

MEDWAY STRATEGIC FLOOD RISK ASSESSMENT: A GUIDE

Context

History of Flooding in Medway

The Medway area, being a significant part of the lower catchment of the River Medway with tidal influences from the wider Thames Estuary, has a long history of flooding. The most significant flood event of recent times was the East Coast Flooding in 1953. This event caused the loss of life of 300 people along England's eastern seaboard. In Medway the event was recorded as a low level tidal flood with levels at the Rochester Bridge reaching 4.84m above Ordnance Datum (AOD).

Records available to the Environment Agency (EA) for the same datum point show that flooding events occurred in 1927 (3.92m AOD), 1949 (4.54m AOD), 1960 (3.80m AOD), 1965 (4.60m AOD) and 1978 (4.51m AOD). In more recent times a tidal surge in December 2005 caused low level flooding of Strood with Cuxton Marina, Jane's Creek and Canal Road affected by inundation. Strood Pier recorded peak levels of 4.22m AOD.

Scope of Strategic Flood Risk Assessment Study

The Environment Agency, in association with Medway Council, commissioned specialist consultants Mott MacDonald to undertake a Strategic Flood Risk Assessment (SFRA) for the Medway area. This was carried out in order to provide an accurate predictive system and map coverage for different flooding scenarios in the area. The SFRA comprises:

- A main report
- A computer model capable of modelling varying flood scenarios
- Maps relating to 1 in 200 and 1 in 1000 flood events (available in digital format and generated by the computer model)

SFRA's are one of a number of pieces of work that are being developed to replace the EA's Indicative Flood Map. One of these, the Flood Zone Map (FZM) is of particular relevance since it shows flood risk in accordance with the Zones described in PPG25 'Development and Flood Risk'. These FZM were first issued to planning authorities in 2004.

The main difference between the FZM and the SFRA is that the latter takes into account flood defences. It is considered by the EA that FZM coverage will still remain of importance to the planning consultation process as it includes floodplain assessments on watercourses not covered by a SFRA.

Methodology of Flood Risk Assessment Process

In order to assess the potential of an area of functional floodplain to flood an SFRA model has to take into regard the differing mechanisms of flooding. The principle categories are:

- Fluvial flooding, where river flows exceed the capacity of the river channel.
- Coastal and tidal flooding where high tides, storm surges and high fluvial flows combine.
- Estuarine flooding and watercourses affected by tide lock, often involving high tidal levels and high fluvial flows.
- Flooding from overland flows due to very high rainfall.
- Flooding from artificial drainage systems due to system failure e.g. blocked sewers.
- Flooding from infrastructure failure e.g. structural, hydrologic or geotechnical failure of infrastructure that retains, transmits or controls flooding, e.g. damn or dyke failure.

The mechanisms of flooding are combined with the probability of a flood hazard occurring together with the magnitude of the flood event. The probability of a flood hazard can be expressed as the chance that it will happen in any year. This can be expressed as a ratio or as a percentage. For example, a 1 in 30 year event has a 3.3% chance of being equalled or exceeded in any year. A 1 in 200 year flood event has a 0.5% chance of being equalled or exceeded in any year and a 1 in 100 year event has a 1% chance of being equalled or exceeded in any year.

The SFRA of an area requires a highly technical modelling exercise. In the Medway study the results from detailed hydrological and 2-D hydraulic modelling of the River Medway was done to obtain accurate flood levels in AOD. This was combined with highly accurate ground level information predominantly sourced from a Light Detection and Ranging LiDAR (airborne laser ground height measurement) system accurate to +/- 15cm.

From these combined data sets map coverage of the extent and magnitude of tidal flood events can be generated. In the Medway study the scenarios already mapped are for a 1 in a 200-year return flood event (a 0.5% probability) and a 1 in a 100-year return flood event (a 0.1% probability).

Purpose of Flood Risk Assessment in the Development Process

Flood risk, or rather its potential, is a material consideration in the determination of planning applications and appeals. In the Medway area the Development Plan currently comprises the Kent and Medway Structure Plan (KMSP) 2006, the Medway Local Plan 2003, RPG9 (2001) plus subsequent amendments and RPG9a, the Thames Gateway Planning Framework.

Regeneration and development within the Thames Gateway must have regard to planning for flood risk, including sites and opportunities already identified in the development plan.

The approach to be adopted is set out in PPG 25 issued in 2001. It provides guidance on how flood risk should be considered at all stages of the planning and development process. The main thrust is to manage and reduce flood risk through the planning process while maintaining a precautionary approach, factoring the effects of climate change into the assessment of risk.

The guidance in PPG25 also makes it clear that local authorities allocating land in development plan documents and deciding applications for development should adopt a sequential zoned approach with regard to flood risk. Little or no risk is represented as Zone 1. Zone 2 represents a low to moderate risk and Zone 3 is considered a high-risk area to flooding.

The Medway SFRA does not define these zones; its role is to inform all relevant parties as to where a flood risk likely and what magnitude and probability it might have. In turn this will assist in the preparation of site-specific assessments and the identification of options to mitigate risk. Developers should have an appreciation of the system and will have to justify why proposed development cannot occur in a lower risk zone on the basis that there are no available options and how the risk will be managed as part of the development proposals.

Principle Findings in Medway

The study confirms that many of Medway's riverside regeneration areas have a degree of risk to flooding events. This was as expected. The risks apply to both current climatic conditions and those predicted for 2100 that can be simulated in the model. The following gives an overview of what the model indicates for the principle regeneration sites in Medway. It is stressed that the forecast events described are based on **existing** flood defences and take no account of potential improvements.

Rochester Riverside

In present climatic conditions the main causes of flooding are predicted to be from surface water and tidal ranges. The EA considers that surface water flooding may be critical, as the existing surface water drainage system in the area does not have the capacity to cater for new development. Into the future tidal floods may become more important.

For the predicted climatic conditions in 2100, tidal flooding is considered the more critical of the two forms of flooding. For both a 0.5% and 0.1% probability of return flood event (1 in a 200 and 1 in a 1000 year return flood event) extensive flooding of the site occurs within 2.5 hours. The model shows much of the Rochester Riverside site extensively flooded with a maximum inundation depth of 4m around the former gas works. Accordingly extensive landraising of the site in association with its development to mitigate this effect is in progress. Surface water drainage systems for the proposed development capable of attenuated flows in high tide events will also be required.

Chatham Waterfront

The two main sources of flooding that are of concern under existing conditions are from tidal and surface water. Of the two, tidal floods will be the more critical into the future. They would affect the low-lying areas of the site but these represent only a small part of the total redevelopment area. Surface water drainage systems should be sufficient to cope with anticipated new development.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence. For both a 0.5% and a 0.1% probability of return flood event, overtopping of Sun Pier occurs within 30 minutes of flood defences being breached toward the northern end of the site. Overtopping of defences continues over the next 2 hours with recession of floodwaters commencing within 3.5 hours of the initial northern defence breach. Floodwater remains trapped behind the defences from the A231 (Medway Street) to near the Arts Centre. Maximum inundation depth could reach 2.2m.

Star Hill to Sun Pier

The two main sources of flooding that are of concern under existing conditions are from tidal and surface water. Of the two tidal floods are considered the more critical, affecting the lower lying parts of the site into the future. This could affect surface water flooding potential if tidal lock of the surface water gravity sewer system occurs.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Flood defences will be breached along the northern bank either side of Ship Pier. Inundation reaches the A2 around Star Hill in less than 60 minutes though the A2 remains just above floodwater levels. Recession begin some 2 to 3 hours after the initial breach with isolated areas of trapped water remaining. Maximum inundation depth with existing defences breached could be 1.5m.

Historic Rochester

The two main sources of flooding applicable to the historic heart of Rochester under existing conditions are from tidal and surface waters. Of the two tidal floods are considered the more critical into the future, although high tide events could have an effect on surface floodwaters. If outlet flap valves close during a high tide the resulting reduction in capacity of the surface drainage water system could result in localised flooding. This flooding would be confined to the low-lying areas of the site close to the river. Much of the historic heart of Rochester is at higher levels.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood

event. Initial overtopping of the flood defences occurs in the southwest corner of the Esplanade and then parallel with the river. The whole of the area between the road and the Esplanade is inundated within 30 minutes of the initial defence breach. The floodwaters begin to recede within 4 hours after the initial overtopping of the defences. The depth of floodwater could reach 2.7m.

Medway City Estate

The two main sources of flooding applicable to the Medway City Estate site under existing conditions are from tidal and surface water. Of the two tidal floods are considered the more critical into the future, although high tidal events could have an effect on the surface drainage system. If outlet flap valves close during a high tide the resulting reduction in capacity of the surface drainage water system could result in flooding.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Initial overtopping of the defences occurs around Phoenix Industrial Estate, the works east of Medway City Estate Park, east of Sir Thomas Longley Road, around the southern tip of Rochester Works and along Anthony's Way and George Summers Close. Within one hour of overtopping most of the western bank and several additional locations along the eastern bank are also overtopped. Flooding extends inland for 2.5 hours around Phoenix Industrial Estate, the works west of Medway City Estate; Riverside works in the south and to the northeast. Over 75% of the river frontage would be overtopped during a 0.5% and a 0.1% year tidal return event under 2100 predicted climate conditions with a maximum depth of some 2.8m. Floodwaters begin to recede after 3 hours leaving isolated patches of water.

Brompton, Fort Amherst and The Lines

Since the site is elevated and has no river frontage the main risk to the site is from surface water. Surface water flooding would only be possible during extreme flood events above a 1 in 30 or 3.3% probability return flood event since the existing public sewer network is not designed to drain very high flows of this magnitude.

Chatham Historic Dockyard

The two main sources of flooding applicable to the Chatham Historic Dockyard site under existing conditions are from tidal and surface water. Of the two tidal floodwaters are considered the more critical into the future.

Surface flooding of the site could occur where the outfall from the surface water gravity sewer is closed due to tide locked conditions. Also, sewer capacity may be inadequate causing localised flooding events from surface waters.

For the climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. In these scenarios initial overtopping occurs by King Stairs Wharf with further overtopping occurring approximately 30 minutes later to the north of the area around Boat Slip Wharf and to the south along Anchor Wharf. The flooding then extends along the bank behind the flood defence reaching East Road and Dock Road after 1.5 and 2.0 hours respectively. The floodwaters begin to recede 3 hours after the initial breach and some water is trapped behind the flood defences. Maximum inundation depth could be 3m and 40% of the river frontage could be affected.

Chatham Maritime and St Mary's Island

The two main sources of flooding applicable to the Chatham Maritime and St Mary Island site under existing conditions are from tidal and surface water. Of the two tidal floodwaters are considered the more critical into the future, though high tidal events could have an effect on surface floodwaters. If outlet flap valves close during such an event the resulting reduction in capacity of surface water drainage water system could result in flooding.

No tidal flooding takes place for a 0.5% probability of return flood event for the predicted climatic conditions for the year 2100. For a 0.1% probability return flood event initial overtopping occurs at the lock between the eastern basin and the central basin. Floodwaters flow into the central basin and are contained. Floodwaters flow into the far western basin 60 minutes after overtopping the lock gates of the central basin and extend northwards into St. Mary's Island and southward towards the A289. One hour later the floodwaters spread further north to the northern defences of the island and then flow southwest into the western basin from the land. Maximum inundation depth could be around 1.5m.

The Upnors

The two main sources of flooding applicable to the site under existing conditions are from tidal and surface water. Of the two tidal floods are considered the more critical into the future. Surface water flooding could occur where water backs up in the sewer as a result of insufficient storage capacity during periods of high tide; when outlet valves are closed. Any flood event in excess a 3.3% probability of return in a year would probably result in surface water flooding.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Initial overtopping occurs on the bank east of Tower Hill, at the pier and on the bank opposite Margretts Place. The flooding extends to the base of Tower Hill but is contained by the bank at Lower Upnor from extending further. Maximum inundation of some 2m occurs 3 hours after initial inundation. The floodwaters recede after 3.5 hours.

Strood Riverside

The two main sources of flooding applicable to the site under existing conditions are from tidal and surface water. Of the two tidal floods are considered the more critical into the future. Surface water flooding could occur where surface water backs up in the sewer as a result of insufficient storage capacity during periods of high tide; when outlet valves are closed. Any flood event in excess a 3.3% probability of return in a year would probably result in surface water flooding.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Initial overtopping occurs at Wigmore Drive and along the northern half of Canal Road. Within 30 minutes overtopping occurs along the whole length of Canal Road extending as far as Strood Station. Within 1.5 hours flooding has extended over the majority of the area to a depth of 2m. The flood begins to recede 3.5 hours after the initial overtopping.

Strood Waterfront

Under existing conditions the two main sources of flooding applicable to the site under existing conditions are from tidal and surface water. Of the two tidal floodwaters into the future are considered the more critical. The main source of surface water flooding could occur where surface water backs up in the sewer as a result of insufficient storage capacity during periods of high tide; when outlet valves are closed. Any flood event in excess a 0.33% probability of return in a year would probably result in an event dependent flooding.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Initial overtopping occurs at Wigmore Drive and along the northern half of Canal Road. Flooding then extends as far as Strood Station. Within 1.5 hours of initial overtopping flood waters have covered most of the area to a possible maximum depth of 2m. The flood waters begin to recede some 3.5 hours after initial overtopping with some isolated patches remaining trapped.

The Esplanade

The two main sources of flooding applicable to the site under existing conditions are from tidal and surface water. Of the two tidal floods are considered the more critical into the future. The main source of surface water flooding could occur where surface water backs up in the sewer as a result of insufficient storage capacity during periods of high tide; when outlet valves are closed. Any event in excess a 0.033% probability of return in a year would probably result in flooding.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Overtopping occurs to the north of the Esplanade area, west of Hathaway Court. Further south, along Centenary walk, flooding is restricted

to the very edge of the bank and does not inundate further inland though 50% of the riverbank and flood defences would be inundated. Flood recession commences 3.5 hours after the initial overtopping.

Gillingham Waterfront

The two main sources of flooding applicable to the site under existing conditions are from tidal and surface water. Of the two tidal floodwaters are considered the more critical into the future. The design of the outfalls are such that it is important to consider the risk of surface water flooding during times of tide lock. Lack of capacity of the sewer system could be attenuated by pumping systems, and/or increased storage capacity within the sewer system. Some surface water flooding would occur during extreme flooding events above a 0.033% probability of return flood event.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Initial overtopping occurs around Gillingham Pier and the Strand Leisure Park. Half an hour later flood waters begin to move inland flooding the marina and leisure park within the hour with a maximum inundation depth of 2m. Flood waters start to recede some 2.5 hours after the initial overtopping leaving some trapped isolated areas.

Chatham Port

The two main sources of flooding applicable to the site under existing conditions are from tidal and surface water. Of the two tidal floods are considered the more critical into the future. The design of the outfalls are such that it is important to consider the risk of surface water flooding during times of tide lock. Lack of capacity of the sewer system could be attenuated by pumping systems, and/or increased storage capacity within the sewer system.

Due to a lack of detailed knowledge of the sewers in this site (private ownership) it is not possible to assess the full impact of surface water flooding. It is expected that during extreme rainfall events some surface flooding would occur.

For the predicted climatic conditions of 2100 tidal flooding remains the most significant influence for both a 0.5% and a 0.1% probability of return flood event. Initial overtopping occurs either side of the locks to the eastern basin. Within 30 minutes extensive flooding occurs either side of the locks and the basin (eastern) starts to fill. Within 1.5 hours the area around the basin is extensively flooded reaching a maximum within 2.5 hours. Total inundation depth around the basin is 1.6m and the area is a pathway to the flooding of Chatham Maritime and St. Mary's Island to the west. Flood waters start to recede 3 hours after the initial overtopping with some residual areas left as isolated patches of water.

Chattenden

There is no risk to the site from tidal flooding. Surface water flooding could result from the inadequate capacity of the surface water drainage system and natural drainage paths. Any development of the site would have to consider the capacity of the current drainage system to enable post-development systems to have sufficient capacity. The natural drainage path appears to be the west-east running watercourse at Lodge Hill. This surface watercourse runs through a rural area. There will be a requirement to ensure that the railway line and station to the east of the Chattenden site is not impacted by any increased site runoff.

If post development site runoff is to be limited to existing conditions of runoff an attenuation pond is likely to be required of the right capacity and location for the proposed development of the area.

Future Guidelines for Development

Each site has its own particular characteristics in terms of its susceptibility to flooding, existing defences and some have recent planning consents that have taken flood risk into account (e.g. Rochester riverside) with mitigation measures being part of the development proposal.

The SFRA does make recommendations for each of the above sites in terms of either land raising heights and/or minimum defence crest height for a 0.5% probability of return event flood for the predicted climatic conditions in 2060 that gives a flood height of 5.3m AOD. They are as follows:

Rochester Riverside

Minimum flood defence crest height or land raising height of 5.6m AOD.

Chatham Waterfront

Minimum flood defence crest height of 5.6m AOD.

Star Hill to Sun Pier

Minimum flood defence crest height of 5.6m AOD.

Historic Rochester

Minimum flood defence crest height of 5.6m AOD.

Medway City Estate

Minimum flood defence crest height of 5.6m AOD.

Brompton, Fort Amherst and The Lines

There are no restrictions on development within this site on the grounds of tidal flooding.

Chatham Historic Dockyard

Minimum flood defence crest height of 5.6m AOD.

Chatham Maritime and St Mary's Island

Minimum flood defence crest height of 6.15m AOD.

The Upnors

Minimum flood defence crest height of 6.15m AOD.

Strood Riverside

Minimum flood defence crest height or land raising height of 5.6m AOD.

Strood Centre

Minimum flood defence crest height of 5.6m AOD.

Strood waterfront

Minimum flood defence crest height of 5.6m AOD.

The Esplanade

Minimum flood defence crest height of 5.6m AOD.

Gillingham waterfront

Minimum flood defence crest height of 6.15m AOD.

Chatham Port

Minimum flood defence crest height of 6.15m AOD.

Chattenden

Situated away from the River Medway, there is no risk from tidal flooding.

Guidance for Developers

The Medway Estuary SFRA will be of critical importance in assessing future development proposals along the Medway Waterfront. It will inform the Local Development Framework and supplementary planning documents such as development briefs prepared by the Council. It should also be fully taken into

account in preparing detailed Flood Risk Assessments (FRAs) for individual sites. FRAs must accompany all relevant planning applications. The approach should be as follows:

1. Agree the scoping of the FRA with the Council and the EA. The brief for the FRA should be set out in writing and sufficient time allowed for a considered response to be given.
2. Contact the EA to arrange a run of the SRFA model for the site concerned. The contact details are as follows:
Email: alan.dengate@environment-agency.gov.uk

Address:

Kent Area Office
Environment Agency
Orchard House
Endeavour Park
London Road
Addington
West Malling
Kent
ME19 5SH

Again sufficient time should be allowed.

- Produce detailed flood risk maps for the site and locality.
- Compile a FRA report and provide a 'draft final' version to the Council and EA to allow an informal assessment to be made of it prior to its formal submission. It should fully meet the requirements set out in PPG25 and its expected successor PPS25.
- Submit the 'final' FRA report with the planning application for the site.