Control	Site Control	Regional Control
Water butts, site layout & management	#	=		#		
Pervious pavements	#			#	=	
Filter drain		#		#	=	
Filter strips			#	#		
Swales		#		#	#	
Ponds					#	#
Wetlands		=			#	#
Detention basin					#	#
Soakaways				#		
Infiltration trenches		=		#	#	
Infiltration basins					#	#
Green roofs	#		#	#		
Bioretention areas				#	#	
Sand filters			#		#	=
Silt removal devices			#			
Pipes, subsurface storage		#			#	

High/primary process = Some opportunities, subject to design

8.10 Additional Options for Flood Risk Management

The river corridors associated with watercourses adjacent to potential future development areas could be enhanced as part of development proposals. Opportunities may exist to enhance the ecology along these watercourses with the incorporation of river rehabilitation and restoration techniques as applicable. Beneficial floodplain creation and storage may be achievable through the creation of additional low-lying areas adjacent to watercourses, and the reuse of spoil where required elsewhere in parts of the development site outside of Flood Zone 3 and 2. Green

SuDS options such as green roofs, reed beds and swales can be designed to provide additional areas that provide ecological benefits alongside there surface water management role.

Where FRM schemes are associated with large development schemes there may be potential for developer contributions and the inclusion of flood attenuation in the site master-planning.

The development control process will provide the key mechanism for reducing flood risk in on the Isle of Wight in three ways: a) by steering development into Flood Zone 1 through the sequential approach, b) ensuring new construction is flood resistant; and c) appropriate runoff management. Over time, with redevelopment these will aid reducing the amount of people and property at risk of flooding.

Flood resistance is achieved by ensuring buildings constructed on land at risk of flooding are designed with Finished Floor Levels with sufficient freeboard. Whilst at times these building may be surrounded by flood water, damage to the fabric and contents of the property is avoided.

9. Summary

The Isle of Wight Council commissioned Entec to conduct a Strategic Flood Risk Assessment for the whole of the Isle of Wight which totals an area of 380km². The SFRA is required to be produced by the Council to support the Council's Core Strategy. From the outset it has been the focus to make this document, the supporting maps and the digital GIS datasets useful tools to assist in the planning process. Information is presented at one of the following scales; Island wide; Key Development Area or; Site specific. This enables the Council to easily access the relevant level of detail when processing an allocation.

The major tasks undertaken in the SFRA are listed below:

At the Island wide scale

- Assessment of flood risks from all sources
- Definition of PPS25 flood Zones
- Assessment of the suitability of Infiltration SuDS
- Assessment of potential surface runoff
- Assessment of the sensitivity of the fluvial floodplains to the possible impacts of climate change
- Description of possible mitigation and management options
- At the Key Development Area scale
- Impact of climate change on coastal flood zones
- Detailed synopsis of all the flood risk issues, including; Flood Zones; Climate change; Historic flood events; surface water drainage and; Information to inform future FRAs

At the Potential Development Site Level

- Every piece of data supplied for use in the SFRA that could be qualified or quantified has been included as an attribute for each of the potential development sites (Table 5.1 for full list of attributes).
- Site specific flood risk definition to inform the allocation of appropriate land uses

9.1 Implications of Isle of Wight SFRA

The findings of the SFRA are presented in the Attribute Database for each of the 1,469 potential development sites. The following sections provide a summary of the key points and issues that have arisen as part of the assessment

9.1.1 Flood Risk

The Level 2 flood risk assessment identified that only 9% (138 out of 1469) of all the potential development sites assessed are impacted by the extent of Flood Zones 2 or 3. This means that 91% of the potential development sites are in Zone 1 making them suitable for all development types. Site Specific flood risk assessments are therefore only required for all those identified as being in Flood Zones 2 and 3 and sites over 1ha of which there are 198.

Table 9.1 Summary Statistics of Flood Risk and Potential Development Sites

Statistic	Total number of sites assessed	Number of sites	Percentage by Number of Sites (%)	Percentage by Area (%)
All Potential Development Sites				
Sites impacted by Flood Zone 2 and 3	1469	138	9.4	-
Sites impacted only by Flood Zone 2	1469	15	1	-
Of the Sites impacted by Flood Zone 2 and 3				
Area within Flood Zone 3	-	-	-	18.2
Area within Flood Zone 2	-	-	-	2.8
Area within Flood Zone 1	-	-	-	80

A numerical assessment of flood risk implies that the allocation of development land should not be overly restricted by flood risk issues. This however belies the fact that flood risk is not evenly distributed across the Island. Key Development areas like St Helens, Ventnor and Wootton have very few potential sites within Flood Zones 2 and 3. On the other hand, Cowes and East Cowes, Newport, Freshwater and Ryde are presented with significant flood risks. Table 9.2 presents a summary of the key flood risk issues in each of the Key Development Areas.

Table 9.2 Summary of Key Flood Risk Issues in Each Key Development Area

Key Development Area	Summary of Key Flood Risk Issues
Bembridge	No Significant Flood Risk Issues Identified – Surface drainage should assessed
Brading	No Significant Flood Risk Issues Identified – Surface drainage should assessed
Brighstone	Fluvial flooding in the Brighstone Brook and Shorewell Stream confluence area. Relatively large areas of Flood Zone 3 are present in the area around the recreation ground
Cowes and East Cowes	Tidal flooding along both sides of the Medina Estuary present a significant flood risk to those sites which are adjacent to the waterfront. Flood Zone 3 makes up the largest proportion of the areas at flood risk.
Newport	All sites adjacent to watercourses have narrow bands of areas of flood risk adjacent to the watercourses. Tidal flooding in the Seaclose area represents a significant restriction to planning. Rivers without Flood Zones, which are classified as Main Rivers (Pan Stream tributaries and Parkhurst Stream) should be considered if development is proposed within 20m of then
Ryde	There are extensive areas of tidal Flood Zone in Ryde which affects large portions of the sites located on the valley floor. The presence of a functional floodplain for the Monkton Mead Brook presents a significant restriction to types of developments that PPS25 will permit for certain sites.
Seaview	Two sites with significant frisks are identified in the north of the town, both of these sites are almost completely within Flood Zones 2 and 3
St Helens	No Significant Flood Risk Issues Identified – Surface drainage should assessed
The Bay	An extensive area of Flood Zone 2 and 3 exists in the north of the town along the edge of the Eastern Yar floodplain and the Yaverland area.
Ventnor	No Significant Flood Risk Issues Identified – Surface drainage should assessed
Wootton	No Significant Flood Risk Issues Identified – Surface drainage should assessed
Wroxall	A narrow fluvial floodplain has been identified through the town which impacts on all the sites that are adjacent to the watercourse. The valley floor is narrow and as such Flood Zone 2 and 3 are similar in extent.
West Wight	The sites in Totland are practically free of flood risk. The sites along the banks of the Western Yar are at risk of both tidal and fluvial flooding. The functional floodplain has been defined for the Western Yar and as such PPS25 presents significant restrictions on the types of land use that can be proposed for some of the sites.
Yarmouth	The town is presented with a significant tidal flood risk, but the majority of the potential sites are only partially at risk of flooding.

9.1.2 Climate Change

The Island's fluvial floodplains were assessed for their sensitivity to climate change. The approach outlined in Section 4.2 has resulted in 24 of the potential development sites being identified as being in areas where the extents of the fluvial Flood Zones may increase significantly as a result of climate change. Figures 13 and 14 in Appendix A illustrate the extent of tidal climate change modelling undertaken in this SFRA. The differing degrees of impact that climate change is predicted to have in different parts of the Island are due to variations in the topography of the

coastline. Where the increase in extent has been considered significant they have been detailed in Section 6. Table 9.3 summarises how the increasing extents impact upon the potential development sites.

Table 9.3 Impact of Climate Change on the Number of Potential Development Sites Likely to Become Within the Flood Zones

Climate Change Horizon	Number of sites identified as being impacted by the extent of:	
	Flood Zone 3	Flood Zone 2
Current Flood Zone	70	88
2026	91	103
2070	112	118
2115	126	133

Climate change results in more potential development sites being affected by the Flood Zones in the future. Therefore in the interest of sustainability, it is advised that impacts of climate change be assessed in detail for any of the sites this SFRA has highlighted as being at risk.

9.2 Development Control

It is important that the Isle of Wight Council is fully informed in relation to the assessment of development and flood risk in order that it may liaise with other responsible authorities (e.g. the Environment Agency and Southern Water). The Sequential Test outlined in PPS25 must be at the centre of spatial planning and development control decisions related to flooding, with sites prioritised for development in Zone 1 wherever possible. A further sequential approach should then be applied to other secondary sources of flood risk.

A SFRA is a strategic exercise providing an assessment over a wide area. It does not preclude the need for local, site specific flood risk assessments (FRAs) as part of the application process for particular developments. However, the broad-scale assessment of risks to the areas presented in the Isle of Wight SFRA should be used to guide and focus subsequent FRAs of sites selected for development. Each of the potential development sites supplied for assessment in this SFRA have been assigned information to aid in the application of the sequential test and to inform the scope of any ensuing FRAs. In addition the site specific flood risk information, the island wide GIS datasets and maps which have been generated in this SFRA can inform the development of any future windfall sites.

Planning applicants should be encouraged to identify and implement flood mitigation and management measures in a way that reduces risks in a sustainable manner, observing good standards of urban design and finding 'green'

solutions which enhance recreation and amenity, and avoid damage to local ecology. Planning conditions should be used to improve flood resilience of buildings where risks exist. The Environment Agency's standard planning conditions on flood risk are a useful aid to development control officers.

9.3 Knowledge Management

Without proper management, this invaluable information on past flood events can be lost, particularly where knowledge resides with officers of longstanding employment who can recall past flood events, their causes, effects and any remedial measures from memory. This SFRA has attempted to collate multiple sources of local information. It is highly recommended that this database of knowledge is expanded and updated as new information arises. There may be concern that organising data in this way may give rise to blighting of properties (similar to the concerns raised over the Register of Contaminated Land). This could be a real issue in the context of the Freedom of Information Act. It is therefore worthwhile considering legal advice.

9.4 Recommendations

The works undertaken with the data available have been sufficient to allow for a detailed assessment of flood risk to be carried out and enabled a series of strong datasets to be produced to help the Council in the allocation of development land. Inevitably, there are aspects of the assessment that would benefit form the inclusion of additional information. The list below outlines some potential means by which this SFRA could be improved:

- **Tidal Flood Zones**: The precision of the definition of the sites presently at risk of flooding could be improved if the Environment Agency undertake a program to re-model the tidal Flood Zones
- **SMP2**: When the SMP2 of the Isle of Wight is completed, its findings on the coastal defences could be used to update the section on residual risk in the SFRA.
- **BGS Groundwater Emergence Map**: BGS are in the process of preparing a groundwater emergence map, which when available will potentially provide additional information to the groundwater section of the SFRA. It may make it possible to classify the Island into areas at risk of flooding from groundwater.
- **National Soils Resources Institute soils (NSRI) distribution map**: Is in the final phase of construction and NSRI and engaged in talks with the Environment Agency about making this data available to them. This dataset will more precisely define the soil classifications which could be used to improve the surface water runoff classifications make in the SFRA
- **Hosting Data on the Internet**: The findings of the SFRA and the site specific information could be easily turned into web pages to make the information freely available to all those who need access to it. This will potentially removing the need for additional ArcGIS licenses and avoid the associated training issues which could be related to using ArcGIS as the main platform for viewing the data presented in this SFRA.

Owing to the likely completion dates of the SMP2 and the publication of the Groundwater Emergence map it would be recommended that an update be considered for early 2009.

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Environment Agency. *2007. Groundwater Source Protection* Zones. [Internet]

Appendix A
SFRA Mapping Output

Please see accompanying volume 'Appendix A' for mapping output

Appendix B
Tables D.1, D.2 & D.3 – Reproduced from Annex D PPS25

Table D.1: Flood Zones

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 Low Probability

Definition

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Appropriate uses

All uses of land are appropriate in this zone.

FRA requirements

For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

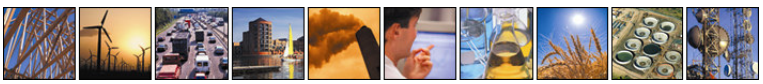


Table D.1: contd.

Zone 2 Medium Probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone.

Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test (see para. D.9.) is passed.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 3a High Probability

Definition

This zone comprises 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.

Appropriate uses

The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone.

The highly vulnerable uses in Table D.2 should not be permitted in this zone.

The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test (see para. D.9) is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

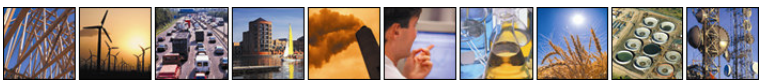


Table D.1: contd.

Zone 3a High Probability *(continued)*

Policy aims

In this zone, developers and local authorities should seek opportunities to:

i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;

ii. relocate existing development to land in zones with a lower probability of flooding; and

iii. create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b The Functional Floodplain

Definition

This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:

– remain operational and safe for users in times of flood;

– result in no net loss of floodplain storage;

– not impede water flows; and

– not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and

ii. relocate existing development to land with a lower probability of flooding.

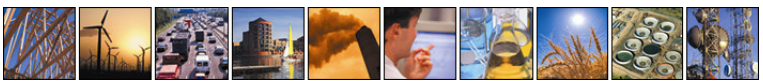


Table D.2: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.[19]
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste.[20] • Sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan**.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).

[19] DETR Circular 04/00 – para. 18: *Planning controls for hazardous substances.* www.communities.gov.uk/index.asp?id=1144377

[20] See *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* for definition. www.communities.gov.uk/index.asp?id=1500757

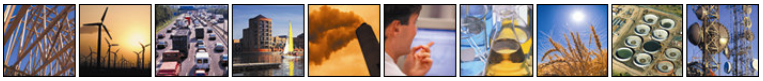


Table D.2: contd.

Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan**.

Notes:

1) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)[21] and also on the need of some uses to keep functioning during flooding.

2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

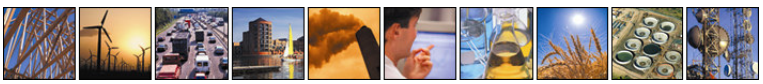


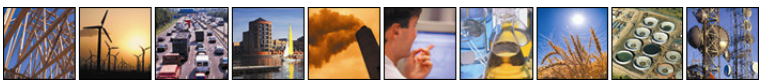
Table D.3[22]: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.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



Appendix C
Coastal Climate Change Modelling Information

Table C.1 Extreme Sea Levels by Area for the 1 In 200 year event

Area	1 in 200 year extreme tide levels for years			
	2000	**2026**	**2070**	**2115**
Yarmouth	2.1	2.2	2.6	3.3
Bembridge	3.2	3.3	3.7	4.4
Totland	2.4	2.5	2.9	3.6
Cowes	2.6	2.7	3.1	3.8
Ryde	3.0	3.1	3.5	4.2
Hurst Point	2.4	2.5	2.9	3.6
Ventnor	3.1	3.2	3.6	4.2
Sandown & Shanklin	3.2	3.3	3.7	4.3
St Lawrence	3.0	3.1	3.5	4.1
Whitecliff Bay	3.3	3.7	3.8	4.4
Boulder Cliffs	2.5	2.7	3.1	3.7
Newtown	2.6	2.8	3.2	3.8
Gurnard	2.7	2.9	3.3	3.9

Table C.2 Extreme Sea Levels by Area for the 1 In 100 year event

Area	1 in 1000 year extreme tide levels for years			
	2000	**2026**	**2070**	**2115**
Yarmouth	2.3	2.4	2.8	3.5
Bembridge	3.4	3.5	3.9	4.6
Totland	2.7	2.8	3.2	3.9
Cowes	2.8	2.9	3.3	4.0
Ryde	3.2	3.3	3.7	4.4
Hurst Point	2.7	2.8	3.2	3.9
Ventnor	3.3	3.4	3.8	4.4
Sandown & Shanklin	3.4	3.5	3.9	4.5
St Lawrence	3.2	3.3	3.7	4.3
Whitecliff Bay	3.5	3.9	4.0	4.6
Boulder Cliffs	2.7	2.9	3.3	3.9
Newtown	2.8	3.0	3.4	4.0
Gurnard	2.9	3.1	3.5	4.1

Appendix C

Appendix D
GIS Dataset Descriptions

Source Data Discussion

The following is a short description of the source data GIS data used during the course of the SFRA. Where available, the reference scale of the map has been included in order to indicate the maximum scale of use for which the map was intended.

Ordnance Survey Basemap

A high level topographic map which provides an overview of the Island and the KDA's was used as a basemap where detailed ordnance information was not required. This map includes data such as the road network, green areas and contours. The data of this map was captured at 1:50,000 reference scale.

Mastermap

Mastermap data was made available by the IoW Council. This dataset is an accurate source of ordnance survey data that informed the SFRA at KDA and site specific scale. The reference scale of the dataset differs depending on the degree of urbanisation, with urban areas having a capture standard of 1:1,250 while for rural areas detail is reduced.

Potential Development Sites

Potential development sites were supplied the IoW Council and included several different datasets of '*Sites*', '*Large Sites*' and '*Employment Sites*'. This dataset identified those areas on the Island that were/might be considered for development. The reference scale of this dataset is unknown. Section 6 provides further details of the potential development sites on the Island.

Geology

Geological maps of the Island were sourced from the British Geological Society (BGS) on behalf of the Council. The datasets included solid (bedrock), drift (superficial), artificial geological maps, as well as linear geological features and areas of mass movement. The reference scale of these maps are 1:63,360. The mass movement dataset is discussed in greater detail in Section 7.3.1.

Soils

Soils data for the Island was sourced from a national gridded dataset of soils. This dataset is comprised of $1km^2$ cells with attributed values for the percentage composition of various soils for the cell of interest. The dataset also contains a HOST value for the soils in the cell. Given that the data originated in a $1km^2$ grid, specific detail about the spatial distribution of soils was lacking. Section 7.3.3 provides additional detail.

Groundwater Vulnerability

A digital dataset of groundwater mapping was provided by the Environment Agency. These maps show the vulnerability of groundwater as a combination of aquifer type and soils. The reference scale for this dataset is 1:100,000. Since soils data are included in the dataset, it was possible to supplement the less accurate national soils grid. Sections 7.3.1 and 7.3.2 discuss this dataset in greater detail.

Source Protection Zones

Source Protection Zones were provided by the Agency for the Isle of Wight. The zones show the risk of contamination from activities that might cause pollution to aquifers used for public water supply. The closer the potential contamination activity is to the abstraction point, the greater the risk classification. The reference scale of this dataset is unknown. Section 7.3.1 provides further information.

Environment Agency Main Rivers

The main rivers on the Island were sourced from an Environment Agency dataset of rivers defined as larger streams and rivers, including smaller watercourses of local significance.

Fluvial and Tidal Flood Outlines for Zones 2 and 3

The Environment Agency provided a digital dataset of the Island which outlined those areas affected by flooding. The data was divided according to flood zone 2 and 3, as well as fluvial and tidal. This data is sourced from modelling done for the Agency which used Synthetic Aperture Radar (SAR) elevation data.

Environment Agency Flood Model Outlines

The Environment Agency provided flood model outlines of various return periods for some of the rivers on the Island, including the Medina, Monkton Mead and Western Yar. This data was used where necessary, to update the fluvial flood outlines provided by the Agency. The accuracy of the datasets is dependant on the modelling process and its input data. The application of this data is discussed further in Section 5.

Historic Flood Outlines

Historic flood outlines were also provided by the Agency. The past flooding events included the years 1974, 1993, 1999 and 2000. The annual exceedence probability of the flood outlines is unknown, and as such, they were used to supplement the existing flood outlines. The reference scale of these outlines is unknown and is dependant on the accuracy of the original data and the scale at which they were digitised. Sections 2 and 6 provide further information about historic flooding on the Island.

Flood Defences

The National Flood and Coastal Defence Database from the Agency was the source for the location, extent and level of protection of flood defences on the Island. The reference scale of this dataset is unknown.

Datasets Produced by the SFRA

Attribution Database

The purpose of this section is to detail the method by which the potential site attribution dataset was created. Much of the relevant detail is mentioned in previous sections, and therefore the intention is to provide an overview of how a single attribute was assigned to a site which was covered by multiple attribute values. Section 4 provides an overview of the potential site attribution dataset. The attribute fields in this dataset were derived as follows:

SITE_ID

A unique identifier was assigned to each site and used the development area for each combined with the Feature ID (FID).

DEV_AREA

In order to retain the major development areas as earlier identified in conjunction with the Council, an attribute relating to the key development area into which the site falls, was included. Section 6 provides further detail on KDAs

AREA_HA

Area for each site was calculated and is represented in hectares (ha). This is important since it enables a site to be classified as requiring a FRA, since all sites over 1ha require a FRA regardless of whether they are vulnerable to flooding.

FRA_REQ

Sites were categorised into those requiring and not requiring a FRA. This was determined by whether or not a site was within any of the flood zones as recorded by the fields (Func_FP, FZ3_T, FZ3_F, FZ2_T and FZ2_F) and whether or not the site was over 1ha. Section 3 provides an overview of the flood risk zones as defined by PPS25.

FUNC_FP, Func_FP, FZ3_T, FZ3_F, FZ2_T and FZ2_F

Each site was attributed as to the flood zones into which it either partially or completely fell. This categorisation was independent of scale, such that a site was accordingly attributed even if only fractionally touched by a flood zone. Details about the flood zones as defined by PPS25 are found in Section 3.

PROB_Y

By assessing whether a site fell within a flood risk area, and the maximum flood risk posed, it was possible to assign a qualitative attribute to each of the affected sites corresponding to the qualitative descriptions used by PPS25. This attribution applied a precautionary approach by identifying the greatest flood risk posed to a site.

SOURCE and PATHWAY

A visual inspection of the potential development sites on the Island enabled the attribution of this field. This was done by identifying those sites at risk of flooding and considering their site context in association with neighbouring watercourses/water bodies.

APP_USES

The various fields recording flood risk to the sites allowed for an initial assessment of appropriate land uses for each site. Thus a site falling outside the flood zone was attributed as not having any restrictions in terms of suitable uses, while for sites falling within flood risk zone, a precautionary approach was used, identifying the most severe flood risk falling on the site, and specifying appropriate uses accordingly. It is therefore advisable to consult the site specific flood risk definition dataset to determine the site distribution be consulted. Table D.2 of Annex D PPS25, as replicated in Appendix B provides further information.

HISTORIC

Historic flood outlines were provided by the Environment Agency for the Island. These outlines provided supporting information of those areas already identified at risk of flood as defined by the functional floodplain, flood zone 2 and flood zone 3 as well identifying potential flood risk areas not included in the Environment Agency maps. The sites were therefore attributed with the month and year for each of the historic floods which they intersected. This categorisation was independent of scale, such that a site was accordingly attributed even if it only fractionally passed through a historic flood zone. Section 6 contains further detail about historic flooding on the Island.

RIV_20_BUF

A generic assessment of the influence of major rivers on flood risk was carried out, since the fluvial flood risk zones as defined by the Agency do not cover all the main rivers on the Island. It was therefore agreed at a meeting

between the IoW Council, the Agency and Entec (on the 18 September 2007), that a 20m buffer would be applied to all major rivers on the Island. Sites that intersected the buffered rivers where then attributed accordingly. This advice is in line with current Agency requirements, since as the Environment Agency is a statutory consultee under Town and Country Planning Act , their authority extends past areas within Flood Zone 2 and 3, and includes development within 20 metres of main rivers. The buffer is 20m either side of the main river centreline. Section 6 details the influence this attribution had on some of the site.

DEFENCES

Since no areas benefiting from flood defences were available for use in the project, an initial assessment was done. This required that all defences on the Island be considered and placed into a single dataset, and insignificant defences removed. For this purpose, the National Flood and Coastal Defence Database was accessed, and defences for the Isle of Wight were extracted. This database provided the position of flood defences on the Island, as well as other related information, including the standard of protection (SOP) offered by each defence (i.e. *DESIGN_STAN*). SOP for the defences on the Island ranged from 5 years to 100 years. It was decided that defences below 20 years SOP, were not significant enough to warrant their inclusion in the identification of areas benefiting from defences, since the minimum return period covered by the different flood zones is for the functional floodplain (20 years). Defences below 20 years SOP were therefore excluded from further consideration.

Sites were said to be either "*Site likely NOT benefiting from flood defences*" or "*Site potentially benefiting from flood defences*". This was a subjective operation and is intended to give just an indication of the existence of a defence.

TIDAL_CC_2 and TIDAL_CC_3

The impact of climate change on fluvial flood risk was an important component of the SFRA. This is because climate change is expected to cause a rise in sea-levels all around the Island. This will have the direct effect of increase the risk of flooding to areas around the coast, and up estuaries. Section 4 discusses this in more detail, and presents the data used and the assumptions made.

The attribution of sites was done for both the future tidal flood zone 2 and 3, since they are not coincident with each other, and have individual bearing on sites with regard to flood risk, and consequently flood risk assessments. For both *TIDAL_CC_2* and *TIDAL_CC_3*, the minimum date from which climate change was predicted to affect the site was recorded. Thus, if a site was overlain by the future flood zones of climate change scenarios 2026, 2070 and 2115, the site would be attributed with the climate change scenario of 2026. A site need only clip the climate change extents for it to be attributed. The site doe not have to be completely within the extents.

FLUVIAL_CC

Climate change on fluvial flood risk was also necessary to assess, since rainfall intensities and hence peak river flows are likely to increase on the Island in the future, resulting in the extension of current fluvial flood zones . Section 4 discusses this in more detail, and provides clarity on the assumptions and simplifications made.

Once areas of fluvial climate change were identified, it was then possible to attribute the sites with an attribute as to whether or not they intersected the identified fluvial climate change areas. A site was accordingly attributed even if it only fractionally passed through an area " *of Fluvial Floodplain Potentially Sensitive to Climate Change*. (See Figure 15 in Appendix A for the areas identified as being potentially sensitive)

SUDS_SUIT and SUDS_VUL

The applicability of SuDS on the Island was a component of the work undertaken as part of the SFRA. This was done in order to provide a site by site generalisation of the suitability of SuDS as categorised by attenuation vs. infiltration techniques. Sections 7.3.1 and 7.3.2 provide a description of the origin of the datasets used to attribute the sites, and the processing involved to arrive at the two SuDS classifications.

SUDS_SUIT was assigned to each site it describes the suitability of infiltration SuDS techniques. If a site was predominantly in an area of 'high' infiltration suitability, and only a small portion was intersected by a 'low' infiltration suitability area, a worst case scenario was assumed, and the resulting *SUDS_SUIT* attribution for that site was recorded as 'low'. Areas of mass movement were assigned a low suitability

SUDS_VUL this classification describes the potential for the contamination of groundwater. This assessment was based on Groundwater protection Zones and three classifications of were produced, low, medium and high. As with *SUDS_SUIT* a worst case scenario was assumed in that if a site was predominantly in an area of low contamination potential but with a small portion in an area of medium contamination potential – the site was assigned a medium contamination potential.

RUNOFF_POT

A component of all FRA's is the requirement for an assessment of site drainage to be undertaken. This process is site-specific and would be inappropriate for the purposes of a SFRA, as 7.3.3 details. Nonetheless, an initial Island wide assessment of runoff potential was carried out, since it provides a preliminary indication of runoff.

This assigned a qualitative attribute to each site of very low, low, medium, high or very high. This attribution was determined through the *SPR_HOST* for each site, which in turn was assigned according to the *HOST* classification for the site. Unlike much of the previous attribution in the dataset, *RUNOFF_POT* required that the predominant *HOST* class for each site be assigned as the attribute value for that site. Therefore, each site was attributed according to the *HOST* class most prevalent (assuming a site was intersected by more than one class). It should be noted though, that some sites were not covered by the original *HOST* dataset, and were therefore attributed as 'unknown'.

HOST and SPR_HOST

HOST and *SPR_HOST* were used to derive the *RUNOFF_POT* for each site. Section 7 describes the process in detail. Seven unique values of host were extracted for the IoW, from a 1km x 1km vector grid of UK soil properties. These values were then matched to their corresponding *SPR_HOST* values according to Table D1 (FEH, 1999).

Table D1 Host Soil Classes and Associated Surface Percentage Runoff.(*FEH 1999*)

HOST CLASS	SPR VALUE	HOST CLASS	SPR VALUE	HOST CLASS	SPR VALUE
1	0.020	11	0.020	21	0.472
2	0.020	12	0.600	22	0.600
3	0.145	13	0.020	23	0.600
4	0.020	14	0.253	24	0.397
5	0.145	15	0.484	25	0.496
6	0.338	16	0.292	26	0.587
7	0.443	17	0.292	27	0.600
8	0.443	18	0.472	28	0.600
9	0.253	19	0.600	29	0.600
10	0.253	20	0.600		

Appendix E
Supporting SuDS Information

Table E1 SuDS - Suitability According to Subdivisions of Water Quality, Quantity and Environmental Benefits

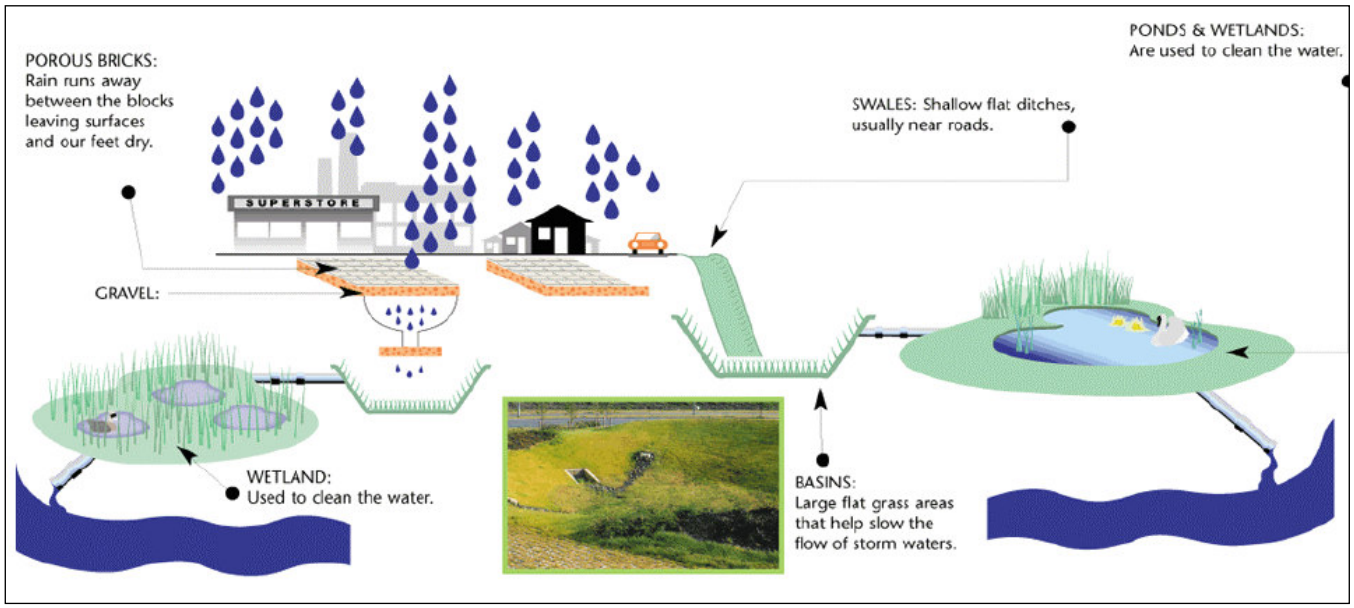
Technique	Description	Water quantity				Water quality								Enviro. benefits		
		Conveyance	Detention	Infiltration	Water harvesting	Sedimentation	Filtration	Adsorption	Biodegredation	Volatilisation	Precipitation	Phytoremediation	Nutrification	Aesthetics	Amenity	Ecology
Water butts, site layout	Good house keeping and design practices	=	=	#	=	=	=	=	=	=	=	=	=	=	=	=
Pervious pavements	Allow inflow of rainwater into underlying construction/soil		#	#	=	#	#	#	#	#				=	=	=
Filter drain	Linear drains/trenches filled with permeable material, often with a perforated pipe in the base of the trench	#	#				#	#	#	#						
Filter strips	Vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and other particulates	=	=	=		#	#	#	#					=	=	=
Swales	Shallow vegetated channels that conduct and/or retain water (and can permit infiltration when un-lined). The vegetation filters particulates	#	#	=		#	#	#	#			=		=	=	=
Ponds	Depressions used for storing and treating water. They have a permanent pool and bankside emergent and aquatic vegetation		#	=	#	#	#	#	#	#	#	#	#	#	#	#
Wetlands	As ponds, but the runoff flows slowly but continuously through aquatic vegetation that attenuates and filters the flow. Shallower than ponds	=	#	=	#	#	#	#	#	#	#	#	#	#	#	#
Detention basin	Dry depressions designed to store water for a specified retention time		#			#	=	=	#			=		=	=	=
Soakaways	Sub-surface structures that store and dispose of water via infiltration			#			#	#	#							
Infiltration trenches	As filter drains, but allowing infiltration through trench base and sides	=	#	#			#	#	#	#						
Infiltration basins	Depressions that store and dispose of water via infiltration		#	#			#	#	#	#				=	=	=
Green roofs	Vegetated roofs that reduce runoff volume and rate		#				#	#	#	#	#	#	#	#	=	#
Bioretention areas	Vegetated areas for collecting and treating water before discharge downstream, or to the ground via infiltration.		#	#		#	#	#	#	#	#	#	#	#	#	#
Sand filters	Treatment devices using sand beds as filter media		#	=			#	#	#	#	#					
Silt removal devices	Manhole and/or proprietary devices to remove silt					#										
Pipes, subsurface storage	Conduits and their accessories as conveyance measures and/or storage. Water quality can be targeted using sedimentation and filter media.	#	#			=	=									

High/primary process = Some opportunities, subject to design

Information in table modified after CIRIA (2007)

The information presented in Table E1 is based on the assumption that only a single SuDS technique is implemented on a site and is independent of connected SuDS.

Figure E1 Likely Implementation of SuDS Management Train



Source of this Graphic = GDSDS (2005)

Table E2 Influential site characteristics on the applicability of SuDS (Modified after CIRIA 2007)

SuDS Group	Technique	Soils		Area draining to a single SuDS component		Minimum depth to water table		Site slope		Available head	
		Impermeable	Permeable	0 – 2 ha	> 2 ha	0 – 1 m	> 1 m	0 – 5%	> 5 %	0-1 m	1 – 2 m
Retention	**Retention pond**	Y	Y[1]	Y	Y[5]	Y[2]	Y[2]	Y	Y	Y	Y
	Subsurface storage	Y	Y	Y	Y[5]	Y[2]	Y[2]	Y	Y	Y	Y
Wetland	**Shallow wetland**	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Extended detention wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Pond/wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Pocket wetland	Y[2]	Y[4]	Y[4]	N	Y[2]	Y[2]	Y	N	Y	Y
	Submerged gravel wetland	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
	Wetland channel	Y[2]	Y[4]	Y[4]	Y[6]	Y[2]	Y[2]	Y	N	Y	Y
Infiltration	**Infiltration trench**	N	Y	Y	N	N	Y	Y	Y	Y	N
	Infiltration basin	N	Y	Y	Y[5]	N	Y	Y	Y	Y	N
	Soakaway	N	Y	Y	N	N	Y	Y	Y	Y	N
Filtration	**Surface sand filter**	Y	Y	Y	Y[5]	N	Y	Y	N	N	Y
	Sub-surface sand filter	Y	Y	Y	N	N	Y	Y	N	N	Y
	Perimeter sand filter	Y	Y	Y	N	N	Y	Y	N	Y	Y
	Bioretention/filter strips	Y	Y	Y	N	N	Y	Y	N	Y	Y
	Filter trench	Y	Y[1]	Y	N	N	Y	Y	N	Y	Y
Detention	**Detention basin**	Y	Y[1]	Y	Y[5]	N	Y	Y	Y	N	Y
Open channels	**Conveyance swale**	Y	Y	Y	N	N	Y	Y	N[3]	Y	N
	Enhanced dry swale	Y	Y	Y	N	N	Y	Y	N[3]	Y	N
	Enhanced wet swale	Y[2]	Y[4]	Y	N	Y	Y	Y	N[3]	Y	N
Source control	**Green roof**	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
	Rainwater harvesting	Y	Y	Y	N	Y	Y	Y	Y	Y	
	Permeable pavement	Y	Y	Y	Y	N	Y	Y	N	Y	Y

Y = Yes

N = No

Y1 = with liner

Y3 = Unless follows contours

Y4 = With liner and constant surface baseflow, or high ground water table

Y5 = possible, but not recommended (appropriate management train not in place)

Y2 = with surface baseflow Y6 = Where high flows are diverted around SuDS component

Additional policy and general guidance on SuDS and drainage include the following:

- PPS25 Practice Guide, 2007
- Water Framework Directive (200/60/EC);
- Highways Act, 1980;
- Town and Country Planning Act, 1990;
- Town and Country Planning Act, 1990 (amended) NB covers S106 Agreements;
- Town and Country Planning Act, 1991;
- Construction, Design and Management Regulations, 1994;
- Building Regulations Part C Approved Document H – Drainage and Waste Disposal of the Building Regulations 2002 Amendment;
- ODPM 2004. Planning Policy Statement 1: *Delivering Sustainable Development*;
- Communities and Local Government, 2006. Planning Policy Statement 25: *Development and Flood Risk*;
- Communities and Local Government, 2007. *Development and Flood Risk: A practice guide companion to PPS25* ;
- BRE Digest 365 Soakaway Design BSE EN 752-4: 1998 Drain and Sewer Systems outside buildings, part 4;
- CIRIA. Sustainable Drainage Systems – Hydraulic, Structural and water quality advice (CIRIA 609);
- CIRIA. The SUDS Manual (CIRIA C697);
- CIRIA. *Source control using constructed previous surfaces. Hydraulic, structural and water quality performance issues* (CIRIA 582);
- CIRIA. *Infiltration Drainage – manual of good practice* (CIRIA R156);
- CIRIA. *Review of the design and management of constructed wetlands* (CIRIA R180);
- CIRIA. *Control of pollution from highway drainage discharge* (CIRIA R142);
- CIRIA. *Design of flood storage reservoirs* (CIRIA Book 14);
- CIRIA. *Designing for exceedance in urban drainage systems – good practice* (CIRIA C635);

- CIRIA. *Rainwater and grey-water use in buildings* (CIRIA C539);
- Defra, 2004. *Making Space for Water – Developing a new Government strategy for flood and coastal erosion risk management in England: A Consultation Exercise;*
- Defra, 2005. *Making Space for Water – Taking forward a new Government strategy for flood and coastal erosion risk management in England: First Government response to the Autumn 2004;*
- Defra, 2006. *Urban Flood Risk and Integrated Drainage*. Scoping report and pilot studies;
- Environment Agency, 2003. Harvesting rainwater for domestic uses: an information guide;
- HR Wallingford. Use of SUDS in high density development;
- National SUDS Working Group, 2006. Interim Code of Practice for SUDS; and
- WRc. Sewers for Adoption 6th Edition (SfA6) (published by Water UK).

Appendix F
Development Control – Standard Paragraphs version 4 PPS25 compliant

Author :Laura Short/Jemma Woodbridge/John Smith **Date of last change: June 2007**

Keywords	**Paragraph type: Objection**
No evidence that the Sequential Test has been properly applied .	The Environment Agency objects to this application because no evidence has been provided that the flood risk Sequential Test has been properly applied. Our objection will remain until your Authority has carried out the Sequential Test to demonstrate that there are no reasonably available alternative sites in areas with a lower probability of flooding that would be appropriate for the type of development proposed. The application site lies in an area of <*high/medium*> flood probability as defined by PPS25 known as Flood Zone <*3a/3b/2*> . The availability of reasonably available sites at lower flood risk following the application of the Sequential Test is sufficient reason in itself for a refusal of planning permission. This approach reflects the requirements of Planning Policy Statement 25 (PPS25) Paragraphs 14-17 and Annex D. We will withdraw our objection on Sequential Test grounds if your authority can confirm that it has applied the Sequential Test and that alternative sites are not available.
Sequential Test indicates other lower risk sites are reasonably available	The Environment Agency objects to this application because the results of the flood risk Sequential Test indicate that development should occur in this area, only when the supply of alternative reasonable available <*site/sites*>, situated in a lower flood probability area <*have/has*> been exhausted. The application site lies in an area of <*high/medium*> flood probability as defined by Planning Policy Statement 25 (PPS25) known as Flood Zone <*3a/3b/2*>. PPS25 requires decision makers to steer new development to areas at the lowest probability of flooding by applying a Sequential Test. In this instance the Sequential Test has been carried out and has indicated that the <*site/sites*> shown below should be developed in preference to this planning application <*Enter name of site*>,which is located at <*enter the site* address>. The availability of reasonably available sites at lower flood risk following the application of the Sequential Test is sufficient reason in itself for a refusal of planning permission. This approach reflects the requirements of PPS25 paragraphs 14-20 and annex D. The Environment Agency will withdraw its objection on Sequential Test grounds if your Authority can confirm that it has applied the Sequential Test and that the alternative sites listed above have been discounted for other sustainability reasons
Development vulnerability not appropriate for the Flood Zone.	The Environment Agency objects to this application because the proposed development falls into a flood risk vulnerability category that is inappropriate for the Flood Zone in which the application site is located. The application site lies in an area of <*high/medium*> flood probability called Flood Zone <*3a/*3b/2> as defined by Planning Policy Statement 25 (PPS25). The proposed application is classified as <*use table D2 PPS25*> in accordance with table D2 of PPS25 and is deemed inappropriate for this location.
FRA inadequate	The Environment Agency OBJECTS to the proposed development. The flood risk information submitted in support of the application is not acceptable to the Environment Agency for the following reasons: REASONS: <*add omissions/areas for clarification/more detail etc as appropriate*>.
Unacceptable risk to life and/or property	The Environment Agency OBJECTS to the proposed development. The site lies within as area of <*high/medium*> flood probability as defined in Planning Policy Statement 25 (PPS25) where, it is considered that the risk to life and property, <*both within the development and to <existing development*>from<*tidal/fluvial/groundwater/sewage*> flooding would be unacceptable if the development were to be allowed. This objection must be supported by REASONS which may include: 1. The proposed development does not have a safe means of access or egress in the event of flooding. There would be an unacceptable increase in risk to the health and safety of the occupants and impose an additional workload and risk to the emergency services. 2. The site lies within a tidal flood risk area and has been identified as having a greater than 0.5% chance of flooding each year. 3. The site lies within Flood Zone <*3a/3b/2*> and has been identified as having a greater

Keywords	Paragraph type: Objection
	than *<0.1%/0.5%/1%>* chance of flooding each year. 4. The site lies within Flood Zone 1 but the impact of climate change during the lifetime of the development will increase the probability of flooding to a greater than *<0.1%/0.5%/1.0%>* chance in each year. 5. The proposed development is currently not defended to an appropriate standard. Defences should be designed to protect (for the lifetime of the development) against the *<1% probability fluvial/0.5% probability tidal>* flood event 6. The proposed development lies within the flood plain and will impede flood flow routes and reduce storage capacity, which may increase the risk of flooding elsewhere. 7. This development will restrict planned maintenance and emergency access to the watercourse. The permanent retention of a continuous unobstructed area is an essential requirement for flood defence purposes. 8. The proposal does not include the provision of an adequate access through the site to the sea wall. The permanent retention of a continuous unobstructed area is an essential requirement for the future maintenance or improvement.
Lack of Flood Risk Assessment	The Environment Agency objects to this application in its current form because it has been submitted without a Flood Risk Assessment (FRA). This is contrary to the requirements of Planning Policy Statement 25 (PPS25) paragraphs 10, 13 and Annex E. The flood risks resulting from and to the proposed development are therefore unknown. The application site lies in an area of *<low(but is larger than 1 Ha/medium/high>* flood risk as defined in PPS25 Table D1. Paragraph 13. PPS 25 requires applicants for planning permission to submit a FRA in accordance with Annex E of PPS25 when development is proposed in such locations.
Lack of or inadequate surface water assessment as part of a FRA (Flood Zone 1)	The Environment Agency OBJECTS to the proposed development on the grounds that the application may present a significant flood risk from the generation of surface water run-off, but is not accompanied by a Flood Risk Assessment (FRA) as required by Planning Policy Statement 25 (PPS25). ADVICE: This site is located in Flood Zone 1, which is land outside the floodplain as shown on the Environment Agency's Flood Zone Maps. Whilst the site is outside the floodplain, development in this category (i.e. over 1 ha) can generate significant volumes of surface water. The impact and risks posed by this will vary according to the characteristics of both the development and the catchment. The applicant must submit a full FRA which must fully address the risk of flooding associated with any increase in surface water run off from the site. The Environment Agency will normally require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (plus an allowance for climate change, 1 in 100 year event *<+20% commercial development +30% residential development>*) the developed rate of runoff into a watercourse or sewerage network should be no greater than the undeveloped rate of runoff for the same event.
Surface Water Condition	CONDITION: Development shall not begin until drainage details, incorporating sustainable drainage principles and an assessment of the hydrological and hydrogeological context of the development, have been submitted to and approved by the local planning authority, and the scheme shall subsequently be implemented in accordance with the approved details before the development is completed. REASON: To prevent the increased risk of flooding and to improve water quality.
Evacuation (Can also be used as advice)	CONDITION: Development must not begin until the Emergency Services have been consulted and have considered the effectiveness of the flood evacuation plans. ADVICE: The Environment Agency advises that evacuation routes should be dry during flooding events. However where this is impossible and the Planning Authority is minded to allocate sites or grant planning permission. Annex H11 of Planning Policy Statement 25 (PPS25) advices that the Emergency Services should be consulted during the preparation of Local Development Documents and during the consideration of planning applications where emergency evacuation requirements are an issue.
Inadequate	CONDITION: A full capacity study of the receiving drainage system must be carried out

Keywords	Paragraph type: Objection
downstream system	before the development commences. ADVICE: The drainage system "downstream" of this development may be inadequate to take increased flows. The Environment Agency is concerned that the flood risk to both this development and to existing development is fully understood before development commences..
Development in accordance with FRA	CONDITION: The development must fully comply with the mitigation strategy detailed within the Flood Risk Assessment (FRA) before any of the development can be occupied. ADVICE: To ensure that a site can be developed safely the FRA is proposing mitigation measures that ensure the <*development/existing development*> is safe from flooding. It is essential that this mitigation is completed before any of the site is occupied.
New works in main river	Under the terms of the Water Resources Act 1991 (Section 109,1), no person shall erect any structure in, over or under a watercourse which is part of the main river < *insert name*> without the prior written Consent of the Environment Agency. This consent will only be issued if the works do not pose a flood risk to property and people and do not conflict with the Environment Agency's other duties.
Repairs/ alterations in main river	Under the terms of the Water Resources Act 1991 (Section 109,2), no person shall alter or repair any structure in, over or under a watercourse which is part of the main river <*insert name*> without the prior written Consent of the Environment Agency, if the work is likely to affect the flow of water in the watercourse or impede any drainage work. This consent will only be issued if the works do not pose a flood risk to property and people and do not conflict with the Environment Agency's other duties.
Byelaws, 15m tidal	Under the Southern Region Land Drainage and Sea Defence Byelaws, the prior written Consent of the Environment Agency is required for any proposed works within 15 metres of a line drawn on the landward side of any sea defence. This Consent will only be issued if the works do not pose a flood risk to property and people.
Byelaws, 8m fluvial	Under the Southern Region Land Drainage and Sea Defence Byelaws, the prior written consent of the Environment Agency is required for any proposed works within 8 metres of the top of the bank of the <*enter name* >, designated a 'main river'. This Consent will only be issued if the works do not pose a flood risk to property and people.
LDA 1991, Ordinary Watercourse	Under the terms of the Land Drainage Act 1991, Section 23 (1a) no person shall erect any mill, dam, weir or other like obstruction to the flow of any ordinary watercourse OR Section 23 (1b) erect any culvert that would be likely to affect the flow of any ordinary watercourse or alter any culvert without the Consent of the Environment Agency. This Consent will only be issued if the works do not pose a flood risk to property, and/or people, and do not conflict with the Environment Agency's other duties.
Sequential Test Advice	We have no objection to the application as submitted but wish to advise your Authority as follows: The application site lies in Flood Zone <*3a/3b/2*> as defined by Planning Policy Statement 25 (PPS25). PPS25 requires decision–makers to steer new development to areas at the lowest probability of flooding by applying a flood risk 'Sequential Test'. In this instance no evidence has been provided that the Sequential Test has been properly carried out. We advise that the Sequential Test must be carried out at early stage of the planning application determination process. Failure to apply the Test at an early stage can result in a waste of time and money for all parties in the completion and assessment of Flood Risk Assessments, for development that is later refused planning permission on Sequential Test grounds.
Climate Change	Advice on climate change and its impact on sea level rise and fluvial flows can be found in Table B.1 and Table B.2 of Planning Policy Statement 25 (PPS25). The Environment Agency is sometimes able to, upon request, provide <*sea level rise predictions/fluvial flood levels*> based on the Ordnance Survey's Newlyn Datum. For your information the 0.5% annual probability extreme tide level for the year <*2060/2115*> in this area is <*enter level*>Above Ordnance Datum Newlyn. For some areas further information on flood levels may be available from the Environment Agency at a small cost.

Keywords	**Paragraph type: Objection**
Riparian Owners	A riparian landowner has duties to landowners both upstream and downstream of their land and cannot undertake any actions that are likely to cause flooding. In general it is a riparian landowner's duty to accept water from their upstream neighbour and pass it on to the downstream neighbour together with the drainage from their property. It is the responsibility of each respective riparian landowner to ensure that the watercourse remains clear from any debris to ensure the clear passage of flows. As a riparian landowner you are responsible for maintaining the beds and banks of the watercourse (including trees and shrubs growing on the banks), and for clearing any debris, natural or otherwise even if it did not originate from your land.
Watercourse ownership, maintenance	Any watercourse within a development should have ownership fully resolved before work commences, this is to ensure that during development and in the future any problems can be resolved quickly. Upon completion of the development, riparian owners must be informed of their rights and responsibilities particularly regarding future maintenance, to prevent the situation arising where no-one admits to owning a watercourse with subsequent maintenance problems.
SUDS	Both Planning Policy Statement 25 (PPS25) and the Building Regulations 2000 set out a hierarchy for surface water disposal in which priority is given to the use of sustainable drainage systems over first watercourses and then sewers. The use of SUDS can make a significant improvement to both the quantity and the quality of surface water leaving a site, provide biodiversity opportunities and provide a local amenity. Further information on SUDS can be found in PPS25 annex F, the CIRIA C697 document "The SUDS Manual" and the Interim Code of Practice
Design calculations **(use paragraphs as required).**	1.The Environment Agency would wish to see details of design calculations for the volume of surface water attenuated on the site, to ensure that there is sufficient capacity to store the 1% probability storm and detail of any control structures. Discharge from the structure to the receiving watercourse should be restricted to the equivalent greenfield runoff or less. Consideration should be given to impact of climate change. 2. The use of sustainable drainage systems (SUDS) to improve water quality is an important consideration when designing drainage schemes. Unfortunately balancing ponds do not provide sufficient water quality improvements for the Environment Agency to recommend their use. The Environment Agency prefers the use of extended detention basins and retention ponds to provide the important element of water treatment. The Environment Agency will ask to see the volume for treatment calculations where water quality improvements are proposed. Further information can be found in the CIRIA document "The SUDS Manual" CIRIA C697. 3.Wherever possible the Environment Agency recommends the use of an open channel to connect to the watercourse. 4.The Environment Agency has no control over existing public sewers. However, you do have limited rights to connect to the public sewer. Before doing so you should ensure that you have agreed, with the sewerage undertaker, an appropriate point of connection. To avoid flooding existing downstream development you must ensure that the public sewerage system has sufficient capacity to take the flows from your development. 5.*Residential:* The Environment Agency will require that, for the range of annual flow rate probabilities up to and including the 1% annual probability (plus an allowance for climate change of +30% in a 1 in 100 year event) the developed rate of runoff into the watercourse or sewerage network should be no greater than the undeveloped rate of the runoff for the same event. The drainage arrangement should also be such that the volumes of surface water leaving the site are no greater than that at pre-development *Non Residential:* The Environment Agency will require that, for the range of annual flow rate probabilities up to and including the 1% annual probability (plus an allowance for climate change of +20%, in a 1 in 100 year event) the developed rate of runoff into the watercourse or sewerage network should be no greater than the undeveloped rate of the runoff for the same event. The drainage arrangement should also be such that the volumes of surface water leaving the site are no greater than that at pre-development.

Keywords	Paragraph type: Objection
Soakaways, BRE 365	The Local Planning Authority should be satisfied that soakaways will work effectively in this locality during winter periods when high ground water levels exist. To ensure that the disposal of surface water to soakaways will not exacerbate or create flooding, it is recommended that the Local Planning Authority request confirmation from the developer that the soakaways have been adequately designed and constructed. They should conform to British Research Establishment (BRE) 365 taking into consideration potential fluctuations in ground water levels.
Tide locked storage	The Environment Agency recommends that sufficient storage is provided within the surface water system to accommodate the co-incidence of the 1% rainfall storm with the 0.5% annual probability extreme sea level for the lifetime of the development. This is to prevent the surcharging and flooding of the surface water drainage system because of tide locking. SUDS systems should be utilised for their environmental advantages e.g. water quality, biodiversity, amenity and recreation.
Consult the Marine and Fisheries Agency	The applicant is advised to consult with the Marine and Fisheries Agency (Tel: 0207 270 8665) to discuss any additional licenses under FEPA (Food and Environment Protection Act 1985 Pt2) or consents under CPA (Coast Protection Act 1949).
Consult Natural England	The Environment Agency suggests that the applicant should consult with Natural England (Tel: 02380 286410) on the proposed works, who may have specific issues and concerns that need to be addressed.
Development where flood risk standing advice applies.	The Environment Agency has produced standing advice to enable Local Planning Authorities in England to make decisions on low risk planning applications where flood risk is an issue without directly consulting the Environment Agency for an individual response. It also identifies those development situations in areas of high flood risk where a case by case consultation with the Environment Agency should continue. In the instance of this application the Environment Agency would refer you to the Flood Zones matrix. The matrix sets out how the Environment Agency is likely to respond to proposed development in different combinations of location and development type. This information can be found at: http://www.pipernetworking.com/floodrisk/matrix.html
No objection	There is no objection from the Development Control team to this proposal.
No objection, good flood risk assessment	Following consultation with the applicant and the submission of a flood risk assessment *<Ref/Date/ Author>* which concludes that there is no increase in risk to people and property, the Environment Agency has no objection on flood risk grounds to this proposal.
Replacement building, floor area check	The proposed replacement of an existing property will result in the loss of storage in the flood plain. The applicant should provide a measurement of floor area to compare the existing to the proposed, including all buildings that are to be demolished and areas of flood storage. The Environment Agency may reconsider its stance on this development should "like for like" compensatory flood storage be provided. Compensation is the matching of volumes lost to the flood plain through development with new floodplain volume created by reducing ground levels. The compensatory volume must be provided at the same level as the lost storage. An equal volume of floodplain must be created to that taken up by the development. This volume of flood plain must be created equal to that taken up by the development. This equal volume must apply at all levels between the lowest point on the site and the design flood level. Normally this is therefore calculated by comparing volumes taken up by the development, and volumes offered by the compensatory storage for a number of horizontal slices through the level range defined above. Typically the thickness of a slice should be about 200mm. This may vary in the case of large, very flat sites, where 100mm or 50mm could be used; or in very steep sites with a high range of flood water levels slice thickness should be set to provide 10 to 15 slices.

Keywords	**Paragraph type: Objection**
Floodproofing	Floodproofing measures that can be taken to reduce the damage to <*buildings/property*> are becoming more common in areas that are subject to flooding. These measures include bringing all electrical services down from ceilings, raising slab levels, covers for <*doors/airbricks*>, <*solid stone/concrete floors*> and no studwork partitions on ground floors. Further information is available in the technical guide "Improving the Flood Performance of New Buildings: Flood Resilient Construction" published on 15 May 2007 by RIBA Publishing, ISBN 978 1 85946 287 4. The guide is also available on the CLG website through the Planning Portal at: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf. It covers the nature of flooding and the planning process; design strategies and the options of avoidance, resistance and resilience; building techniques; and a summary of the research done.
Details of guidance for FRA's	Detailed guidance on many aspects regarding flood risk including advice on producing Flood Risk Assessments (FRAs) can be found in the Communities and Local Government document "Development and Flood Risk: A Practical Guide Companion to PPS25". This guide is available on the CLG website at: http://www.communities.gov.uk/index.asp?id=1506265 To enable development to take place a FRA must prove that the development is safe and that flood risk is not increased to existing properties for the lifetime of the development. FRAs should be appropriate for the scale of the development and can include the following information: A flood level for the 1% annual probability fluvial flooding event A 0.5% annual probability extreme tide level The above plus an allowance for climate change A topographic survey of the site including the access routes Identification of likely routes for flood waters Site drainage arrangements Any existing defences and their level of protection Source(s) of flooding A hydrographic survey An evacuation plan agreed with the LPA
Sequential Test Advice	We have no objection to the application as submitted but wish to advise your Authority as follows: The application site lies in Flood Zone <*3a/3b/2*> as defined by Planning Policy Statement 25 (PPS25). PPS25 requires decision–makers to steer new development to areas at the lowest probability of flooding by applying a flood risk 'Sequential Test'. In this instance no evidence has been provided that the Sequential Test has been properly carried out. We advise that the Sequential Test must be carried out at early stage of the planning application determination process. Failure to apply the Test at an early stage can result in a waste of time and money for all parties in the completion and assessment of Flood Risk Assessments, for development that is later refused planning permission on Sequential Test grounds.
Climate Change	Advice on climate change and its impact on sea level rise and fluvial flows can be found in Table B.1 and Table B.2 of Planning Policy Statement 25 (PPS25). The Environment Agency is sometimes able to, upon request, provide <*sea level rise predictions/fluvial flood levels*> based on the Ordnance Survey's Newlyn Datum. For your information the 0.5% annual probability extreme tide level for the year <*2060/2115*> in this area is <*enter level*>Above Ordnance Datum Newlyn. For some areas further information on flood levels may be available from the Environment Agency at a small cost.

Keywords	**Paragraph type: Objection**
Riparian Owners	A riparian landowner has duties to landowners both upstream and downstream of their land and cannot undertake any actions that are likely to cause flooding. In general it is a riparian landowner's duty to accept water from their upstream neighbour and pass it on to the downstream neighbour together with the drainage from their property. It is the responsibility of each respective riparian landowner to ensure that the watercourse remains clear from any debris to ensure the clear passage of flows. As a riparian landowner you are responsible for maintaining the beds and banks of the watercourse (including trees and shrubs growing on the banks), and for clearing any debris, natural or otherwise even if it did not originate from your land.
Watercourse ownership, maintenance	Any watercourse within a development should have ownership fully resolved before work commences, this is to ensure that during development and in the future any problems can be resolved quickly. Upon completion of the development, riparian owners must be informed of their rights and responsibilities particularly regarding future maintenance, to prevent the situation arising where no-one admits to owning a watercourse with subsequent maintenance problems.
SUDS	Both Planning Policy Statement 25 (PPS25) and the Building Regulations 2000 set out a hierarchy for surface water disposal in which priority is given to the use of sustainable drainage systems over first watercourses and then sewers. The use of SUDS can make a significant improvement to both the quantity and the quality of surface water leaving a site, provide biodiversity opportunities and provide a local amenity. Further information on SUDS can be found in PPS25 annex F, the CIRIA C697 document "The SUDS Manual" and the Interim Code of Practice
Design calculations **(use paragraphs as required).**	1.The Environment Agency would wish to see details of design calculations for the volume of surface water attenuated on the site, to ensure that there is sufficient capacity to store the 1% probability storm and detail of any control structures. Discharge from the structure to the receiving watercourse should be restricted to the equivalent greenfield runoff or less. Consideration should be given to impact of climate change. 2. The use of sustainable drainage systems (SUDS) to improve water quality is an important consideration when designing drainage schemes. Unfortunately balancing ponds do not provide sufficient water quality improvements for the Environment Agency to recommend their use. The Environment Agency prefers the use of extended detention basins and retention ponds to provide the important element of water treatment. The Environment Agency will ask to see the volume for treatment calculations where water quality improvements are proposed. Further information can be found in the CIRIA document "The SUDS Manual" CIRIA C697. 3.Wherever possible the Environment Agency recommends the use of an open channel to connect to the watercourse. 4.The Environment Agency has no control over existing public sewers. However, you do have limited rights to connect to the public sewer. Before doing so you should ensure that you have agreed, with the sewerage undertaker, an appropriate point of connection. To avoid flooding existing downstream development you must ensure that the public sewerage system has sufficient capacity to take the flows from your development. 5.*Residential:* The Environment Agency will require that, for the range of annual flow rate probabilities up to and including the 1% annual probability (plus an allowance for climate change of +30% in a 1 in 100 year event) the developed rate of runoff into the watercourse or sewerage network should be no greater than the undeveloped rate of the runoff for the same event. The drainage arrangement should also be such that the volumes of surface water leaving the site are no greater than that at pre-development *Non Residential:* The Environment Agency will require that, for the range of annual flow rate probabilities up to and including the 1% annual probability (plus an allowance for climate change of +20%, in a 1 in 100 year event) the developed rate of runoff into the watercourse or sewerage network should be no greater than the undeveloped rate of the runoff for the same event. The drainage arrangement should also be such that the volumes of surface water leaving the site are no greater than that at pre-development.

Keywords	Paragraph type: Objection
Soakaways, BRE 365	The Local Planning Authority should be satisfied that soakaways will work effectively in this locality during winter periods when high ground water levels exist. To ensure that the disposal of surface water to soakaways will not exacerbate or create flooding, it is recommended that the Local Planning Authority request confirmation from the developer that the soakaways have been adequately designed and constructed. They should conform to British Research Establishment (BRE) 365 taking into consideration potential fluctuations in ground water levels.
Tide locked storage	The Environment Agency recommends that sufficient storage is provided within the surface water system to accommodate the co-incidence of the 1% rainfall storm with the 0.5% annual probability extreme sea level for the lifetime of the development. This is to prevent the surcharging and flooding of the surface water drainage system because of tide locking. SUDS systems should be utilised for their environmental advantages e.g. water quality, biodiversity, amenity and recreation.
Consult the Marine and Fisheries Agency	The applicant is advised to consult with the Marine and Fisheries Agency (Tel: 0207 270 8665) to discuss any additional licenses under FEPA (Food and Environment Protection Act 1985 Pt2) or consents under CPA (Coast Protection Act 1949).
Consult Natural England	The Environment Agency suggests that the applicant should consult with Natural England (Tel: 02380 286410) on the proposed works, who may have specific issues and concerns that need to be addressed.
Development where flood risk standing advice applies.	The Environment Agency has produced standing advice to enable Local Planning Authorities in England to make decisions on low risk planning applications where flood risk is an issue without directly consulting the Environment Agency for an individual response. It also identifies those development situations in areas of high flood risk where a case by case consultation with the Environment Agency should continue. In the instance of this application the Environment Agency would refer you to the Flood Zones matrix. The matrix sets out how the Environment Agency is likely to respond to proposed development in different combinations of location and development type. This information can be found at: http://www.pipernetworking.com/floodrisk/matrix.html
No objection	There is no objection from the Development Control team to this proposal.
No objection, good flood risk assessment	Following consultation with the applicant and the submission of a flood risk assessment *<Ref/Date/ Author>* which concludes that there is no increase in risk to people and property, the Environment Agency has no objection on flood risk grounds to this proposal.
Replacement building, floor area check	The proposed replacement of an existing property will result in the loss of storage in the flood plain. The applicant should provide a measurement of floor area to compare the existing to the proposed, including all buildings that are to be demolished and areas of flood storage. The Environment Agency may reconsider its stance on this development should "like for like" compensatory flood storage be provided. Compensation is the matching of volumes lost to the flood plain through development with new floodplain volume created by reducing ground levels. The compensatory volume must be provided at the same level as the lost storage. An equal volume of floodplain must be created to that taken up by the development. This volume of flood plain must be created equal to that taken up by the development. This equal volume must apply at all levels between the lowest point on the site and the design flood level. Normally this is therefore calculated by comparing volumes taken up by the development, and volumes offered by the compensatory storage for a number of horizontal slices through the level range defined above. Typically the thickness of a slice should be about 200mm. This may vary in the case of large, very flat sites, where 100mm or 50mm could be used; or in very steep sites with a high range of flood water levels slice thickness should be set to provide 10 to 15 slices.

Keywords	**Paragraph type: Objection**
Floodproofing	Floodproofing measures that can be taken to reduce the damage to <*buildings/property*> are becoming more common in areas that are subject to flooding. These measures include bringing all electrical services down from ceilings, raising slab levels, covers for <*doors/airbricks*>, <*solid stone/concrete floors*> and no studwork partitions on ground floors. Further information is available in the technical guide "*Improving the Flood Performance of New Buildings: Flood Resilient Construction"* published on 15 May 2007 by RIBA Publishing, ISBN 978 1 85946 287 4. The guide is also available on the CLG website through the Planning Portal at: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf. It covers the nature of flooding and the planning process; design strategies and the options of avoidance, resistance and resilience; building techniques; and a summary of the research done.
Details of guidance for FRA's	Detailed guidance on many aspects regarding flood risk including advice on producing Flood Risk Assessments (FRAs) can be found in the Communities and Local Government document "Development and Flood Risk: A Practical Guide Companion to PPS25". This guide is available on the CLG website at: http://www.communities.gov.uk/index.asp?id=1506265 To enable development to take place a FRA must prove that the development is safe and that flood risk is not increased to existing properties for the lifetime of the development. FRAs should be appropriate for the scale of the development and can include the following information: A flood level for the 1% annual probability fluvial flooding event A 0.5% annual probability extreme tide level The above plus an allowance for climate change A topographic survey of the site including the access routes Identification of likely routes for flood waters Site drainage arrangements Any existing defences and their level of protection Source(s) of flooding A hydrographic survey An evacuation plan agreed with the LPA
Sequential Test Advice	We have no objection to the application as submitted but wish to advise your Authority as follows: The application site lies in Flood Zone <*3a/3b/2*> as defined by Planning Policy Statement 25 (PPS25). PPS25 requires decision–makers to steer new development to areas at the lowest probability of flooding by applying a flood risk 'Sequential Test'. In this instance no evidence has been provided that the Sequential Test has been properly carried out. We advise that the Sequential Test must be carried out at early stage of the planning application determination process. Failure to apply the Test at an early stage can result in a waste of time and money for all parties in the completion and assessment of Flood Risk Assessments, for development that is later refused planning permission on Sequential Test grounds.