May 2016

Kent County Council

Flood Investigation Report

Flooding affecting the Tunbridge Wells Area on

24th August 2015

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This document has been prepared by Kent County Council Flood and Water Management Team as the Lead Local Flood Authority under Section 19 of the Flood and Water Management Act 2010, with the assistance of:

- **Kent County Council Highways, Transportation and Waste**
- **Tunbridge Wells Borough Council**
- **Kent Fire and Rescue Service**
- **Southern Water**

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For further information or to provide comments, please contact us at flood@kent.gov.uk

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1 Introduction

Significant flooding in parts of Tunbridge Wells was reported to Kent County Council (KCC) and other authorities on 24 August 2015. Many of the areas affected experience significant flooding with several properties inundated and disruption to traffic and transportation. As a consequence KCC has undertaken an investigation into this flood event. This is the report of that investigation.

1.1 Requirement for Investigation

As the Lead Local Flood Authority (LLFA) for Kent, KCC has a duty to investigate flood incidents as set out in Section 19 of the Flood and Water Management Act 2010 (the Act). The Act says:

> (1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate:
>
> (a) which risk management authorities have relevant flood risk management functions, and
>
> (b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
>
> (2) Where an authority carries out an investigation under subsection (1) it must:
>
> (a) publish the results of its investigation, and
>
> (b) notify any relevant risk management authorities.

A flood investigation does not necessarily require a thorough investigation of the flood and its mechanisms, only the determination of the risk management authorities who have the relevant functions. However, KCC may choose to undertake a more detailed investigation into a flood incident in order to better deliver the objectives of Kent's Local Flood Risk Management Strategy, for instance to improve the understanding of flood risk.

1.2 Trigger for Investigation

As the primary purpose of an investigation is to determine the responsible body or bodies to respond to the flood that occurred, KCC will undertake a flood investigation where no other risk management authority is exercising or is proposing to exercise its functions in respect of the flood and where the flood is significant. A significant flood is defined by Section 5.1 of the Local Flood Risk Management Strategy for Kent, and is one that causes:

- internal flooding to one or more properties;
- external flooding of five or more properties;
- flooding of roads, rail and other transport infrastructure to an extent that they become impassable by vehicles;
- flooding of or near locally important services or infrastructure, for example health centres and electricity substations, to an extent that they cannot function normally.

1.3 This investigation

The flood event in Tunbridge Wells on 24 August 2015 meets the criteria of a significant flood event and therefore requires investigation. Whilst other RMAs are exercising their functions in response to

the event, an investigation was also deemed necessary due the widespread nature of the flooding and public interest, and to provide information for further studies into flood risk of this area.

2 Background Information

2.1 Location and Known Extent of Flooding

Widespread flooding was reported on the 24th August 2015 within the Tunbridge Wells area. Table 1 provides a summary of the known locations affected based on reports received by Tunbridge Wells Borough Council (TWBC), Kent Fire and Rescue Service (KFRS) and Kent County Council (KCC).

Table 1 Summary of investigated flooding issues and known flooding extent.

Location	Details of Flooding	Source of Report
Pantiles Area and River Grom		
Nevill Street	2 Fire engines pumped out water from two properties. Highway flooded and impassable by cars.	TWBC KFRS KCC
The Pantiles	Commercial properties internally flooded. Drains not taking volume of water away. Pedestrian area flooded and impassable.	TWBC KFRS
Market Street	2 Fire engines pumped out water from two properties. Highway flooded and impassable.	TWBC KFRS KCC
Warwick Park	1 Fire engine pumped out water from flooded residential basements and gardens using a light portable pump. 1 property flooded internally and gardens flooded due to overflowing watercourse. Culvert headwall damaged by water flow.	TWBC KFRS KCC
Sussex Mews	Internal flooding reported affecting lower ground floor of 1 property.	TWBC KFRS
London Road and Castle Street		
London Road	Flooding reported affecting at least 2 properties externally. It is unknown if any were internally flooded.	TWBC KFRS
Castle Street	1 commercial property internally flooded and highway flooded and impassable by pedestrians.	KFRS KCC
Mount Pleasant Road and Railway Station		
Mount Pleasant Road	Internal flooding to 1 commercial property and highway flooded.	KFRS
Tunbridge Wells Railway Station	Railway track flooded from overflowing drainage causing closure of Tonbridge to Hastings line until flooding subsided.	TWBC Network Rail

The locations of these roads can be seen in Figure 1. It should be noted that this list of affected locations is not exhaustive and many other localised incidences of flooding were reported at this time. Local news reports also indicate additional locations suffered flooding which were not reported to risk management authorities.

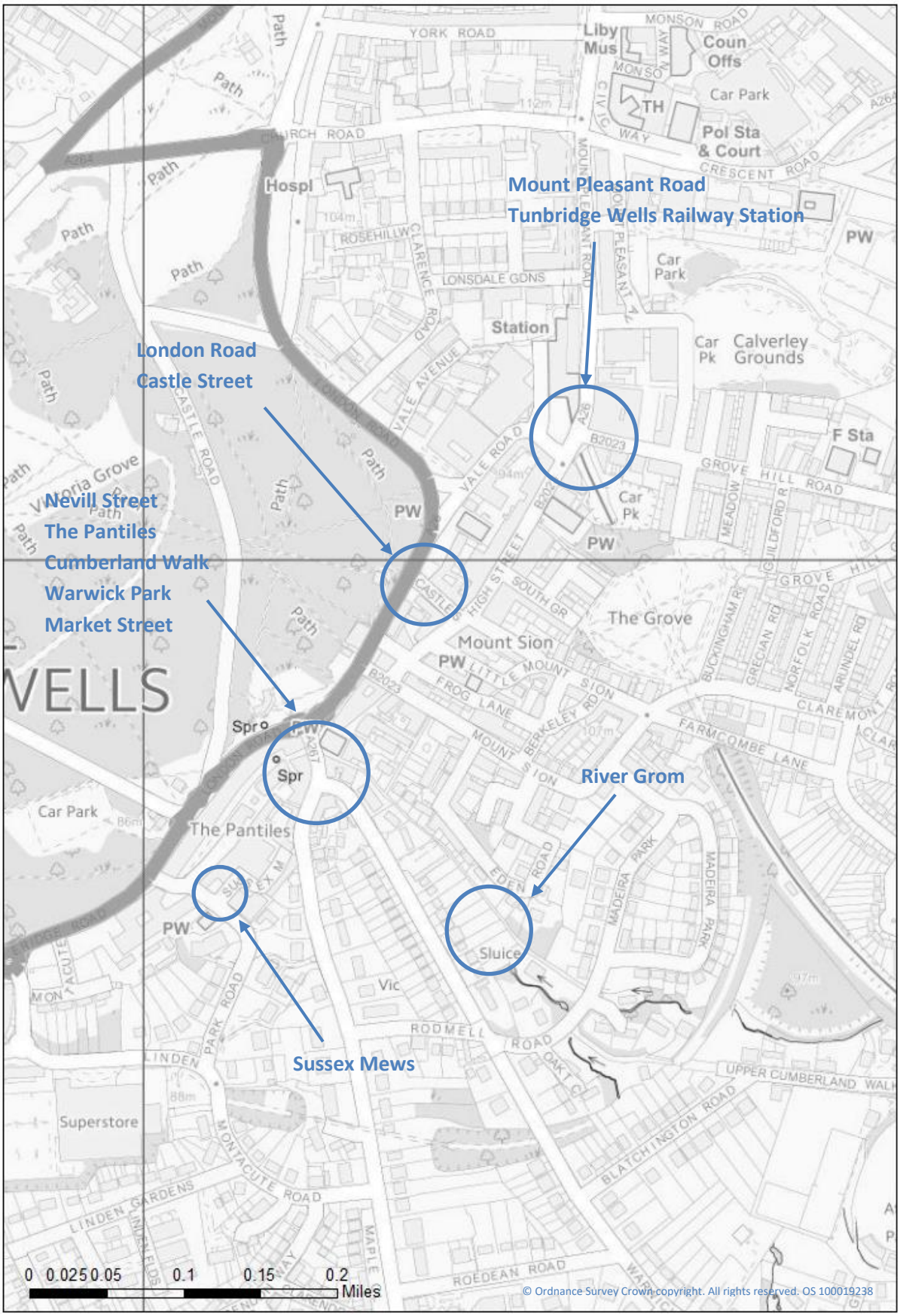

Figure 1 Locations of Flooding under Investigation.

2.2 Rainfall Data

Rainfall data was obtained from the Environment Agency for review from gauges located at Tunbridge Wells, Lamberhurst, and Redgate Mill, the locations of these rain gauges can be seen in Figure 2.

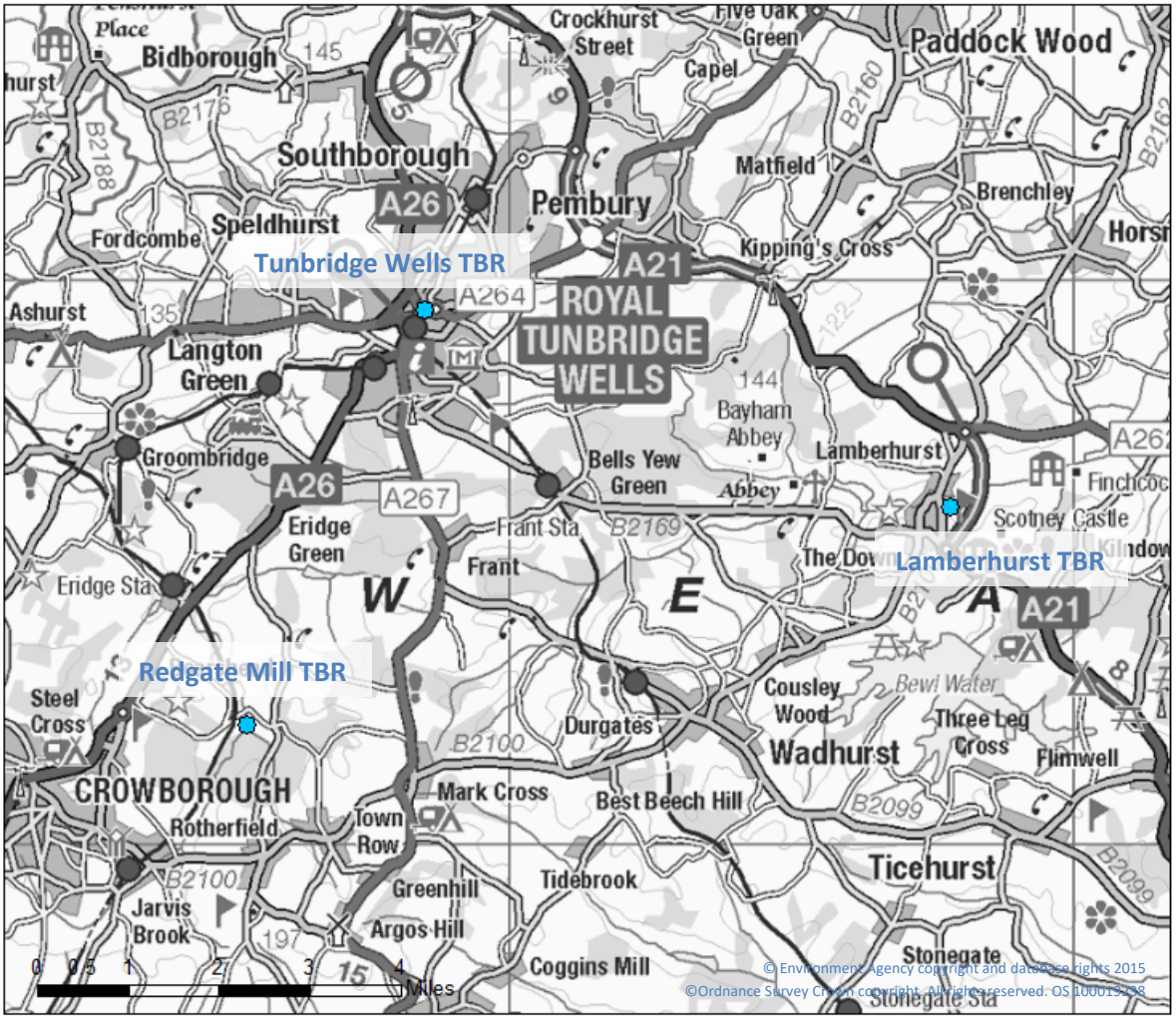

Figure 2 Locations of Rainfall Gauges.

The most significant rain was recorded between 17:00 and 18:00 BST at the Tunbridge Wells rain gauge, which recorded 40.4mm of rainfall within this hour period. This coincides with the first reports of flooding, which were received at 17:34. This event has a return period estimated as 1 in 51 year AEP using the Flood Estimation Handbook (FEH)[1]. A total of 66.4mm was recorded for the whole day, 47mm of which fell between 15:45 and 20:30, which includes the above event.

Rain gauges located at Redgate Mill (approximately 7.5km southwest) and Lamberhurst (approximately 10km southeast) each record less than 10mm in total of rainfall between 17.00 and 18.00, and under 30mm for the whole day. This indicates the storm event affecting the Tunbridge Wells area was localised in nature and likely to be a heavy summer storm.

[1] FEH is the standard tool in the UK to estimate rainfall return periods. It is used by the Environment Agency and all professional hydrologists to estimate rainfall and rainfall return periods.

A graph showing the rainfall for the day is presented in Figure 3.

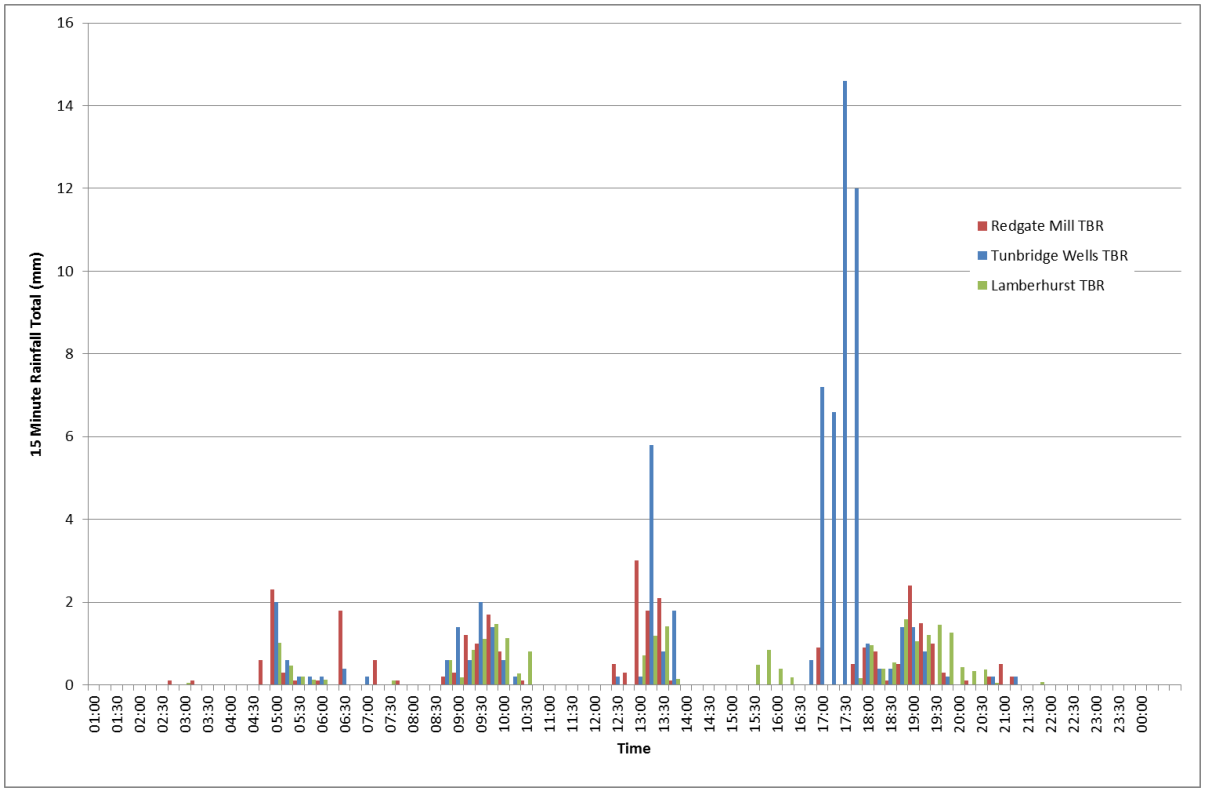

Figure 3 Rainfall Data for 24th August 2015 at 15 minute intervals, adjusted to BST.

2.3 Existing Drainage Infrastructure

2.3.1 Sewers

The majority of this area is urban development of residential and commercial properties associated with this town centre location. The area therefore has a high percentage of impermeable area due to buildings, car parks, hard standings and highways, these drain to either combined sewers (carrying both foul and surface water) or to dedicated surface water sewers where they are available. The public sewers in Tunbridge Wells are owned and maintained by Southern Water. The public highway generally drains to the public sewer network in this area via road gullies and pipework owned and maintained by KCC as the Highway Authority. The town centre area to the northeast of The Pantiles is generally drained by combined sewers ultimately discharging to the Tunbridge Wells South Waste Water Treatment Works. There are only a few dedicated surface water sewers in this part of the town.

To the south and east of The Pantiles, much of the area has separate surface water and foul water drainage although some combined drainage may exist in older parts of the town. The surface water sewers generally discharge to watercourses which ultimately flow into the River Grom.

North of the town centre, and areas of more recent construction, there are also separate systems of foul and surface water public sewers in many areas. The surface water sewers generally discharge into ordinary watercourses throughout the area flowing northwards towards the North Farm Stream.

A plan of the public sewers in Tunbridge Wells can be seen in Figure 4. The concentration of combined sewers (red in the map) indicates the older areas of the town; with the separate system (blue for surface water and brown for foul) the more recently developed areas.

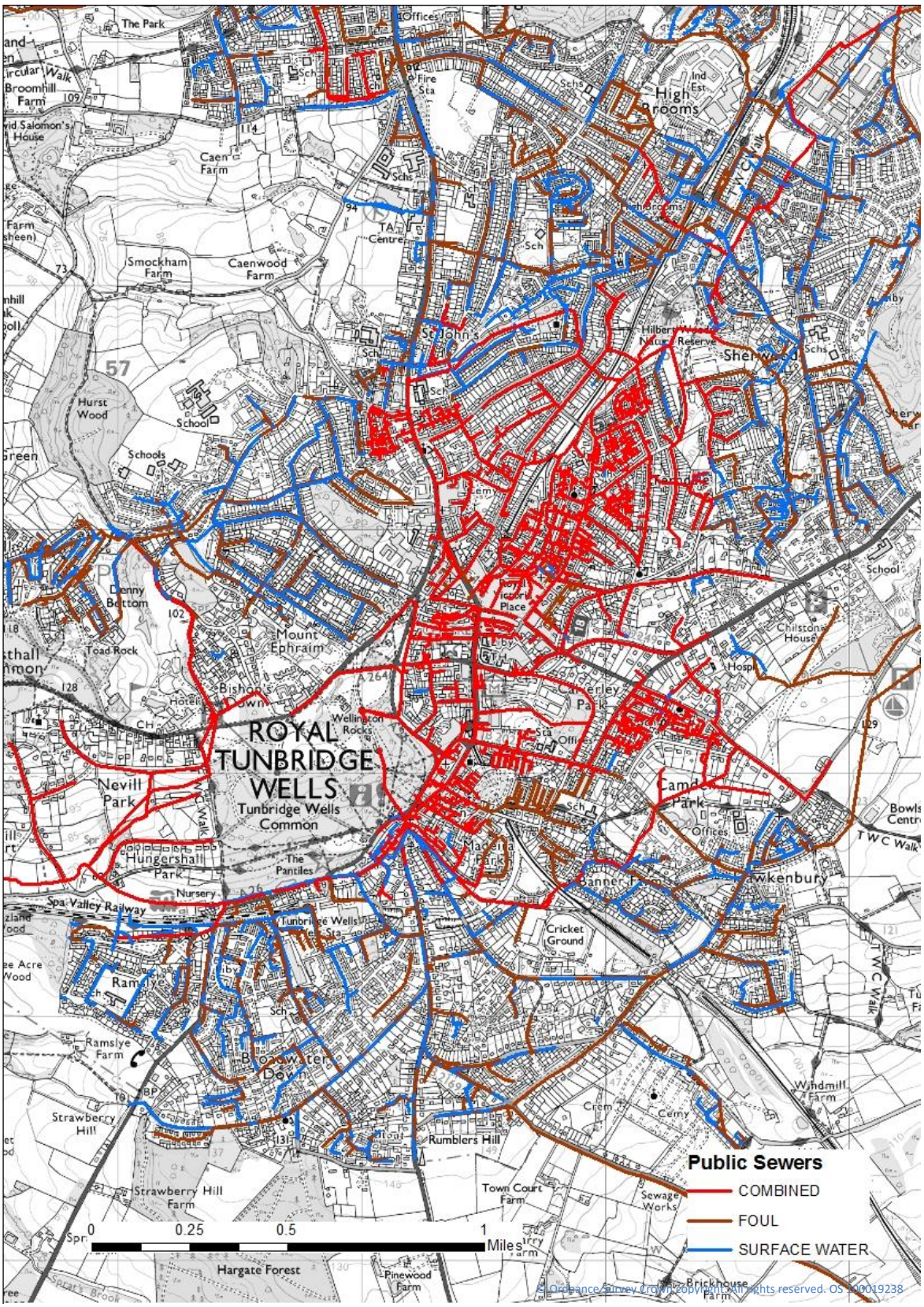

Figure 4 Public sewers in Tunbridge Wells

Modern sewerage in the UK is designed according to the standards set out in Sewers for Adoption guidance together with the sewerage undertaker's own supplementary design stations. Sewers for Adoption was first published in 1980 and sets out a design standard for sewers and drains of 1 in 30 years plus climate change, i.e. a new sewer system should be designed to contain a storm of 1 in 30 years return period, storms that exceed this intensity needn't be contained in the sewer system. Water companies that own the public sewer network can invest in the sewers according to their business plan, however this investment is regulated by the water regulator, OfWat, and must be cost beneficial. Consequently it is rare for improvement works on sewers to provide a capacity greater the 1 in 30 year standard where the existing system does not already exceed this standard.

2.3.2 Watercourses

The River Grom is a watercourse that flows through the lower part of Tunbridge Wells around the Pantiles and Nevill Cricket Ground area. It was culverted (i.e. piped) to enable development above it, probably in stages, and cannot be seen in the town centre.

The exact source and route of the tributaries of the River Grom is now unclear as there has been so much development in this area, but the River Grom flows into the in a private garden in the residential area northeast of Warwick Park. From there it flows in a north-westerly direction towards the junction of Warwick Park and Nevill Street, where it turns to the west and flows west and becomes an open watercourse again to the west of the Eridge Road railway bridge. The approximate course of the River Grom culvert can be seen in Figure 5.

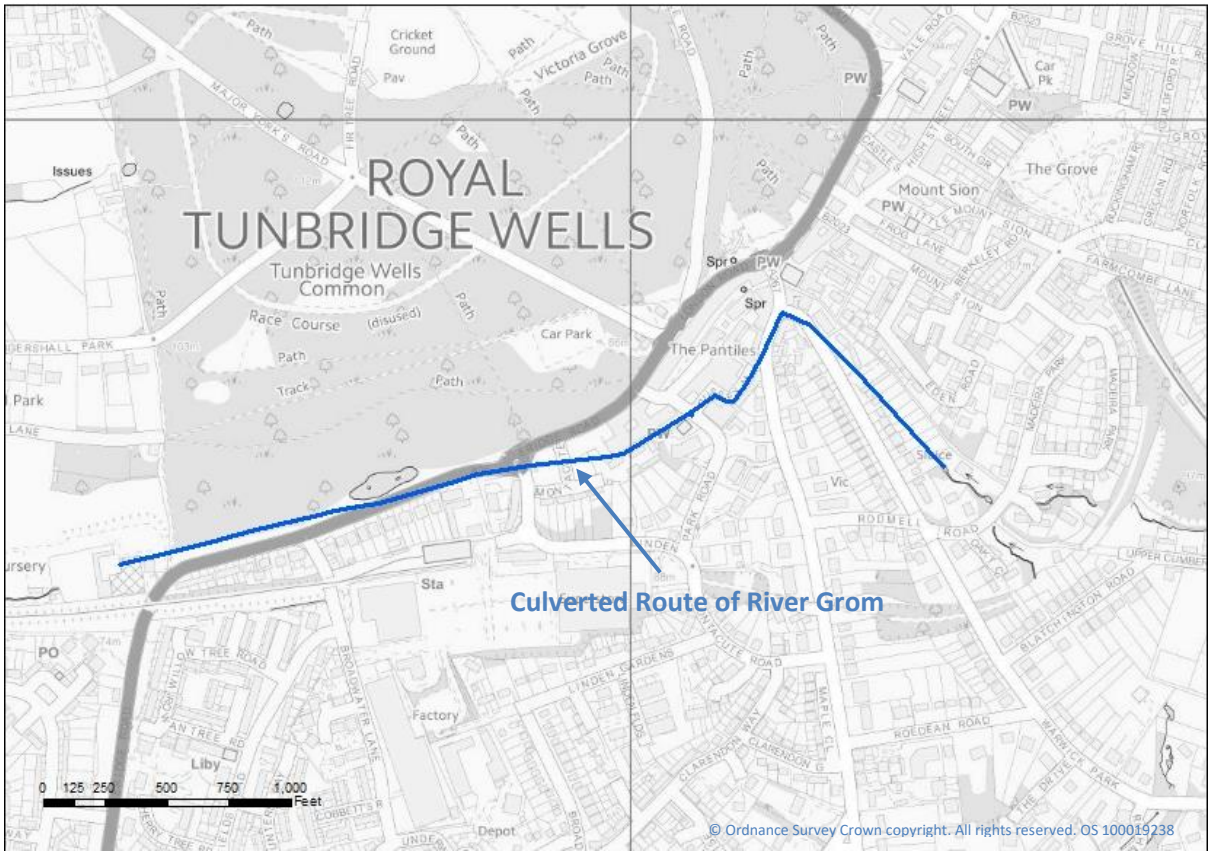

Figure 5 Approximate location of the River Grom culvert in Tunbridge Wells

It is likely to have been culverted first during the late Victorian era. The River Grom directly drains the area around the Nevill Cricket Ground, including an area to the north of the railway line. There is a Combined Sewer Overflow (CSO) from the public combined sewer in the culverted section of the River Grom that allows the combined sewer in the Pantiles area Tunbridge Wells to discharge into it if its capacity is exceeded. This is a consented discharge. There are also some surface water sewers that discharge into the River Grom culvert that drain the areas to the south of the river.

The culvert is large, ranging in width from approximately 0.9 m up to 1.8 m in places. The geometry of the culvert changes, in places it is a Victorian brick arch culvert in others a concrete circular culvert. There are no records of flooding from the culverted section. The open section upstream of the culvert has experienced flooding in the past. The River Grom is registered as a public sewer on Southern Water's records.

2.4 Roles and Responsibilities

2.4.1 Kent County Council

KCC is the lead local flood authority for Kent and the highway authority. The Flood and Water Management Act 2010 gives lead local flood authorities powers and duties for the strategic overview of local flooding and for some flood-risk management functions including:

- a duty to investigate flooding
- a duty to maintain a register of significant structures and features
- powers to regulate ordinary watercourses
- A duty as a statutory consultee to review drainage strategies and surface water management provisions associated with applications for major development

As the highways authority KCC are responsible for the maintenance and operation of drainage gullies and pipework connecting these to the public sewers for the proper function of highways and safety of highway users.

2.4.2 Tunbridge Wells Borough Council

Tunbridge Wells Borough Council (TWBC) is responsible for street cleaning / sweeping within the area. They are also a category one responder under the Civil Contingencies Act 2004, along with KCC and the emergency services during emergency responses such as that required by a flooding event.

2.4.3 Statutory Undertaker for Public Sewers

Southern Water are responsible for the maintenance and operation of the public sewer network throughout the area carrying foul water, surface water or combined (sewers carrying both foul and surface water).

2.4.4 Riparian Landowners

Private landowners have responsibilities for the maintenance and upkeep of ordinary watercourses, including any associated culverts, and the bed / banks of any watercourse adjacent to or within their land. They should clear away any debris from the watercourse or culvert even if it did not originate from their land.

2.4.5 Residents and Property Owners

Private landowners are responsible for the maintenance and operation of drainage assets and connecting pipework located on privately owned roads and footways, car parks and other hard standings and for building surface water drainage.

Residents and property owners who know they are at risk of flooding have responsibilities to mitigate the risk of flood damage to their property as far as is reasonably practicable. They should take measures to protect themselves and their property when flooding is imminent. Residents and property owners have the right to defend their property as long as they do not subsequently increase the risk of flooding to other properties.

3 Analysis of the Flood Event

The details of the flooding in the areas affected during the event on 24 August are set out in more detail in this section of the report to collate existing and published information, and details recorded during the investigations of the flooding event.

3.1 Pantiles Area (Including Nevill Street, Cumberland Walk, The Pantiles, Warwick Park, Market Street, Sussex Mews)

3.1.1 Summary of Impact

The Pantiles area was affected by surface water ponding in excess of 0.5m depth with the flooding extending along Nevill Street between the junctions with London Road, Market Street. The Pantiles, Market Street and Warwick Park were also flooded local to Nevill Street.

It is understood that the flooding on the road had drained away within two hours of rainfall ceasing, and a road sweeper was sent by KCC to clean up silt and gravel deposited by the water flows. Kent Fire and Rescue Service were at the scene assisting with pumping out properties until 01:16am of 25th August 2015.

Two residential properties and four commercial properties are known to have flooded internally. Flooding was also reported in Market Street due to an accumulation of surface water at its low point, resulting in the flooding of two properties. Flooding of one residential property was also reported in Sussex Mews but is a separate incidence of flooding.

Photo 1 Flooding in Nevill Street (Source: Kent and Sussex Courier)

The flooding in this location was reported by the local media and provides photographs of the flooding event; http://www.courier.co.uk/Flooding-swamps-Tunbridge-Wells/story-27667627-detail/story.html andhttp://www.courier.co.uk/Flash-floods-cause-devastation-Tunbridge-Wells/story-27668096-detail/story.html

3.1.2 Site Location, Topography and Published Flood Risk

The junction of Nevill Street, The Pantiles and Warwick Park lies within a low point in the area at approximately 80.3mAOD. There are also low points at Market Street of approximately 81mAOD and at Sussex Mews, at the junction with Linden Park Road at approximately 79.3mAOD. In addition to these low points, many buildings affected by flooding have basements below street level.

The updated Flood Map for Surface Water (uFMfSW) shown in Figure 6 is published on the Environment Agency website and provides information on areas considered risk of flooding due to surface water.

The affected area includes locations indicated to be at high risk of surface water flooding. High risk is defined a chance of flooding during a 1 in 30 year event. This map does not take into account the presence of watercourses, sewers or other drainage features that convey water efficiently and is only indicative of areas at risk of surface water flooding.

The map indicates the risk in this area is due to the number of flow routes converging in this area with limited ability for the water to flow away over the ground.

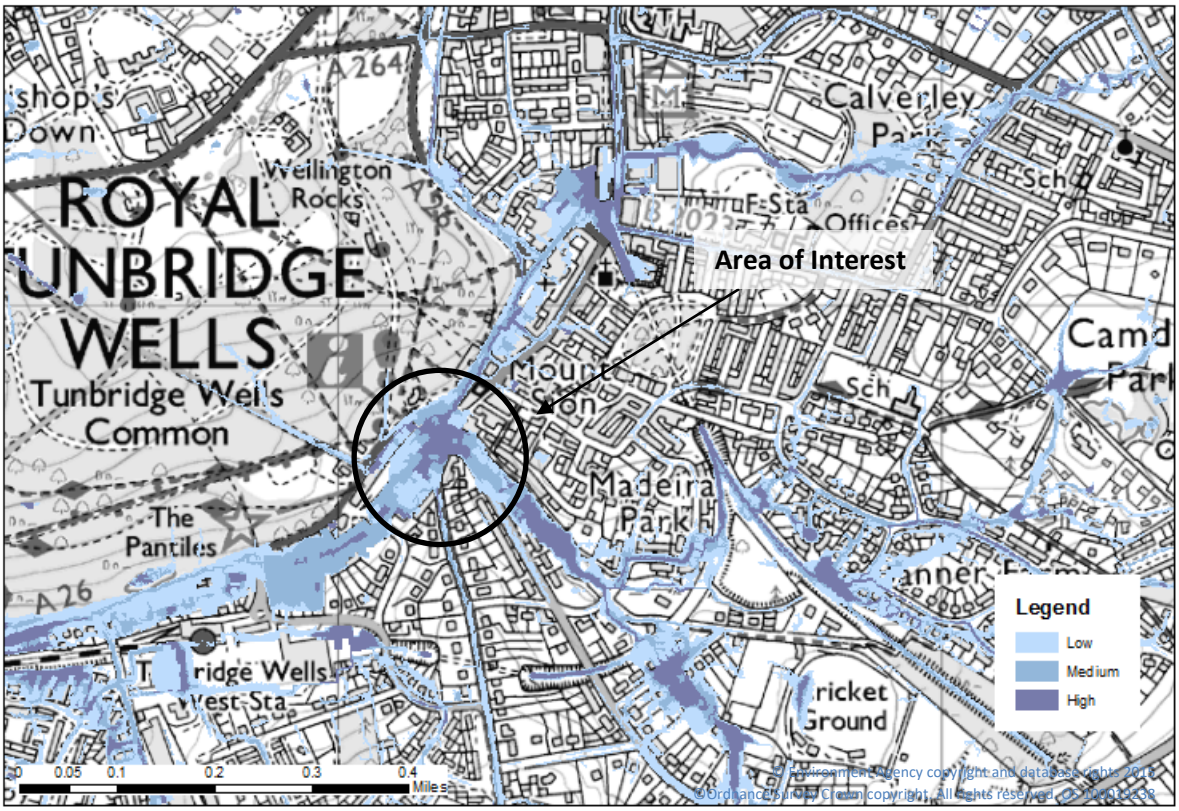

Figure 6 Surface water flood risk for the Pantiles Area.

3.1.3 Existing Drainage and Watercourses

Both highway and private drainage systems in this area predominantly discharge to the public combined sewer, either by gravity or via a localised pumped system. The culverted River Grom flows underground below Warwick Park and to the south of The Pantiles

3.1.4 Flood History

The Tunbridge Wells Surface Water Management Plan notes instances of foul and surface water flooding reported by Southern Water due to hydraulic overload of foul and surface water sewers at Warwick Park in 2009 and 2012.

KCC have received reports of flooding affecting properties in the area of Nevill Street and Warwick Park in November 2013, December 2013, February 2014, October 2014 and August 2015.

3.1.5 Flooding Mechanism

The primary cause of the flooding was excessive rainfall which exceeded the capacity of the drainage systems in this area. The intensity of the rainfall meant that surface water was unable to enter the sewer network fast enough and accumulated in the topographical low points, which reached sufficient depths to enter property in some locations. This heavy rainfall also caused surcharging (backing up) of the combined sewer network at Nevill Street causing the drains to back up into properties.

During the investigation a number of factors were identified that may have affected the depth of the flooding, these are set out below:

Road wash

Vehicles large enough to drive through flood water caused a bow wave effect which led to additional damage to property from the resulting rapid water movement. No properties however are known to have flooded primarily as a result of road wash from vehicles.

Blocked drainage

Subsequent investigations by Southern Water found a blockage caused by a piece of concrete in the public sewer leading from Cumberland Walk to a submersible pump at Warwick Park. This provides foul and surface water drainage for the block of properties between Cumberland Walk, Nevill Park and Warwick Park and surface water drainage for buildings and some of the highway drainage at this location. The piece of concrete can be seen in Photo 2.

Photo 2 Piece of concrete recovered from 150mm diameter combined sewer line (Source: Southern Water)

Internal flooding of properties in this location was also reported by local residents on the 13 August, 16 September and 21st September. At least one residential property and two commercial properties are known to have been affected. On 13 August, a total of 20.2 mm of rain was recorded by the Tunbridge Wells rain gauge, 13.8 mm of which fell between 09:15 and 13:00 with the highest intensity of 5mm in 15 minutes at 10:30am. On the 16th and 21st September, daily rainfall totals recorded were 25.0 mm and 22.8 mm respectively. Further analysis of these events has not been undertaken as they are outside the scope of this investigation.

Flooding on the 24th August is unlikely to have been preventable due to the public sewer capacity being exceeded; however the extent of flooding may be increased to some degree by this blockage. In the above subsequent events, it is a contributory factor to the repeat instances of flooding. The presence of this piece of concrete has been linked to recent resurfacing works on the highway. However, the constituency of the concrete does not match any material used during the resurfacing works. The source of the concrete remains unknown.

Reports of blocked drains along Warwick Park were also received by KCC and also noted during a site walkover. The highway drainage engineer noted one drain at Warwick Park near Nevill Street has been found to have had its pipework damaged by utility works. Whilst these blockages were unlikely to cause significant flooding, they may contribute to higher surface water flows towards the low points of Warwick Park and Nevill Street in a very heavy rainfall event. It is noted in previous maintenance records that the cleaning of drains in these street has been problematic in the past due to parking restrictions being ignored by vehicles, meaning they cannot access drains to clean.

Road Resurfacing

It was also reported by local residents and businesses and local media that blockages of the highway drainage with tarmac had occurred from resurfacing works undertaken from 12 to 17th August 2015 on Nevill Street and the adjacent roundabout on London Road.

During the clean-up operations following the flood event, highway gullies on the western side of Nevill Street, adjacent to the Pantiles, were found to contain some tarmac in their sumps. However, these deposits were not significant and did not block the outlet pipes from these drains.

A manhole adjacent to the highway drains at Nevill Street in Photos 3a and 3b contains a build-up of silt, however this is only an access to a non-return valve and this debris is not causing a blockage on the drainage network. A subsequent CCTV survey undertaken by KCC shows the non-return valve to be in full working order.

Standard procedure for resurfacing works is to cover the gullies to prevent tarmac from entering them. If this procedure had not been followed the drains would have been fully and visibly blocked with tarmac and unable to be cleaned. These deposits may have come from a previous repair on these gullies. No tarmac was found in the other highway drains within the area that was resurfaced.

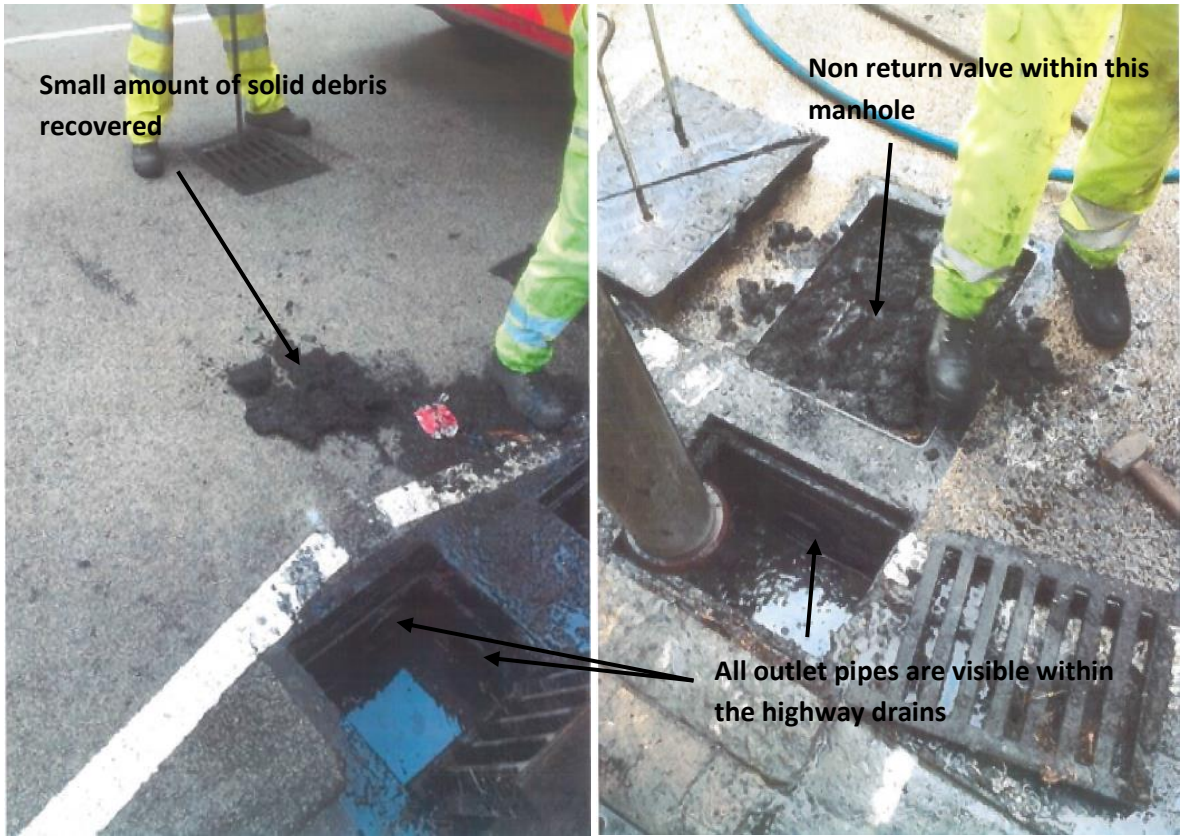

Photo 3a and 3b Photographs taken during drainage cleansing on 25th August (Source: Southern Water)

Photo 3 (left) and 4 (right):

3.1.6 Response to Flooding and Proposed Further Actions

The following RMAs having relevant flood risk management functions have exercised or are proposing to exercise the following functions and actions in response to the flood event.

KCC undertook the following activities in the area during and after the flooding:

1. The duty officer was sent to site on 24 August 2015 and arranged clearance of debris from the highway after flood water had subsided.
2. Assistance was provided to KFRS to clear drains to assist with pumping out of properties on Nevill Street.
3. Following inspection of the area, KCC programmed cleansing the drainage Warwick Park on 18 November 2015. There are four drains remaining requiring further work due to parked cars or drain grids requiring replacement.
4. One damaged drain in Warwick Park has been reported to the relevant party for them to undertake a repair.
   Due to the high consequence of flooding in this area, KCC will increase the maintenance frequency of the highway drains in Nevill Street and Warwick Park to twice a year.

KCC have undertaken a CCTV survey of the publically maintainable drainage along and immediately adjacent to Nevill Street to assess the system layout and inform future flood risk management studies. No significant defects were found by the investigation.

Southern Water has undertaken the following activities:

1. CCTV survey in the Pantiles area identified the blockage from the lump of concrete, which was removed.
2. The sewer in Warwick Park has a small submersible pumping station, with a low discharge rate. Significant quantities of grit and stone build up have been removed from the pumping station wet well. This grit may have been washed into the station during the rainfall event or has come from the construction works in that locality.
3. Inspection of the Neville Street CSO screen has been carried out. This has identified some minor maintenance work which has now been completed.

Southern Water has identified some discrepancies on their public sewer map which have now been updated with the recent survey data. Hydraulic modelling is currently being undertaken on the Warwick Park submersible pump to ensure the capacity is sufficient for the flow it receives.

TWBC attended the site as part of emergency response procedures and undertook clean-up operations following the flood event. They have supported the LLFA in the investigation of the flood event and provided information of the affected areas.

3.2 River Grom

At Warwick Park, the River Grom was reported to have overflowed the entrance to the culvert during the heavy rainfall causing internal flooding to one property. The water also collected in several gardens to a depth in excess of 1m. High flows and debris in the water flow also caused damage to the culvert headwall's trash screen itself.

3.2.1 Site Location, Topography and Published Flood Risk

The entrance to the River Grom culvert lies in a private garden. The flow at this point has come from a mixture of open watercourses, culverted sections of watercourse and drainage from the developments in the area to the north, south and southeast of the Nevill Cricket Ground. Due to the river the topography in the area naturally drain water towards the culvert. This is reflected in the flood risk indicated by the Updated Flood Map for Surface Water, shown in Figure 7.

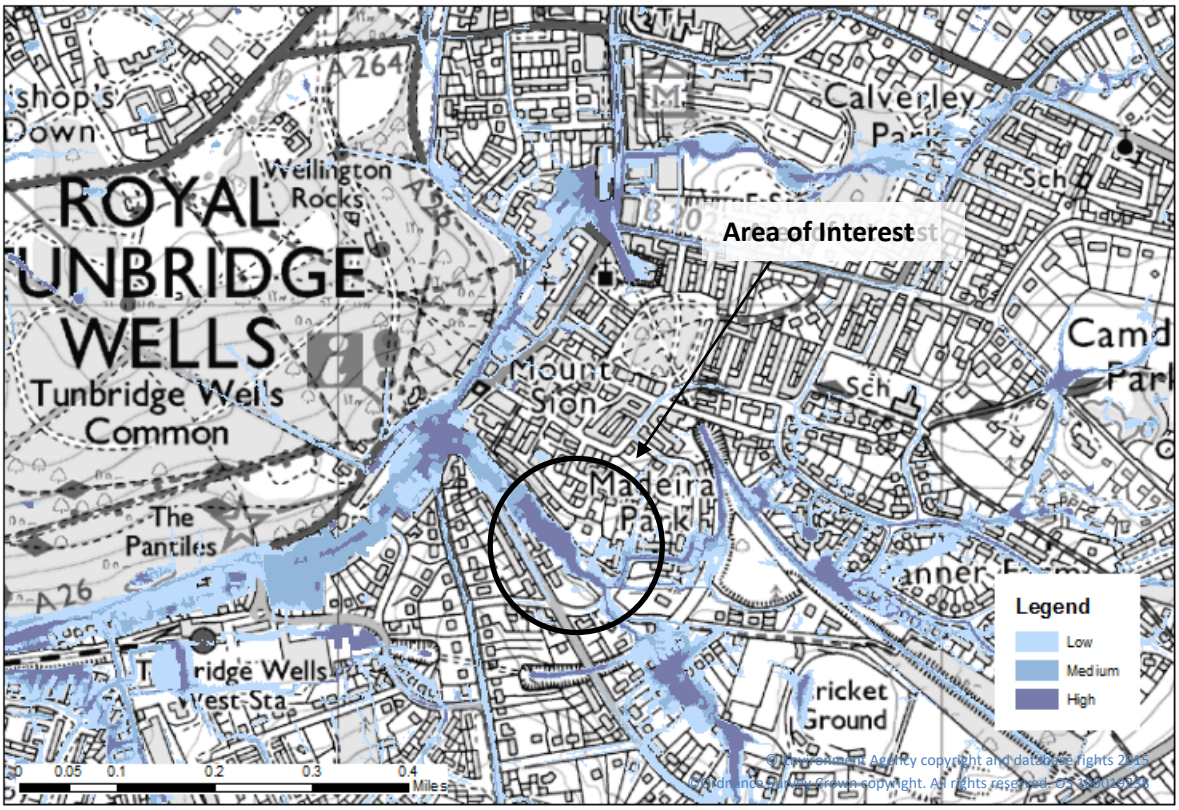

Figure 7 Surface water flood risk at Warwick Park

3.2.2 Flooding Mechanism

Due to the urban nature and the relatively low permeability of the ground in this area, the watercourses respond rapidly to rainfall. On 24 August the heavy rainfall caused high flows which overwhelmed the culvert and channel capacity. The culvert has a trash screen that prevents debris from entering the culvert where it can cause a blockage that is hard to remove. Due to the age of the trash screen and its design, it is dangerous to maintain in high flows.

Trash carried by the flood water may have caused the trash screen to impede some of the flow, and due to the dangerous level of the water it could not be kept clear. The maintenance of the culvert trash screen and the ordinary watercourse upstream are the responsibility of the riparian landowners.

3.2.3 Response to Flooding and Proposed Further Actions

KCC has inspected the trash screen on the culvert entrance. The land owners are aware of their riparian responsibilities and are considered to have adequate maintenance measures in place. KCC's inspection found that the trash screen would be very difficult to maintain in a high flow event from a safety perspective.

3.3 London Road and Castle Street

3.3.1 Summary of Flood Impact

Flooding in this location is reported to have affected two properties externally at London Road although others are likely to have suffered flooding to driveways and the front of properties by flowing water as shown in Photo 6.

In Castle Street, which is located off London Road, one commercial property is reported to have flooded internally and the highway was flooded to a depth of approximately 0.3 to 0.4m over a of distance of at least 50m in its lowest point.

Photo 4 Flooding of property off London Road near Castle Street (Source: Kent and Sussex Courier)

3.3.2 Site Location, Topography and Published Flood Risk

There is a localised topographical depression at Castle Street, where water can build up, which is likely to have led to flooding of properties on London Road from the rear. Other properties flooded on London Road from the front due to the water flowing down the road.

The uFMfSW shown in Figure 4 provides information on areas considered risk of flooding due to surface water.

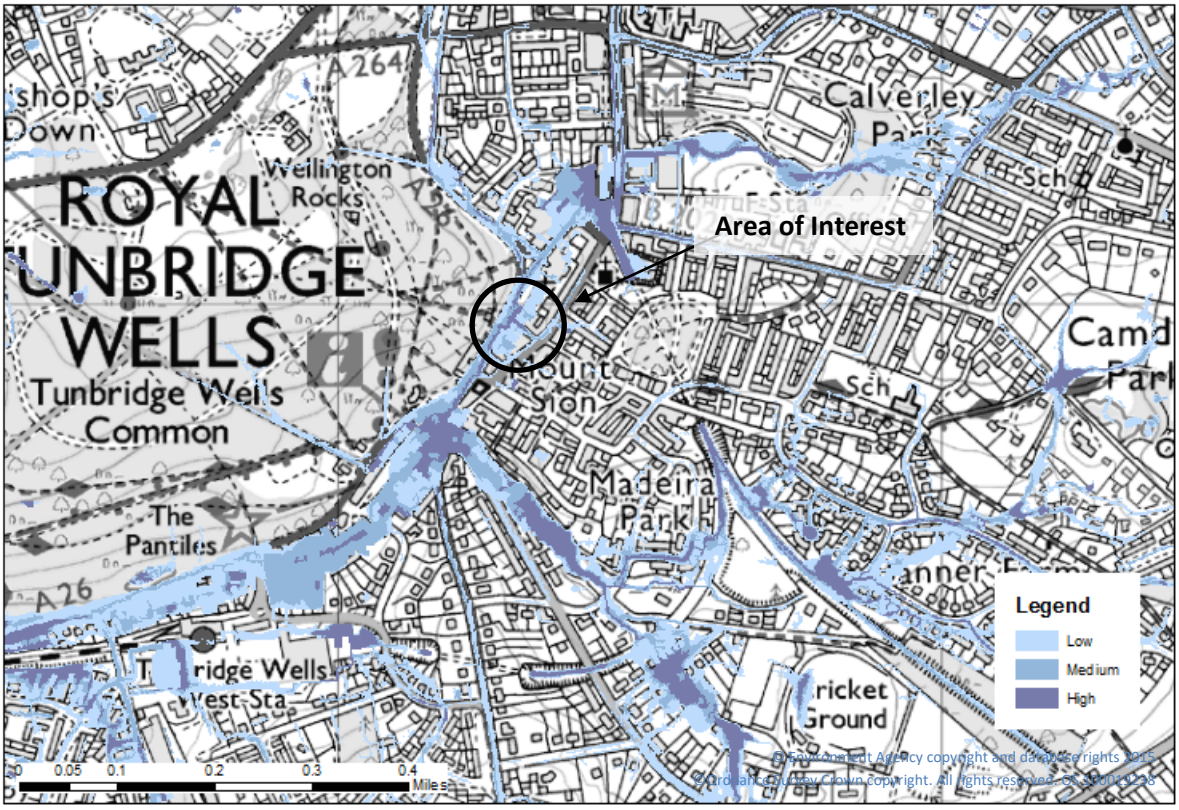

Figure 8 Surface water flood risk at London Road and Castle Street

The affected area includes locations indicated to be at high risk of surface water flooding. High risk is defined a chance of flooding in a 1 in 30 year event. This map does not take into account the presence of watercourses, sewers or other drainage features that convey water efficiently and is only indicative of areas at risk of surface water flooding.

The risk on the map in this area is due to a topographical low point between London Road and High Street local to Castle Street.

3.3.3 Existing Drainage and Watercourses

Both highway and private drainage systems in this area discharge to the public combined sewer. There are no dedicated surface water sewers in this area.

3.3.4 Flood History:

There are also no previous reports of flooding at this location although one enquiry at Castle Street dated May 2005 commented that erosion of the cobbled street had occurred due to surface water flows from the High Street into Castle Street. No property flooding is reported to have occurred as a result as the water drained away via the highway drains within Castle Street itself.

3.3.5 Flooding Mechanism

The primary cause of the flooding was excessive rainfall which exceeded the capacity of the drainage in this area. This meant that surface water was unable to enter the sewer network fast enough and

accumulated in the topographical low points, which reached sufficient depths to enter property. There are no other known contributory issues to the flooding in this area.

3.3.6 Response to Flooding and Proposed Further Actions

The following RMAs having relevant flood risk management functions have exercised or are proposing to exercise the following functions and actions in response to the flood event.

KCC undertook an inspection of this area following the flooding and found the majority of highway drains are clear (with the outlet pipes visible).

Southern Water has carried out CCTV Surveys on the public trunk sewers in and around London Road. These have not identified any issues.

3.4 Mount Pleasant Road and Tunbridge Wells Station

3.4.1 Summary of Flood Impact

Flooding in this location is reported to have affected one commercial property in the ground floor and basement levels due to water flowing through doorways and into the basement. The highway suffered flooding due to water collecting in the lowest point up to 0.3m in depth shown in Photo 7.

Photo 5 Flooding of Mount Pleasant Road (Source: Kent Messenger)

Tunbridge Wells Railway Station, located adjacent to Mount Pleasant Road, suffered flooding to the track bed of a depth of approximately 0.15m due to an overflowing manhole as shown in Photo 8. This caused a temporary closure of the Tonbridge to Hastings line.

Photo 6 Flooding of Tunbridge Wells Station (Source: Network Rail)

3.4.2 Site Location, Topography and Published Flood Risk

At Mount Pleasant Road, a low point is present near the southern end of the road at approximately 94mAOD. The adjacent railway station lies in a deep cutting and passes beneath the highway at the southern end of Mount Pleasant Road.

The uFMfSW shown in Figure 9 provides information on areas considered risk of flooding due to surface water.

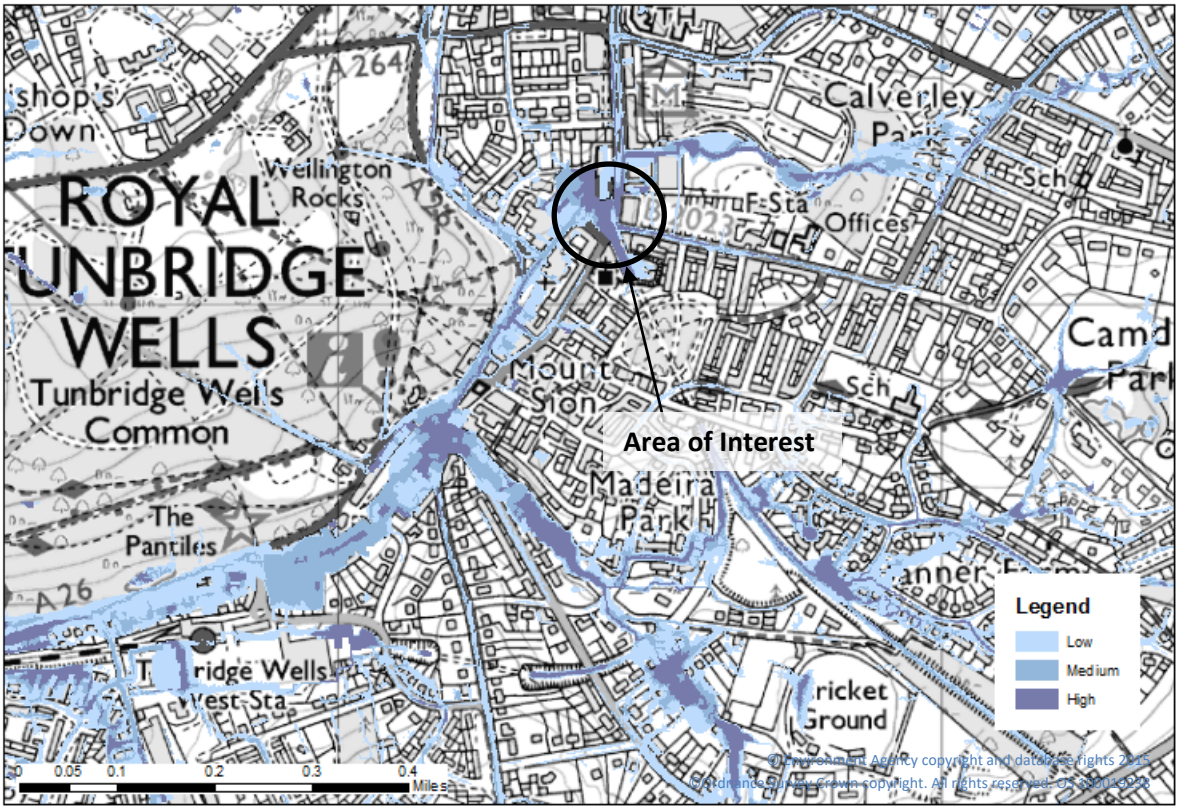

Figure 9 Surface water flood risk local to Tunbridge Wells Railway Station

The affected area includes locations indicated to be at high risk of surface water flooding. High risk is defined a chance of flooding in a 1 in 30 year event. This map does not take into account the presence of watercourses, sewers or other drainage features that convey water efficiently and is only indicative of areas at risk of surface water flooding.

The risk on the map in this area is partly due to the railway cutting which the modelling would have included and from which the model will not include any way of water escaping, leading to an accumulation of flood water in the model that may not be representative of the real situation. Outside of the railway station the risk in this area is due to the change in gradient at the bottom of the Mount Pleasant Hill that causes water flowing down the hill to pond, the water will arrive here faster than it can escape due to this change in gradient.

3.4.3 Existing Drainage and Watercourses

Both highway and private drainage systems in this area discharge to the public combined sewer. There are no dedicated surface water sewers in this area.

3.4.4 Flood History:

KCC have not received any previous reports of flooding at the low point of Mount Pleasant Road.

Network Rail have reported that Tunbridge Wells Station has suffered similar flooding events at the following dates and times, which have resulted in disruption to trains services:

- 24/08/2015 17:15
- 10/08/2014 11:00
- 20/10/2013 15:40
- 23/09/2012 15:58
- 03/06/2012 00:55
- 24/07/2009 16:18
- 20/07/2007 11:19

Southern Water has not received any reports of flooding from the public sewer affecting Tunbridge Wells Train Station prior to this flooding event and was previously unaware of any problem here.

3.4.5 Flooding Mechanism

The primary cause of the flooding was excessive rainfall which exceeded the capacity of the drainage in this area. This meant that surface water was unable to enter the sewer network fast enough and accumulated in the topographical low points, which reached sufficient depths to enter property.

At Mount Pleasant Road, an overland flow path for surface water is indicated from Calverley Grounds, however it is not known if surface water from this area contributed to the flooding. Surcharging (backing up) of the combined sewer was reported to have occurred at Tunbridge Wells railway station causing flooding to the track bed where it passes beneath the railway.

There are no other known contributory issues to the flooding in this area.

3.4.6 Response to Flooding and Proposed Further Actions

The following RMAs having relevant flood risk management functions have exercised or are proposing to exercise the following functions and actions in response to the flood event.

KCC undertook an inspection of this area following the flooding and found the majority of highway drains are clear (with the outlet pipes visible)

Southern Water has carried out CCTV Surveys on the public trunk sewers in and around London Road, and in the vicinity of Tunbridge Wells Station. No defects were found during these surveys.

4 Conclusions and Recommendations

The flooding that occurred on 24 August 2015 in Tunbridge Wells was caused by 40.4 mm of rain falling in one hour, an event of 1 in 51 year return period. Modern urban drainage is not designed to cope with rainfall this intense. The majority of the flooding occurred due to water collecting in topographical low points. Other factors have been identified that may have contributed to the extent or depth of flooding but these will not have caused it.

Whilst a flood from a similar event cannot be fully prevented in future (as drainage infrastructure is not commonly designed to accommodate the intensity of rainfall that was experienced in this event), there may be steps that can be undertaken that may be able to reduce the risk. Some of the opportunities that have been identified as part of this investigation are outlined below:

1. KCC should programme and undertake future gulley cleaning throughout Warwick Park in co-operation with Tunbridge Wells Borough Council's Street Sweeping operations. Southern Water should also be invited to attend should they have any routine maintenance requirements in this location.

2. KCC and Southern Water should explore the opportunity to drain surface water from highway areas in the Nevill Street and Warwick Park area directly to the culverted section of the River Grom (indicated as a public surface water sewer). The feasibility of connecting highway drainage directly to this watercourse should be assessed to improve resilience against highway flooding and free up capacity within the public combined sewer.

3. Southern Water will assess the capacity of the submersible pump that serves the sewer on Cumberland Walk and to undertake a survey of the sewer under Tunbridge Wells railway station.

4. Network Rail should liaise with Southern Water regarding problems caused by the surcharging of a manhole in the track, which may include sealing of the manhole. Network Rail should ensure future incidences of flooding from the sewer are reported to Southern Water.

5. KCC should liaise with the land owner where the entrance to the River Grom is located to assess whether the trach screen arrangement can be improved.

6. KCC to investigate the potential contribution of overland flow through Calverley Park and Calverley Grounds noted on the uFMfSW."

7. Residents should be aware of their risk of flooding and investigate if there is anything they can do to protect themselves, such as the fitting of Property Level Protection Measures. Kent County Council can provide advice on local flood risk on request (by emailing us at flood@kent.gov.uk) Advice about Property Level Protection to reduce the risk of flooding can be found from the National Flood Forum (http://www.nationalfloodforum.org.uk/property-level-protection-community-tool/). Residents and landowners can review their own flood risk from rivers and surface water via the Environment Agency website. Advice regarding property level flooding protection is available on the National Flood Forum's website.