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EPSOM & EWELL BOROUGH COUNCIL

Epsom & Ewell Surface Water Management Plan

Volume 1 – Summary Report and Action Plan

July 2011

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Document control sheet BPP 04 F8

Client:	Epsom & Ewell Borough Council
Project:	Epsom & Ewell Surface Water Management Plan
Job No:	B1584500
Document Title:	Volume 1 – Summary Report and Action Plan

	Originator	Checked by	Reviewed by	Approved by
ORIGINAL	NAME **DC**	NAME **RH**	NAME **RH**	NAME **DC**
DATE **April 2011**	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE
Document Status				

REVISION	NAME **DC**	NAME **RH**	NAME **RH**	NAME **DC**
DATE **July 2011**	SIGNATURE	SIGNATURE	SIGNATURE	SIGNATURE
Document Status				

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Document Status				

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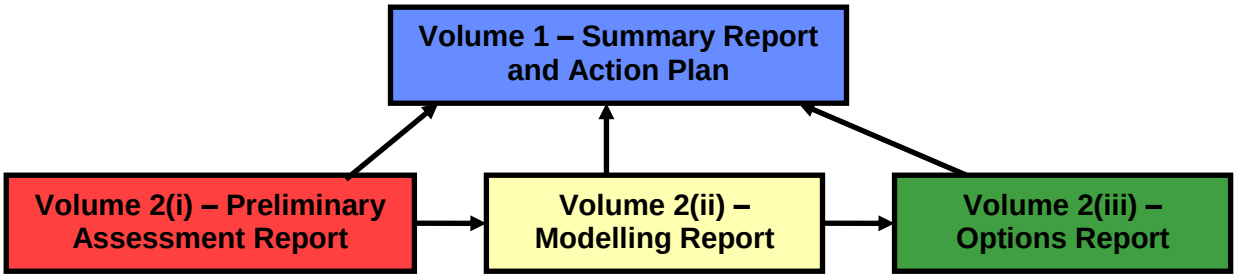
Map for the EEBC Surface Water Management Plan

Structure of the Reports



SWMP Report	Key Contents
Summary Report and Action Plan	• Study background and key surface water flooding issues (Sections 1.1 & 1.2) • Modelling results including predicted pattern of flooding and economic damages (Section 1.3) • Description of individual measures and appraisal of options (Section 1.4) • Description of Borough-wide and location-specific options (Section 2.1) • Links to Infrastructure Delivery Plan and other funding opportunities (Sections 2.2 & 2.3)
Preliminary Risk Assessment	• Records of flooding in the Borough (Section 3 & Appendix B map) • Observations from site inspections (Section 5 & Appendix B map) • Views expressed at the Stakeholder Surgery (Section 6) and Communication & Engagement Plan (Appendix A) • Definition of Drainage Areas across the Borough (Section 7 & Appendix D map)
Modelling Report	• Details of model development (Section 3) • Economic damage assessment in the current situation (Section 5 & Appendix I map) • Results of modelling selected management options (Section 6 & Appendix K) • Maps of maximum depth, velocity, hazard and time to peak (Appendices E-H)
Options Report	• Details of individual measures (Section 2 & Appendices C - P) • Listing, maps and appraisal of options (Section 3 and Appendix B map)

Where to Find…

Topic	Report Section
Recommended actions (including links to Infrastructure Delivery Plan)	This report – Section 2
Location map and detailed information on all options	Options Report – Appendices B – P
Appraisal of options through indicative benefit:cost analysis, multi-criteria analysis and feedback from the options workshop	This report – Section 1.4 and Options Report Section 3
Natural drainage routes, topographic depressions, locations of past flooding etc.	Preliminary Risk Assessment Appendix B maps
Maps of maximum depth of flooding in the 0.5% (1 in 200) AEP rainfall event	Modelling Report Appendix E maps
Details and maps of economic damage due to surface water flooding	Modelling Report Section 5 and Appendix I maps
Details of modelling of selected options	Modelling Report Section 6
List of consultees	Preliminary Risk Assessment Appendix A

Contents

List of Boxes

List of Figures

List of Tables

Abbreviations Used in This Report

Term	Definition
Climate Change	Long term variations in global temperature and weather patterns caused by natural and human actions.
Culvert	A channel or pipe that carries water below the level of the ground.
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EEBC	Epsom & Ewell Borough Council
FDGiA	Flood Defence Grant in Aid is government money allocated to Risk Management Authorities (Environment Agency, Local Authorities, Internal Drainage Boards) - for capital works which manage and reduce flood and coastal erosion risk.
FMfSW	Flood Map for Surface Water
Flood & Water Management Act	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which (partly) is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a river.
LLFA / Lead Local Flood Authority	Local Authority responsible for taking the lead on local flood risk management
Main River	Main rivers are usually larger streams and rivers. However, they do include smaller watercourses of local significance. A main river is a watercourse marked as such on a main river map. This is an official document. The Environment Agency has powers to carry out flood defence works to main rivers.
NRD	National Receptor Dataset – a collection of risk receptors produced by the Environment Agency
Ordinary Watercourse	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, IDBs. N.B. Ordinary Watercourse does not imply a “small” river, although it is often the case that Ordinary Watercourses are smaller than Main Rivers.
Partner	A person or organisation with responsibility for the decision or actions that need to be taken.
Pluvial Flooding	Flooding from water flowing over the surface of the ground or ponding before it has reached a watercourse or drainage system; often occurs when the soil is saturated and natural drainage channels or artificial drainage systems have insufficient capacity to cope with additional flow.
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
SCC	Surrey County Council
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.

Term	Definition
SuDS / Sustainable Drainage Systems	Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.
Surface water	Rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving), and has not entered a watercourse, drainage system or public sewer.
SWMP	Surface Water Management Plan
TW	Thames Water Utilities Ltd

1 Summary of the Epsom & Ewell SWMP

1.1 Background and Motivation

Based on national mapping provided by the Environment Agency, Defra identified that a significant number of properties in the Borough of Epsom & Ewell may be susceptible to surface water flooding. Subsequently, Epsom & Ewell Borough Council (EEBC) has successfully applied for and been allocated funding by Defra to prepare a Surface Water Management Plan (SWMP) for the Borough.

Surface water flooding can be caused by intense rainfall before it enters a watercourse or sewer, overland flow resulting from high groundwater levels, exceedance of the capacity of the sewer network and 'out of bank flow' from small watercourses which are not designated as Environment Agency Main River. In addition to damage to properties, roads and other infrastructure, the onset of surface water flooding can be relatively sudden and can lead to both high velocity flows in steep areas and deep ponding of flood water. There is, therefore, a risk to life associated with significant surface water flooding.

The purpose of the SWMP study is to identify sustainable responses to manage surface water flooding and to prepare an Action Plan. The Action Plan provides an evidence base upon which future decisions and funding applications for putting the recommendations into practice can be put forward. Preparation of the Action Plan for Epsom & Ewell has followed the latest Defra guidance. The Action Plan is presented in Chapter 2 of this Summary Report. Full technical detail can be found in the supporting reports which are listed in Table 1.

Table 1 Structure of the EEBC SWMP reports

Report Volume	Title	Defra Guidance Stage
Volume 1 (this report)	SWMP Summary Report and Action Plan	Implementation and Review
Volume 2(i)	Preliminary Risk Assessment	Preparation
Volume 2(ii)	Detailed Modelling Report	Risk Assessment
Volume 2(iii)	Options Report	Options

1.2 Building on Previous Studies

The SWMP project started in October 2010 and has followed on from previous studies, particularly the Strategic Flood Risk Assessment and the Hogsmill Integrated Urban Drainage Pilot Study. These studies identified that the main risk of flooding in the Borough is not from fluvial flooding, but as a consequence of:

- the inability of the sewer network to safely remove rainfall of an intensity greater than approximately 10% (1:10 year) to 5% (1:20 year) annual probability which falls directly on to the urban areas;
- surface runoff from the Chalk in the south of the Borough on to the Clay underlying the urbanised north of the Borough; and
- groundwater flooding from the Chalk following prolonged above average rainfall.

Recommendations made by previous studies to improve flood risk management in the Borough include the following strong themes:

- Use of open spaces to manage flood flows
- Management of flood risk through planning and redevelopment, including encouragement for SuDS and property level resistance and resilience
- Appropriate maintenance of infrastructure

The partnership approach to integrated flood risk management used in these previous studies has also been strengthened in this SWMP through integrated working between EEBC (lead partner), Surrey County Council (SCC), the Environment Agency (EA), Thames Water (TW) and other stakeholders. The vision for the project was agreed by the SWMP Partnership as shown in Figure 1.

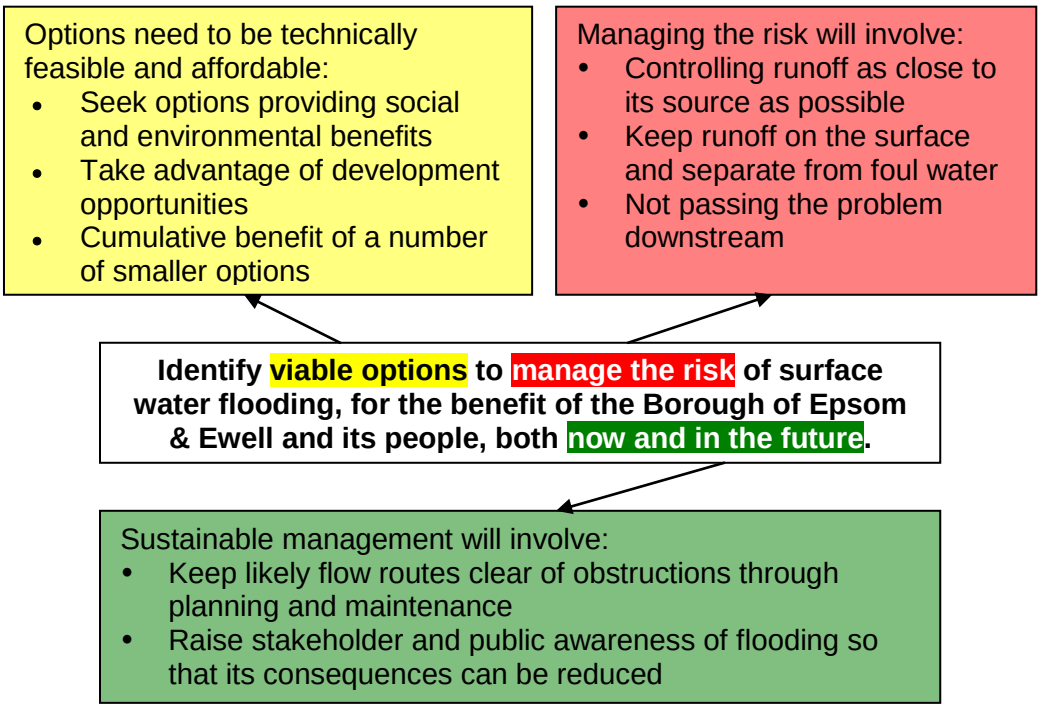


Figure 1 The SWMP vision statement highlighting key concepts

Consultation with partner organisations, stakeholders and representatives of the public has been a key element throughout development of the SWMP. Following the agreed Communication & Engagement Plan, a 'stakeholder surgery' was held on 22 February 2011 with a number of counsellors, technical experts in the councils and representatives of Residents' Associations to discuss key flooding issues and gather local information to help direct the study. There was general confirmation of the evidence upon which the study was being founded and enthusiastic support for the project and its direction.

Key flooding issues identified at the outset of this SWMP are summarised in Box 1. To summarise the susceptibility to local flooding, the Borough has been split into eleven discrete geographic areas termed Drainage Areas (see Figure 2). The geology, type of drainage (i.e. to soakaway or piped sewer), sewer catchment area (if applicable) and topography (drainage to a watercourse) is broadly the same within each identified Drainage Area. The Drainage Areas across the centre of the Borough generally have the highest susceptibility to each of the three sources of flooding (surface water, groundwater and sewers). These Drainage Areas have been used to discuss and group results and management options in this SWMP.

Key flooding issues identified in the Borough

- There is demonstrable history of surface water and groundwater flooding across the Borough in larger events (e.g. winters of 2000/1, 2002/3 and July 2007) as well as a number of locally important issues. Although relatively few depressions were observed where water is likely to pond to a significant depth, there are some significant natural drainage paths, some of which could extend long distances across the Borough. These could become conduits for surface water flow during intense rainfall and/or when the surrounding chalk hills become saturated or frozen.

- Many of the natural drainage paths have been obstructed or diverted by development to the point where there is a risk of flooding when they become active. Future development (e.g. West Park hospital site and Plan E Epsom town centre) has the opportunity to grow around these natural drainage routes and therefore manage surface water flood risk.

- A number of potential flow routes cross political boundaries, entering the Borough of Epsom & Ewell from Banstead & Reigate and Sutton. Furthermore, decisions taken in Epsom & Ewell have the potential to impact on downstream flood risk in Kingston via the River Hogsmill. Therefore, cross-border communication and co-operation will be important to manage surface water flooding.

- A number of reported flooding issues appear to result from poorly maintained drainage systems, or systems with insufficient capacity. A prioritised maintenance schedule may assist in tackling this.

Box 1 Key flooding issues identified in the Borough

1.3 Risk Assessment through Detailed Modelling

A detailed two dimensional hydraulic model has been developed to support the SWMP Action Plan. The model has been used to better understand the locations and mechanisms of flooding and inform identification and development of management options.

The model covers the majority of the Borough, with only those small portions not in the River Hogsmill catchment (i.e. The Wells and Worcester Park Drainage Areas) excluded. The model has been adopted from that developed for the Hogsmill IUD study, with improvements made to representation of key topographic features (e.g. openings in railway embankments and inclusion of building footprints), representation of the Thames Water surface water sewer network, the hydrology (including consideration of UKCP09 climate change recommendations) and improved representation of the likely volume and timing of surface flows from the chalk and clay geology types.

The model has been used to predict the maximum flood depths, velocities, hazard and time to maximum depth for the following range of design events: 50% (1:2 year), 10% (1:10 year), 3.33% (1:30 year), 1.33% (1:75 year), 1% (1:100 year) and 0.5% (1:200 year) annual probability. The depth, velocity, hazard, risk and time-to-peak maps have been used in the development of the SWMP Action Plan.

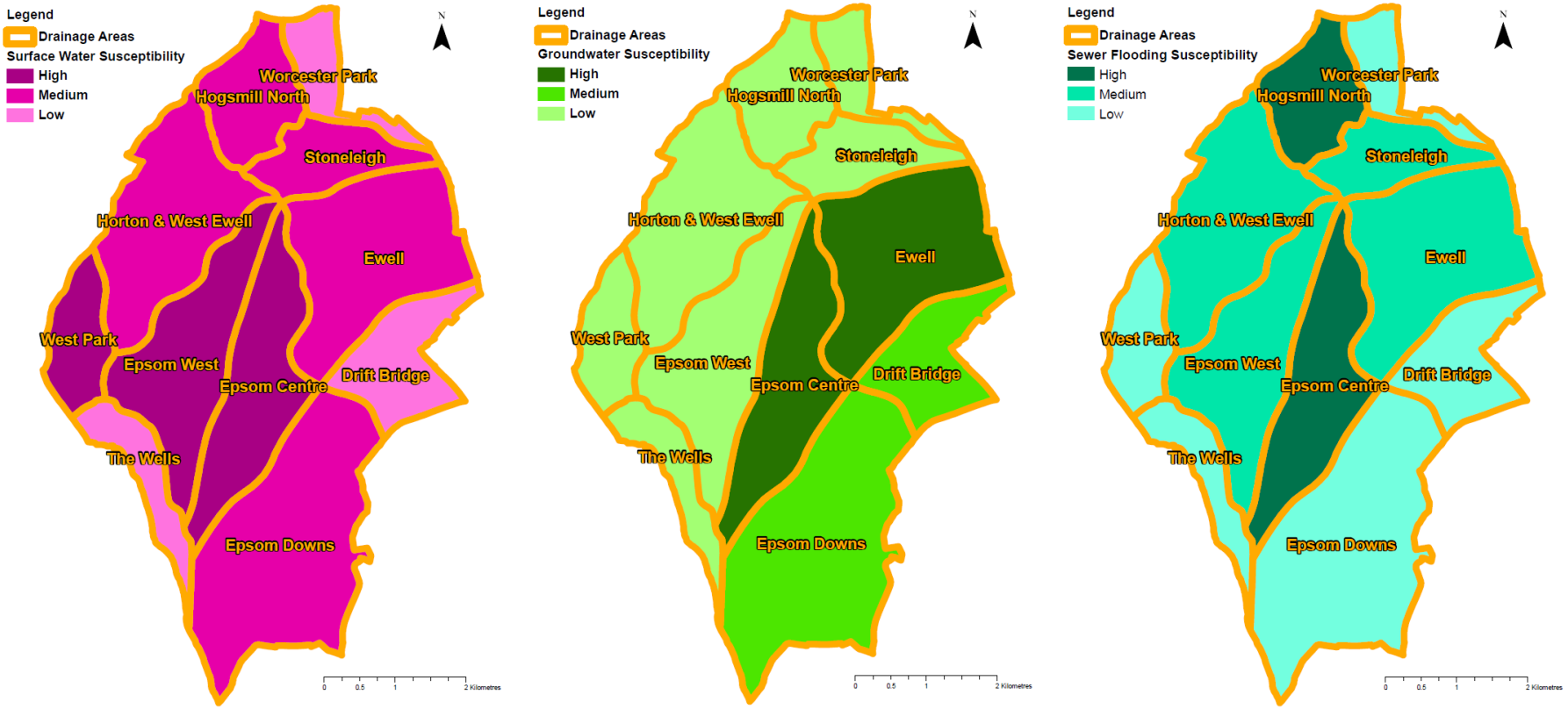


Figure 2 Drainage areas and their indicative susceptibility (high, medium or low) to flooding due to surface water (intense rainfall), high groundwater levels and exceedance of the sewer capacity

Table 2 summarises the pattern of flooding in each Drainage Area as predicted by the detailed model. The table focuses on where, and in what magnitude of an event, flooding is likely to be first observed. Based on comparison with anecdotal evidence of flooding and the Environment Agency Flood Map for Surface Water, the SWMP model provides a reasonable representation of the likely risk of surface water flooding. However, it is noted that the model domain is a large and hydrologically complex area and that a number of simplifications have had to be made. Therefore, the model should only be used for similarly large-scale purposes and any detailed design should include necessary improvements and refinements to the model.

Climate change was represented in the model by increasing the rainfall intensities for the 3.33% (1:30 year) and 1% (1:100 year) events by 28%. Comparison of the maximum depths indicates that the 3.33% (1:30 year) plus climate change event is very similar to the 1.33% (1:75 year) event and that the 1% + climate change event is very similar to the 0.5% (1:200 year) event.

Maximum depths at individual properties in the EA National Receptor Database have been used to estimate economic damages due to surface water flooding in the existing ('do minimum') situation. Assuming a standard property threshold level of 0.15m above surrounding ground level, it is estimated that approximately £110M of damage (including indirect, intangible and emergency service costs where applicable) due to surface water flooding will be experienced across the Borough in the next 100 years. For the 1,400 or so residential properties which are predicted to experience flooding, the average annual damage could be around £1,500, which equates to approximately £45,000 of damage per residential property over the next 100 years. This high value is due in part to the predicted shallow flooding in high frequency events, and also the relatively high market values for properties. However, it is in line with Defra guidance on flood damage which assumes £30,000 of damage per property per flood event. The primary clusters of predominantly residential properties experiencing the highest damages are in the areas of (see Figure I.1 in the Volume 2(ii) - *Modelling Report* for a map):

- Rosebery Park (including Epsom General Hospital) and between Rosebery Park and the Utilities Site, East Street
- Between Upper High Street and the Utilities Site, East Street
- Along the line of Greens Lane Stream, from Eastdean Avenue, near to Manor Green road, near to Blenheim High School and Blenheim Road business park
- Superstore and High Street in Ewell, between Epsom Road and Reigate Road
- Holmwood Road in East Ewell
- Around the allotment gardens in Stoneleigh and westwards along the line of the Ewell Court Stream
- Clarendon Park development
- Adjacent to the River Hogsmill in West Ewell

1.4 Options for Sustainable Management of Surface Water Flooding

A range of options has been identified to improve management of surface water flooding across the Borough of Epsom & Ewell. The options have been developed from a review of previous studies, Multi-Criteria Analysis (MCA) of individual measures, site inspection, detailed modelling and consultation with project partners and stakeholder organisations. The options have been designed to fit within the following overall philosophy (as illustrated in Figure 2):

- Seek management options providing social and environmental benefits
- Manage runoff close to its source and keep runoff on the surface
- Keep likely flow routes clear of obstructions through planning and maintenance
- Raise stakeholder and public awareness of flooding so that its consequences can be reduced
- Implement identified options incrementally and take advantage of opportunities as they arise

Options have been developed by grouping individual measures (see Table 3) under the following headings:

- **Do nothing**: Undertaking no maintenance on existing infrastructure and not planning for any improvement in flood risk management will result in an increasing flood risk as existing drainage capacity, resistance and resilience deteriorates and future climate change increases the frequency of extreme events.
- **Source control and Sustainable Drainage Systems (SuDS)**: Source control measures aim to reduce the rate and volume of surface water runoff through infiltration or storage. Controlling inflows entering the urban area will be a particularly desirable option.
- **Design for exceedance:** Roads, buildings and other features can be designed to control overland flow and direct it safely through the urban environment, such that floodwater does not enter a building or other structure to a given depth. Designing for exceedance recognises that flows that exceed the below ground drainage capacity are always possible but can be managed to some degree by creating designated flow routes or other measures such as threshold raising at access points.
- **Increasing capacity:** Adding storage and/or increasing the capacity of the sewer network and the watercourses may improve the conveyance of floodwater and limit overland flow.
- **Separation of foul and surface water:** Ensuring new developments are separately sewered, rectifying existing misconnections and reducing ingress into the sewers can reduce flooding and pollution
- **Non-structural measures:** Improved maintenance, flood warning, planning policy and property level resistance/resilience measures can reduce the consequences for the receptors of flooding, e.g. people, property and the environment. In most cases, these are likely to be implemented widely across the Borough through introduction of policy.

Six options have been identified for generic implementation across the Borough, most likely through introduction of EEBC policy, and sixteen for implementation at specific locations. Options have been appraised using the following procedures:

- **Indicative benefit:cost ratio:** For ten of the location-specific options, the potential benefits (i.e. damages avoided) and costs have been estimated (see Box 2). This provides an indicative benefit:cost ratio for each of the ten options which has been used to provide one indicator of priority which considers the degree of flood risk.
- **SWMP Partnership priority:** At an Options Workshop, the wider SWMP Partnership discussed their support and suggested indicative priorities for all options (see Box 3). The priorities, and the associated indication of support for the option, provides a second indicator of priority.

Table 2 Pattern of Surface Water Flooding in the Drainage Areas

	Design Rainfall Event						
Drainage Area	**50% (1:2 year)**	**10% (1:10 Year)**	**3.33% (1:30 Year)**	**1.33% (1:75 Year)**	**1% (1:100 Year)**	**0.5% (1:200 Year)**	**Velocity & Hazard in the 0.5% Event**
Epsom Downs	No flooding	Surface water is first observed, with flow accumulating near Langley Vale Road.	Surface flow northwards along Langley Vale is properly established.		Flooding of isolated areas between South Hatch and Downs Avenue is predicted, including flooding of Downs Avenue.	Maximum flood depths of approximately 1m are predicted around the Thames Water pumping station adjacent to Langley Vale Road.	Maximum velocities generally exceed 1.5m/s along the flow routes. The Defra hazard score suggests values between 'danger for some' and 'danger for most' along the Langley Vale flowpath.
West Park	Maximum flood depths of over 0.5m are predicted, from northerly flow over Christchurch Road between Stew Pond and the Bonesgate Stream.	Maximum depths of over 1.0m are predicted in small areas.					Velocities approaching 2.0m/s are predicted in small areas. The hazard score predicts 'danger for most' along the flowpath across the majority of the West Park site, with 'danger for all' to the adjacent to Christchurch Road.
Epsom West	There is an indication of flooding in the playing field of Rosebery School as well as in isolated areas adjacent to the Greens Lane Stream.	The flowpath connecting Rosebery School and Longmead Road shows almost continuous surface flow, with flooding between Upper Court Road and Longmead Road where the Greens Lane Stream is culverted.	There is substantial flooding along the Greens Lane Stream.		Maximum depths of approximately 1.0m are predicted on the road where the Greens Lane Stream passes under Christ Church Mount, the Ridgeway, Gibraltar Crescent and Chessington Road. In addition, the majority of Longmead Road and Green Lanes roads are flooded.		Maximum velocities are generally less than 1.5m/s. 'Danger for most' is typically predicted along the flowpath until Longmead Road, with 'danger for all' along Greens Lane Stream further north.
Epsom Centre	There are some isolated patches of surface water flooding (maximum depth less than 0.5m) on the flowpath between Rosebery Park and the High Street. There are also isolated patches elsewhere in the Drainage Area.	Surface water is evidently ponding in areas along Greens Lane Stream and on the eastern side of the railway embankment.	There is a continuous flowpath between Dorking Road and the Greens Lane Stream via High Street and Hook Road.	There is an almost continuous flowpath from Albert Road in towards the Utilities Site via Upper High Street.	Continuous flow is predicted from Langley Vale into the Greens Lane Stream via the town centre, as well as flow from Albert Road into the Utilities site. Maximum flood depths of over 0.5m are predicted in the town centre.		Velocities are greater than 2.5m/s in some areas (e.g. railway underpass between High Street and East Street). There are numerous areas of the flowpaths where the hazard score indicates 'danger for most', with 'danger for all' indicated at the railway underpass along Hook Road and adjacent to Greens Lane Stream.
Drift Bridge	No flooding		Continuous flooding north along the flow route from Nork is observed.	Depths of greater than 0.3m are predicted on Reigate Road downstream of the railway embankment.			Due to the steep nature of the catchment to the Drift Bridge railway underpass, maximum velocities of over 4m/s are predicted. As a result, a 'danger for all' hazard is indicated along Reigate Road and northwards along the flowpath.
Horton & West Ewell	No flooding		There is predicted to be shallow flooding of some areas of the Clarendon Park development. The majority of the northerly flow is stopped at the pond in Horton Country Club.	Surface flow along both main flowpaths is well established, including flow through the Clarendon Park development.			Maximum velocities are relatively low, and almost always below 1.5m/s. There is 'danger for some' and 'danger for most' along most sections of the main flowpaths.
Ewell	The only surface water flooding which will affect properties is for the superstore adjacent to the Ewell bypass.		Flooding along the major flowpaths is predicted, converging along the High Street in Ewell and passing through the railway underpass on Holmwood Road.		Almost continuous surface water flow is predicted between Hampton Grove and Boleyn Avenue and the River Hogsmill near Bourne Hall and between Nonsuch Walk and Holmwood Road. Northwards flow is also predicted from the sports ground on Cheam Road through the school near Harefield Bridge and into Nonsuch Park.		Maximum velocities are generally less than 1.5m/s with 'danger for most' in the areas of deep ponding which are largely in open ground.
Stoneleigh	Patches of surface water are predicted to pond along the line of the Ewell Court Stream, near the allotment gardens and adjacent to Kingston Road.		Flooding forms an almost continuous flowpath between Nonsuch Park and the confluence of the Stream with the River Hogsmill		Depths peak at around 1.0m in some locations.		Maximum velocities are almost exclusively less than 1.5m/s with 'danger for most' in the areas of deep ponding, some of which are in residential areas.
Hogsmill North	No flooding		Apart from ponding of surface water in the floodplain of the River Hogsmill in more frequent events, flooding of properties is likely to commence in this event.		There is an almost continuous line of surface water of between the Kingston Road and the River Hogsmill adjacent to Old Malden Lane. There is also deep ponding predicted for properties between Ruxley Lane and Riverview Road.		Maximum velocities are almost exclusively less than 1.5m/s. In terms of the Defra hazard score, the danger is almost exclusively confined to corridors adjacent the River Hogsmill and the drain north of Wandgas Athletic Ground.

Note: Descriptions are only for flood depths greater than 0.1m and Drainage Areas are ordered approximately south west to north east

Table 3 Description of individual measures considered to improve surface water management in the Borough

Category	Measure	Illustration	Category	Measure	Illustration	Category	Measure	Illustration
Source control and Sustainable Drainage Systems (SuDS)	**Detention basins** are surface water storage areas which provide flow control and reduction through attenuation. They are normally dry and therefore could be used as car parks, recreational facilities etc for much of the time. It may be possible to later reuse the stored water on site (e.g. irrigation or aquifer recharge) depending on storage arrangements.		SuDS	**Water butts** are used to collect rainwater from individual properties for outside use although some capacity must be available at the start of a storm. Alternatively, downpipes can be disconnected from discharging directly into surface water drains and be routed through a SuDS attenuation feature. **Rainwater harvesting** collects rainwater for non-potable reuse both internally and externally.		Separation of foul and surface water	**Greenfield development** opportunities usually have separate foul and surface water drainage systems and such opportunities should be maximised. **Brownfield development** opportunities are generally as for Greenfield but the existing drainage system may be combined. In such cases opportunities should be taken to convert to a separate piped system where practical.	
	Ponds and wetlands are designed to be areas of permanent standing water which can provide attenuation of flows and a certain degree of treatment. In doing so they can provide some improvement in water quality. They can provide ecological, aesthetic and amenity benefits.		Design for exceedance	**Surface flow routes**, formalised through road profiling, kerb heights, speed bumps etc, can be used to safely route exceedance flows through urban areas. Use of lower floors of, for example, multi-storey car parks for temporary flood storage could be considered as long safety is sufficiently addressed.			**Misconnections** between the surface water and foul systems should be rectified as opportunities arise. This can reduce pollution associated with surface water flooding.	
	Swales are shallow linear vegetated drainage features which can store and convey surface water. As part of a management train, they can pass water from one storage/treatment area to the next and provide infiltration where underground conditions are suitable. Swales can be designed to be permanently wet or generally dry and are often located next to roads, car parks or other open spaces.			**Green Streets** use attractive kerbside planters into which surface water on the road is directed. The plants provide some cleaning of the water, attenuation of peak flows and, given suitable ground conditions, infiltration of the stored water.			**Maintenance, desilting and removal of obstructions** can ensure that the watercourses and drainage infrastructure (particularly road gulleys and associated soakaways) are operating to their design potential. In the case of surface water features (e.g. watercourses, ponds, swales etc) this also provides improved amenity and aesthetic value.	
	Green roofs covered with vegetation can intercept and retain precipitation to reduce the volume of runoff and attenuate peak rainfall flows. Large flat or gently sloping roofs (e.g. commercial buildings, schools and hospitals) are particularly suited and cost-effective.			**Raising property thresholds** at access points can provide additional flood protection. Retail and other premises which must permit disabled access can consider gentle ramping, although sufficient space must be available. Vehicular entrances to underground car parks or basement areas should also be considered – raised ramping across the entrance may be sufficient to mitigate surface water flood risk.			**Flood Warning:** the Met Office and the EA operate an Extreme Rainfall Alert Service which provides county-scale alerts of extreme rainfall to Category 1 and 2 responders. Given the knowledge of areas most susceptible to surface water flooding, these alerts could be used to target responsive action. A programme of awareness raising should also be considered in parallel.	
	Pervious pavements are suitable for pedestrian and vehicular traffic. Construction can use porous material which permits infiltration across the entire surface or material which is impervious to water but which is laid with void spaces to permit infiltration. The sub-base of the pavement may use geocellular block systems which provide storage.		Increasing capacity	**Increasing the capacity of the current drainage network** may be possible through enlarging existing sewers, adding new sewers (which can be oversized to provide additional storage) or providing overground storage through interruption of the existing sewers. Increased network capacity could reduce the likelihood of flooding and the discharge of potentially polluted floodwater through Combined Sewer Outfalls.		Non-structural measures	**Planning policies** could be developed and adopted by the council to steer new development away from known surface water flood risk areas and flow paths or, if necessary, to control their development through requiring specific flood management measures implemented through planning or building control.	
	Soakaways are filled excavations which store runoff from single properties or larger developments and roads and allow infiltration into the surrounding soil. They only work in freely draining soils.			**Widening and/or deepening of the watercourse channels** and opening up of culverted sections have the potential to improve the capacity of the watercourses to receive and convey flood flows. Where rapidly passing peak flows could cause flooding downstream, any local improvement in conveyance should be offset with increased storage to attenuate the peak.			**Resistance and resilience** measures can be fitted to prevent surface water entering properties and minimise the damage caused by flood water. Measures can be fitted to new properties or retrofitted to existing properties. Some form of grant assistance could be allocated to property owners for installation. Some resistance or resilience measures are only deployed upon receipt of a flood warning.	

- **Multi-Criteria Analysis:** Each option has been scored on its feasibility and/or benefits according to the following criteria: technical, economic, social, environmental and SWMP project objectives. The options have been ranked on this overall score which provides a third indicator of priority (see Box 4).

The different methods used for appraisal and prioritisation of the options presented comprise an evidence base from which appropriate options can be consider further as opportunities arise. Indeed, a number of opportunities have already been identified in the council Infrastructure Delivery Plan, including for implementation of options relating to Epsom and Ewell town centres and for implementation of generic measurers relating to the use of pervious paving and maintenance.

However, improved and sustainable management of surface water flooding is unlikely to arise through implementation of one or two of these options alone. Instead, implementing any of the options proposed in this report, when the opportunities arise (e.g. as part of existing development plans) will have a beneficial effect, providing that implementation of only part of an option will not adversely impact flood risk before the whole option is realised. Therefore, it is strongly recommended that all options are kept in mind by the various key council teams for implementation and their potential reviewed on a regular basis.

Indicative Benefit:Cost Ratios

As part of the development of the management options and to test their impact, ten of the most likely substantial options across the Borough have been represented in the detailed model in conceptual terms. Options have been represented with 'reasonable' sizes and characteristics in mind which is in line with the overall strategy of incremental benefits across the Borough. By comparing the number of properties predicted to be flooded in the basecase and 'with option' simulations of the 3.33% (1:30 year) annual probability event, the damages avoided by implementing the option have been estimated.

Indicative costs for the considered options have been estimated from the best available information on capital construction costs and scaled up to account for preliminary works (e.g. feasibility studies and detailed design), risk and optimism bias which is assumed to cover any ongoing maintenance.

The estimates of damages avoided ('benefits') and indicative cost of implementing the option ('costs') have been used to determine an indicative benefit:cost ratio. The four options with an indicative benefit:cost ratio greater than 1 are:

1. Reduction of inflows into the Greens Lane Stream upstream of Stamford Pond (14:1)
2. Attenuation and reuse of flows through the RAC Golf Club site and into Woodcote (11:1).
3. Increase storage in Nonsuch Park and the allotment gardens in Stoneleigh to protect properties along the line of the Ewell Court Stream (8:1).
4. Route flows which exceed the capacity of the drainage network into storage in Rosebery Park (2:1)

Box 2 Location-specific option appraisal through detailed modelling and estimating indicative benefit:cost ratios

Options Workshop

A draft list of generic and location-specific options was discussed at an Options Workshop. Representatives from all the key stakeholder organisations were invited. The purpose of the workshop was for the invited stakeholders to comment on and discuss reasons for what they believe to be the most viable options, any perceived constraints; and their priorities, both individually and collectively. The prioritisation was agreed to be in terms of:

- Priority 1: A 'quick win' or action urgently required within 12 months
- Priority 2: Consider now for implementation in the next 1-5 years
- Priority 3: Consider now for longer term implementation (5 years+)

The following options received strong support during the discussions:

- Generic options:
  - Existing and new SuDS (particularly soakaways) and road drainage should be properly maintained to ensure their continued effectiveness. In addition, maintain existing watercourses, trash screens etc. (Priority 1)
  - Raise awareness of surface water flood risk both within EEBC and potentially with the public. Link with encouraging use of rainwater harvesting, other source control measures and uptake of property level resistance and resilience measures. (Priority 1)
  - Adopt a map indicating natural drainage routes which future development should respect. Development should also respect local landform to ensure sufficient property thresholds. In addition, adopt a map indicating the suitability of locations for appropriate SuDS across the Borough. (Priority 1)
  - Policy to fit green roofs to new buildings and retrofit where existing roofs are being replaced. In addition, fit pervious pavement car parking where practicable. (Priority 2)

- Location-specific options:
  - Attenuation and reuse of flows through the RAC Golf Club site and into Woodcote (Priority 1)
  - Increase storage in Nonsuch Park and the allotment gardens in Stoneleigh to protect properties along the line of the Ewell Court Stream (Priority 1)
  - Reduction of inflows into the Greens Lane Stream upstream of Stamford Pond (Priority 2)
  - Route flows which exceed the capacity of the drainage network into storage in Rosebery Park (Priority 2)
  - Various locations for interruption of the surface water sewers in land adjacent to the Hogsmill River (Priority 2)

Box 3 Option appraisal through discussion at the Options Workshop

Multi-Criteria Analysis of Options

The Multi-Criteria Analysis (MCA) score considers the benefits and feasibility of the options from technical, economic, social, environmental and SWMP project perspectives, as outlined in the following table.

Criteria	Description	Score
Technical	Is it technically possible and do-able? Is it a priority to implement?	-2 severe negative outcome -1 moderate negative outcome 0 neutral outcome 1 moderate positive outcome 2 high positive outcome
Economic	Is there a sufficient existing risk? Will benefits exceed costs?	
Social	Will the community benefit or suffer from its implementation	
Environmental	Will the environment benefit or suffer from its implementation	
SWMP	Did the wider SWMP Partnership support this option via discussion at the Options Workshop?	

For ten of the location-specific options, the indicative benefit:cost ratio was used to inform the economic score. The feedback from the wider SWMP partnership obtained through the Options Workshop was used as the SWMP score.

The top scoring generic and location-specific options according to the MCA score are:

- **Joint top scoring generic options:**
  - Existing and new SuDS (particularly soakaways) and road drainage should be properly maintained to ensure their continued effectiveness. In addition, maintain existing watercourses, trash screens etc.
  - Raise awareness of surface water flood risk both within EEBC and potentially with the public. Link with encouraging use of rainwater harvesting, other source control measures and uptake of property level resistance and resilience measures.

- **Top scoring location-specific option:** Attenuation and reuse of flows through the RAC Golf Club site and into Woodcote

Box 4 Multi-Criteria Analysis of options

2 SWMP Action Plan

2.1 Generic and Location-specific Actions

Based on the work summarised in Chapter 1, the Action Plan presented in Table 4 and Table 5 in this Chapter presents the list of viable options to manage the risk of surface water flooding, for the benefit of the Borough of Epsom & Ewell and its people, both now and in the future. The Action Plan summarises an evidence base upon which future decisions and funding applications for putting the recommendations into practice can be put forward.

Table 4 lists the options which could be implemented generically across the Borough. Table 5 lists the location-specific options which are illustrated on the map in Appendix B of the *Options Report*. Both tables provide the following information:

- **What?** The description of the option.
- **Where?** For location-specific options, the location including the Drainage Area.
- **How?** The suggested approach to implementing the option, including any identified priority actions.
- **Who?** The partner organisation which is best placed to lead implementation.
- **When?** An indication of the timescales within which the option could be implemented:
  - Priority 1: A 'quick win' or action urgently required within 12 months
  - Priority 2: Consider now for implementation in the next 1-5 years
  - Priority 3: Consider now for longer term implementation (5 years+)

The table also presents an indication of the degree of support the option received at the Options Workshop (out of a maximum score of 2) and the overall score the option received through the MCA appraisal (out of a maximum score of 10).

However, improved and sustainable management of surface water flooding is unlikely to arise through implementation of one or two of these options alone. Instead, the overall philosophy supported throughout the SWMP study is for *incremental* change which *takes advantage of opportunities* as they arise to implement options which *cumulatively* have the effect of better managing flood risk. Therefore, all options should be kept in mind by the key EEBC and SCC teams and their potential reviewed on a regular basis. To this end, it is **strongly recommended that the SWMP Partnership continues to meet quarterly** to review the progress of implementing the options and identify opportunities. An ongoing forum may be best facilitated by SCC in its Lead Local Flood Authority role and could involve all second tier authorities in Surrey to promote efficiency and sharing of good practice. Potential links to the EEBC's Infrastructure Delivery Plan and ideas for other funding opportunities are provided in the following Sections 2.2 and 2.3. Box 5 highlights some similar key messages which have been developed throughout the SWMP study. It is **recommended that these key messages are considered alongside the options** in Table 4 or Table 5.

Table 4 Generic management options (priority 1 options shaded green)

Generic Option ('What?')	Priority Actions ('How?')	Primary Action Owner ('Who?')[1]	Priority ('When?')[2]	SWMP Partnership support (max. 2)	Overall MCA Score (max. 10)
Existing and new SuDS (particularly soakaways) and road drainage should be properly maintained (including reprofiling of roads as required) to ensure their continued effectiveness. In addition, maintain existing watercourses, trash screens etc.	1. Identify where existing infrastructure is and who owns and/or is responsible for maintaining it. Link with new SCC responsibility to maintain an Asset Register. 2. Provide guidance on asset ownership and responsibility for maintenance. 3. Focus maintenance activities using SWMP hazard maps	SCC (highway assets) EA (Main River assets)	1	2	8
Raise awareness of surface water flood risk both within EEBC and potentially with the public. Link with encouraging use of rainwater harvesting, other source control measures and uptake of property level resistance and resilience measures.	1. Brief EEBC and SCC council teams on surface water flood risk using SWMP materials 2. Review opportunities in the Infrastructure Delivery Plan and particularly Plan E and West Park proposals in light of SWMP findings 3. Produce Partnership position statement on paving over front gardens which is used in response to planning applications.. 4. Provide guidance on use of rainwater harvesting, other source control measures and property level resistance and resilience measures.	EEBC	1	2	8
Adopt a map indicating natural drainage routes which future development should respect. Development should also respect local landform to ensure sufficient property thresholds. In addition, adopt a map indicating the suitability of locations for appropriate SuDS across the Borough.	1. Brief EEBC (and SCC) council teams on natural drainage routes and suitability of locations for appropriate SuDS using SWMP materials 2. Review opportunities in the Infrastructure Delivery Plan and particularly Plan E and West Park proposals in light of SWMP findings 3. Consider removing Permitted Development rights without an agreement to reduce surface runoff to greenfield rate.	EEBC	1	2	7
Policy to fit green roofs to new buildings and retrofit where existing roofs are being replaced. In addition, fit pervious pavement car parking where practicable.	1. Develop an EEBC policy regarding use of green roofs and pervious paving where possible 2. Investigate existing opportunities in the Infrastructure Delivery Plan and particularly Plan E and West Park proposals	EEBC	2	2	7
Build capacity for drainage expertise within EEBC including improved record keeping of flood events	1. Include link to National Flood Forum Blue Pages on council flood related websites. 2. Improve record keeping of flood events as evidence to support grant applications. Link with SCC role as LLFA. Information on sewer flooding should be passed to TW for evidence to support any future remedial works. 3. Investigate opportunities to build longer-term drainage expertise within EEBC through partnering with SCC as LLFA	EEBC in close collaboration with SCC as LLFA	2	1	5
Develop a policy which requires rectification of any reasonable existing drainage problem (e.g. blinded soakaways, sewer misconnections) before permission for improvement works is granted. Consider introducing incentives for those who rectify existing problems.	1. Continue investigations into the feasibility of developing this policy	EEBC	3	0	2

Notes: [1] EA – Environment Agency; EEBC – Epsom & Ewell Borough Council; SCC – Surrey County Council (LLFA – Lead Local Flood Authority)
[2] Priority 1 (shaded green): A 'quick win' or action urgently required within 12 months; Priority 2: Consider now for implementation in the next 1-5 years; Priority 3: Consider now for longer term implementation (5 years+)

Table 5 Location-specific management options (priority 1 options shaded green)

Location-specific Option ('What?')	Option Location ('Where?')	Priority Actions ('How?')	Primary Action Owner ('Who?')[1]	Priority ('When?')[2]	SWMP Partnership support (max. 2)	Overall MCA Score (max. 10)
Store surface water runoff from Langley Vale in a reservoir, detention basin, pond or wetland to reduce the runoff rate and volume. Use stored water either for (i) irrigation for RAC Golf Club or (ii) artificial recharge of aquifer. Increase storage capacity of existing Woodcote Millennium Pond.	Langley Vale / Woodcote (Epsom Downs Drainage Area)	1. Maintain communication with RAC regarding the planning application for the reservoir with a view to them implementing the elements of the option on their site 2. Maintain communication with the EA, SESW and TW regarding aquifer recharge at Langley Vale 3. Approach the Woodcote Millennium Green Trust to discuss improving storage of high flows in the pond 4. Undertake feasibility study into the proposed option	EEBC	1	2	9
Store surface water runoff in a detention basin, pond or wetland north of Stew pond in site of filled-in pond, and downstream of West Park development.	West Park (West Park Drainage Area)	1. Discuss potential for excavation of historic pond with Epsom Common Association and West Park developer with a view to them implementing the option 2. Developer to undertake a contaminated land assessment 3. Undertake feasibility study into the proposed option	EEBC / West Park developer	1	1	6
Store surface water runoff in a detention basin, pond or wetland to reduce the runoff rate and volume.	North East Surrey College of Technology (NESCOT; Ewell Drainage Area)	1. Discuss option proposal with site developer with a view to them implementing the option	EEBC / NESCOT site developer	2	1	6
Store surface water runoff in a series of detention basins, ponds or wetlands to reduce the runoff rate and volume. Interrupt surface water sewer upstream of Stoneleigh allotment gardens to reduce downstream volumes, the risk of sewer flooding and attenuate flows to reduce peak runoff.	Nonsuch Park (Stoneleigh Drainage Area)	1. Discuss option proposal with Friends of Nonsuch Park 2. Discuss feasibility of sewer interruption in the allotment gardens with TW 3. Undertake feasibility study into the proposed option	EEBC / LB Sutton	1	2	5
Interrupt surface water sewer upstream of overground attenuation area to reduce downstream volumes, the risk of sewer flooding and attenuate flows to reduce peak runoff. Store surface water runoff in Stamford Pond and reduce runoff into Greens Lane Stream.	Rosebery School / Stamford Pond (Epsom West Drainage Area)	1. Discuss option proposal with Rosebery School, Epsom Common Association and the EA 2. Discuss feasibility of sewer interruption in the allotment gardens with TW 3. Undertake feasibility study into the proposed option	SCC (regarding use of school grounds) EEBC (regarding Stamford Pond)	2	2	5
Store surface water runoff from Cuddington Golf Course in a reservoir, detention basin, pond or wetland to reduce the runoff rate and volume. Use stored water either for (i) irrigation for Cuddington Golf Club or (ii) artificial recharge of aquifer.	Cuddington Golf Course (LB Sutton)	1. Maintain communication with Cuddington Golf Course regarding planning application for the reservoir with a view to them implementing the elements of the option on their site 2. Maintain communication with the EA, SESW and TW regarding aquifer recharge 3. Undertake feasibility study into the proposed option	LB Sutton / Cuddington Golf Course owners	1	1	5
Route flows which exceed the drainage capacity along (i) Woodcote Green Road and Dorking Road into Rosebery Park via existing footpath and western gate (ii) along Ashley Road and into Rosebery Park. Store surface water runoff in Rosebery Park in series of low terraces and an enlargement of the existing pond.	Woodcote Green Road / Dorking Road / Ashley Road / Rosebery Park (Epsom Centre Drainage Area)	1. Undertake feasibility study into the proposed option – considering implementing the Rosebery Park element initially.	EEBC	2	1	4
Interrupt surface water sewer upstream of various attenuation areas to reduce downstream volumes, the risk of sewer flooding and attenuate flows to reduce peak runoff. These will have a particular benefit to reducing peak flows down the Hogsmill River into Kingston.	Land adjacent TA building on Primrose Walk, West Ewell playing field (adjacent Horton Stream) and various locations adjacent Hogsmill River (various Drainage Areas)	1. TW and EEBC to investigate feasibility of sewer interruption in the various identified locations	TW / EEBC	2	2	4

Location-specific Option ('What?')	Option Location ('Where?')	Priority Actions ('How?')	Primary Action Owner ('Who?')[1]	Priority ('When?')[2]	SWMP Partnership support (max. 2)	Overall MCA Score (max. 10)
Store surface water runoff in a swale to the south of McKenzie Way which directs water into the surface water sewer. Re-profile Horton Lane at junction with Long Grove Road for drainage to runoff into open land to north east. Store surface water runoff in detention basin, pond or wetland at junctions of Horton Lane with B284 and B2200. Store surface water runoff from Horton Country Club Golf Course in a reservoir, detention basin, pond or wetland to reduce the runoff rate and volume. Use stored water for irrigation for Golf Club.	Clarendon Park / Horton Country Club (Horton & West Ewell Drainage Area)	1. Discuss option proposal with Horton Country Club 2. Undertake feasibility study into the proposed option, including requirement for works upstream of Clarendon Park	EEBC / SCC	2	1	3
Route flows which exceed the drainage capacity along Ashley Road and the High Street to the B284 railway underpass. Install new drainage infrastructure to convey surface water to a detention basin, pond or wetland in the Utilities Site, East Street. Use green street planters along High Street.	Epsom Town Centre / Utilities Site, East Street (Epsom Centre Drainage Area)	1. Use SWMP material to inform Plan E proposals 2. Undertake feasibility study into the proposed option	EEBC	2	1	2
Interrupt surface water sewer upstream of overground attenuation areas to reduce downstream volumes, the risk of sewer flooding and attenuate flows to reduce peak runoff. Attenuate high flows in Greens Lane Stream in swales.	Longmead Road, Gibraltar Recreation Ground and Utilities Site, East Street (Epsom West Drainage Area)	1. Discuss feasibility of sewer interruption in the various locations with TW 2. EA to determine feasibility of attenuation swales adjacent to Greens Lane Stream	TW / EEBC (regarding sewer interruption) EA (regarding swales on Greens Lane Stream)	3	1	2
Store surface water runoff from Reigate Road (Nork, Reigate & Banstead) in swales or detention basins adjacent to Reigate Road.	Reigate Road at Drift Bridge (Drift Bridge Drainage Area)	1. Undertake maintenance of existing drainage infrastructure 2. Undertake feasibility study into the proposed option	SCC	3	0	2
Route flows from the High Street which exceeds the drainage capacity into the channel between the road and Bourne Hall.	Bourne Hall (Ewell Drainage Area)	1. Work with EA to undertake maintenance of existing drainage infrastructure 2. Undertake feasibility study into the proposed option	SCC	1	0	2
Interrupt surface water sewer upstream of overground attenuation areas to reduce downstream volumes, the risk of sewer flooding and attenuate flows to reduce peak runoff.	King George Field (Auriol Park), Wandgas Athletic Ground and Shadbolt Park (Hogsmill North Drainage Area)	1. TW and EEBC to investigate feasibility of sewer interruption in the various identified locations	TW / EEBC	3	0	2
Store surface water runoff or flows which exceed the capacity of Pound Lane ditch in a detention basin to reduce the runoff rate and volume.	Court Recreation Ground (Epsom West Drainage Area)	1. Undertake feasibility study into the proposed option	EEBC	3	1	1
Store surface water runoff arriving at Epsom College sports ground. Route flows which exceed the drainage capacity along Downs Avenue and store in the park adjacent to the junction with Downs Road.	Epsom College area (Epsom South Drainage Area)	1. Discuss proposed option with individual land owners 2. Undertake feasibility study into the proposed option	EEBC	3	1	-1

Notes: [1] EA – Environment Agency; EEBC – Epsom & Ewell Borough Council; SCC – Surrey County Council (LLFA – Lead Local Flood Authority)
[2] Priority 1 (shaded green): A 'quick win' or action urgently required within 12 months; Priority 2: Consider now for implementation in the next 1-5 years; Priority 3: Consider now for longer term implementation (5 years+)

Key SWMP Messages

Sustainable surface water flood risk management requires considering flood risk when undertaking other council or stakeholder activities. If this is done:

- flood risk will be managed through the cumulative benefit of numerous smaller schemes;
- opportunities for 'piggy-backing' flood management activities onto other works will be identified and could result in cost savings and efficiencies;
- the Borough will incrementally adapt to the potential impacts of climate change through creative water management, leading to multiple benefits and win-win solutions; and
- awareness will be raised and maintained which will develop expertise.

Examples of putting these into practice should include:

- When **new developments** are being considered – Could the layout be modified to better respect the natural drainage routes? Could larger SuDS features be created which also store high flows from outside the site?
- When **existing developments** are being modified – Could the building support a green roof or rainwater harvesting? Could the car park be made permeable or support shallow temporary storage? Could the resistance or resilience to flooding be improved?
- When **road works** are being undertaken – Could existing road drainage be cleaned or 'quick win' improvements be made? Could the road be re-surfaced so that surface water drains more easily?
- When **sewers** are being maintained – Could oversized pipes be retrofitted? Could misconnections be identified and rectified?

Box 5 Key SWMP messages

2.2 Links to Infrastructure Delivery Plan

The EEBC Infrastructure Delivery Plan (IDP) identifies the following categories of works which are planned to be undertaken in 5 year periods (2010 to 215, 2015 to 2020, 2020 to 2025):

- **Physical Infrastructure:** Transport, Energy, Water & Drainage, Waste, ITC, Public Realm, Historic Legacy
- **Green Infrastructure:** Open Space, Rivers, Historic Landscapes
- **Social & Community Infrastructure:** Affordable housing, Education, Employment, Benefits / Tax, Children's Services, Health, Gypsies & Travellers, Post Offices, Community Services, Culture, Leisure

In Table 6, extracts from the March 2010 version of the IDP are cross-referenced with the management options to identify where opportunities may exist for SWMP options to be incorporated into existing infrastructure delivery plans. In addition to ongoing maintenance works in parks, the main opportunities relate to the options in Epsom and Ewell town centres and for implementation of generic measures relating to the use of pervious paving and maintenance.

2.3 Funding Opportunities

The following streams may provide opportunities to fund implementation of the options:

- **Surrey County Council:** As the Lead Local Flood Authority for the county which includes Epsom & Ewell, SCC will be in receipt of formula grant funding provided by Defra to undertake the lead authority role. This grant is not ring fenced and so SCC will need to determine, in consultation with the other risk management authorities, how much is spent on which local priorities. Although SCC will retain overall responsibility for managing local flood risk, some of its responsibilities can be delegated. Therefore, there may be opportunities for EEBC to work with SCC to build expertise and invest some of the available funding in improving surface water management in the Borough.

- **Environment Agency/Defra Flood Defence Grant-in-Aid (FDGiA) funding**: The EA administers Flood Defence Grant in Aid (FDGiA) which is government money allocated to Risk Management Authorities, which now includes local authorities. The funding is for capital works which manage and reduce flooding. Projects arising from flooding from ordinary watercourses, surface runoff, or from groundwater, are now eligible, although those arising from flooding from sewerage systems are not. To allocate FDGiA funding, the EA collate and appraise applications on an annual basis. From 2012/13 onwards, a fixed amount of FDGiA funding will be offered to any project, based on the outcomes it will deliver. Projects whose costs do not qualify for full FDGiA funding will require cost savings to be found and/or local contributions to proceed.

- **Environment Agency/Defra – Property Level Flood Protection Grants:** Defra Grant-in-Aid funding has been made available by the Environment Agency to fund works to improve the resistance/resilience of individual properties where there are no plans for community-based schemes. Applications for the 2011/12 scheme closed on 15 April and no application was submitted for properties in the Borough due to the lack of records of past flooding which were required as evidence. However, future funding rounds could be considered and motivate improved record keeping of flood events.

- **Thames Water - Investment Plan 2010 – 2015:** By 2015, Thames Water has committed to reduce flooding to around 1,700 properties on its 'risk register' which have flooded internally and over 500 which have flooded externally at least once every ten years. However, it is understood that none of this investment is planned to be for the surface water sewer in the Borough. For Thames Water to consider implementing a scheme to reduce flooding, the cause must be related to the hydraulic inadequacy of the public sewerage system and, as a general rule, for each cluster of properties affected at least one of the properties must have been flooded internally. Thames Water works within a framework of cost and benefit so that where solution options do not meet specific criteria for affordability or benefit they do not proceed and more local measures (e.g. property resistance/resilience) may be considered. Working with the councils and the EA to implement some of the options proposed in this SWMP may be more cost-beneficial than, for example, enlarging the sewers. However, Thames Water investment in any scheme will have to be justified by the severity and frequency of sewer flooding and must be agreed with Ofwat at the start of the next five year period (2016 - 2020). Reporting sewer flooding to Thames Water is therefore crucial to seeking future investment.

- **Developer's Section 106 contribution / Community Infrastructure Levy (CIL):** When new development occurs within the Borough, a levy can be charged by the council which is designed to cover the cost of new public facilities. The larger developments proposed within the Borough (e.g. West Park and Plan E) have the potential to use Section 106 / CIL contributions to fund options proposed in this SWMP and especially those which will have multiple benefits, e.g. pond or wetlands which can receive surface water as well as providing improved amenity value.

Other possible funding sources could include:

- Local business rates including 'business rate supplements' and council taxes including specific precepts and 'special expenses', plus fees and charges, where appropriate and affordable.
- Local activities that can achieve flooding and coastal erosion benefits as a secondary outcome to their primary purpose of securing community benefit and facilitating economic growth and sustainability.

Table 6 Indication of which IDP schemes could present opportunities to implement elements of the SWMP options

IDP Period	IDP Category	IDP Scheme	Description of SWMP Option Element	Option Priority*
2010-2015	Physical Infrastructure	Plan E Town Centre Highway improvements: 1. Return South Street to two-way-traffic	Route flows which exceed the drainage capacity along Woodcote Green Road / Dorking Road / South Street and into Rosebery Park via South Street entrance	2
		Re-designation of Market Place as a highway	Design for exceedance / green street along Market Place	2
		Rear servicing (Town Hall car park for High Street)	Encourage use of pervious pavement car parking	2
		Hook Road / East Street pedestrian facility	Design for exceedance along Hook Road. Install new drainage infrastructure to convey surface water to a detention basin, pond or wetland in the Utilities Site, East Street.	2
		Epsom Town Centre – dropped kerbs to improve accessibility	Design for exceedance / green street along High Street	2
		Ewell Village Highways works	Route flows from the High Street which exceeds the drainage capacity into the channel between the road and Bourne Hall.	1
		New Town Centre pedestrian and cycle links 1. East Street shared pathway 2. Station approach 3. Market Place 4. Utilities site, East Street/ 5. Upper High Street and Depot Road	Route flows which exceed the drainage capacity along Ashley Road and the High Street to the B284 railway underpass. Install new drainage infrastructure to convey surface water to a detention basin, pond or wetland in the Utilities Site, East Street.	2
		Flood alleviation schemes at Wet Spots locations throughout the Borough	Existing and new SuDS (particularly soakaways) and road drainage should be properly maintained to ensure their continued effectiveness	1
	Green Infrastructure	Court Recreation Ground – Improvements to paths, information boards, entrances, gates / bollards (to restrict access for vehicles), teen play area and landscaping old playground	Store surface water runoff or flows which exceed the capacity of Pound Lane ditch in a detention basin to reduce the runoff rate and volume.	3
		Gibralter Recreation Ground – surfacing and landscaping around the pavilion, improving information boards and entrances	Increase storage in surface water sewer near West Street via underground tank or lowering of Gibraltar Recreation Ground.	3
		Shadbolt Park – improvements to landscaping	Interrupt surface water sewer upstream of Shadbolt Park, provide storage in a detention basin and permit re-entry of flows to the sewer system	3

IDP Period	IDP Category	IDP Scheme	Description of SWMP Option Element	Option Priority*
		Auriol Park – Rebuilding of tennis courts and landscaping, improvements to information boards and entrances	Interrupt surface water sewer upstream of King George Field, provide storage in a detention basin and permit re-entry of flows to the sewer system	3
	Social & Community Infrastructure	Redevelopment of the North East Surrey College of Technology (NESCOT) to provide replacement college buildings and facilities.	Store surface water runoff in a detention basin, pond or wetland to reduce the runoff rate and volume.	2
		Need to upgrade the United Reform Church (Church Street, East Street)	Design for exceedance along Church Street	Opportunities for property resistance/ resilience
		Need to upgrade the Baptist Church (Church Street, Epsom)	Design for exceedance along Church Street	
2015-2020	Physical Infrastructure	Kiln Lane Link	Detention basin, pond or wetland in Utilities Site, East Street	2
		Improvements to town centre junctions 1. The Quadrant 2. The Spread Eagle	Design for exceedance / green street along Market Place and High Street	2
		Series of improvements to the local public highway network within and surrounding the West Park Development	Adopt a map indicating natural drainage routes which future development should respect. Development should also respect local landform to ensure sufficient property thresholds.	1
		Improvements/ relocation of town centre bus layover bays	Encourage use of pervious pavement car parking where practicable	2
		Improvements to pedestrian links to Ewell East Station in association with NESCOT redevelopment	Store surface water runoff in a detention basin, pond or wetland to reduce the runoff rate and volume.	2
	Green Infrastructure	Gibraltar Recreation Ground – resurfacing of tennis courts and provision of teen play equipment	Increase storage in surface water sewer near West Street via underground tank in Gibraltar Recreation Ground.	3
		Auriol Park – extension to car park	Interrupt surface water sewer upstream of King George Field, provide storage in a detention basin and permit re-entry of flows to the sewer system	3

IDP Period	IDP Category	IDP Scheme	Description of SWMP Option Element	Option Priority*
2020-2025	Physical Infrastructure	Potential return of Ashley Avenue and Ashley Road to two-way traffic	Route flows which exceed the drainage capacity along Ashley Road and the High Street to the B284 railway underpass.	2
		Improvements to public car parking at Upper High Street and Depot Road in association with the redevelopment of this site	Encourage use of pervious pavement car parking where practicable	2

Notes: *Priority 1: A 'quick win' or action urgently required within 12 months; Priority 2: Consider now for implementation in the next 1-5 years; Priority 3: Consider now for longer term implementation (5 years+)