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Somerset County Council
Lead Local Flood Authority

Flood Investigation Report

Croscombe, Shepton Mallet, Somerset

11th July 2012

October 2012

Revision Schedule

Rev	Date	Details	Author	Checked by	Approved by
1	28/08/12	Draft for stakeholder consultation	S Webster	D Martin	
2	4/10/12	Final			S Webster

Acknowledgements

The assistance of Croscombe Parish Council in collecting data and photographs of the flood incident is gratefully acknowledged.

Contents

Executive Summary

This Flood Investigation Report has been prepared by Somerset County Council under our duties as a Lead Local Flood Authority (LLFA) as prescribed by the Flood and Water Management Act 2010 (FWMA). The Act states that as a LLFA the County Council has a duty to investigate flood events that occur within its area, as it deems necessary.

We are grateful for the information and support provided by a number of teams and individuals within Somerset County Council, Environment Agency, Wessex Water and Croscombe Parish Council.

It was deemed necessary to complete an investigation into the flood incident at Croscombe as a number of properties were flooded internally resulting in significant local concern. This investigation was conducted to determine the cause of the flooding and assess the likelihood of a recurrence along with the need for measures to reduce the risk.

Our investigation has concluded that the overall cause of flooding was surface water runoff from higher ground that was unable to enter the river, which at that time had the capacity to accept it.

This report provides a summary of the roles and responsibilities of the authorities involved and the actions under investigation to mitigate the problem. Section 5 of this report provides options to reduce the risk of flooding in the future.

These works will need to be developed and approved, whilst ensuring that any physical measures put in place do not merely transfer the flooding problem to another location. Delivery of options will be subject to the availability of funding.

1. Introduction

1.1. Lead Local Flood Authority Duty to Investigate

Under the Flood and Water Management Act 2010, Somerset County Council is designated as the Lead Local Flood Authority (LLFA) for Somerset. This Act sets out a number of responsibilities for the County Council with regard to flooding, including a duty to investigate flood events within its area as it deems necessary:

(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.

Section 19, Flood and Water Management Act 2010.

In discussion with other flood risk management agencies it was deemed necessary to complete and publish an investigation into the flood event at Croscombe, Shepton Mallet on 11th July 2012 because of the number of properties affected and the possible multiple sources of flooding.

This report provides a summary of the event and probable causes. It records the actions taken and/or proposed and the organisation or individuals responsible for completing them.

1.2. Site Location

Croscombe lies on the River Sheppey, 2km west of Shepton Mallet along the A371 as shown in Figure 1 below. A more detailed map of Croscombe is included as Figure 4 at the end of this report.

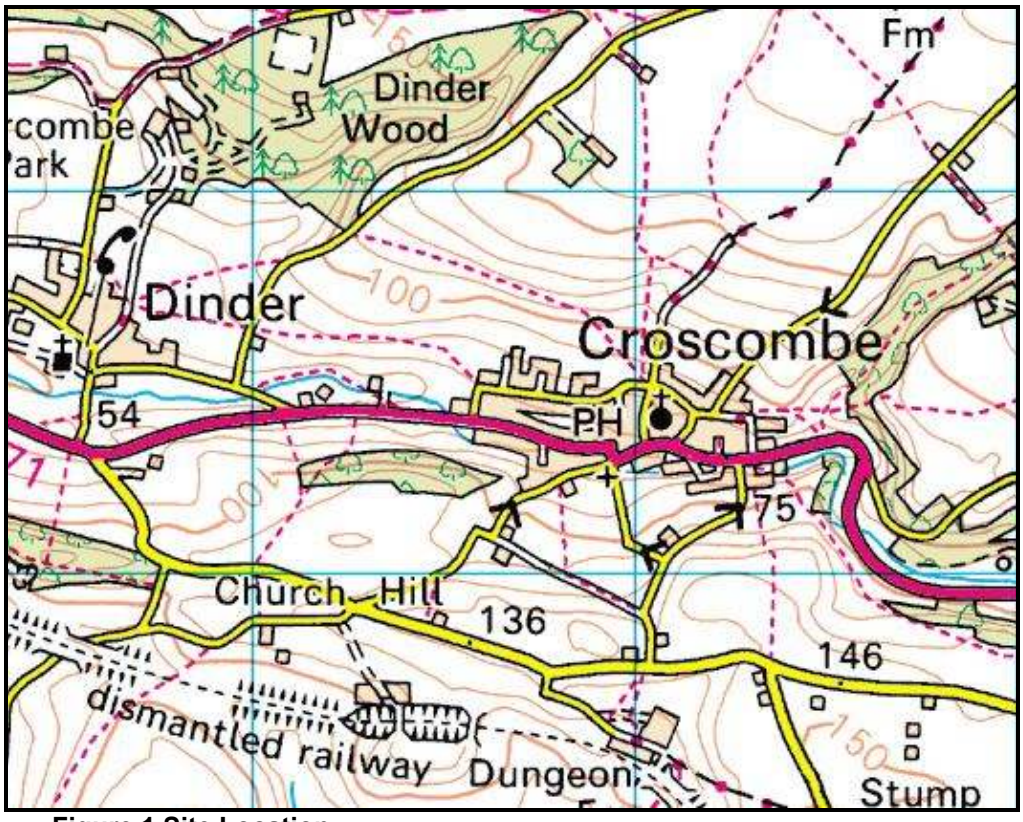


Figure 1 Site Location

1.3. Site Characteristics and Drainage

As can be seen from the contours on Figure 1 above, the village lies in the bottom of the steep sided valley of the River Sheppey. Ground levels rise about 60m in half a kilometre.

The River Sheppey has been highly modified by the construction of numerous mills that are now disused. The river bifurcates at Jack's Bridge with the main river running alongside Long Street and a millstream passing under the Manor House, rejoining the river before it passes into a culvert for 200m.

Ground conditions to the southeast of the village are characterised by free draining limestone, while to the west and north are free draining soils. To the south, making up the majority of the catchment draining to the Croscombe from Paradise Hill, there is a band of clayey soils that are much less free draining.

The natural flow paths for the area have been modelled using LIDAR data and are shown in Figure 2 below (a larger version is included in the back of this report). The majority of the catchment to the south of Croscombe drains to

Old Street Lane and development then prevents water leaving the road, forcing it to flow down to Jack's Bridge. The natural flow routes off Old Street Lane shown in Fig 2 being blocked by Bella-Vista and Middle Farm. The steepness of Old Street means that the road gullies are ineffective at collecting the runoff and would only have been designed to accommodate runoff from the road, not agricultural land.

Figure 2 Flow Paths

On reaching Jack's Bridge the flow is prevented from entering the river by the headwall of the bridge and the upstand on the river bank retaining wall. As a result the water drains into the watercourse via the highway gullies. Openings have been created in the headwall to allow flow into the river, but they are not very efficient as they are perpendicular to the flow.

2. Drainage and Flood History

2.1. Previous Flood Incidents

Croscombe has suffered numerous flood events in recent years, the most notable being February 1990, March 1996, August 1996, December 2008 and November 2011.

According to records, the December 2008 event was the most serious with four properties being flooded. The majority of properties have been flooded from surface water, although some are affected by high levels in the River Sheppey. Improvements to the surface water drainage were carried out by Area Highways after the event with additional gullies being installed.

2.2. Flood incident under investigation

During the flood incident of 11th July, initially intense rainfall led to large quantities of surface water runoff from the steep catchment to the south of the village, flowing down the roads and accumulating on Long Street (A371)

where it was unable to enter the river. The majority of the surface water flowed down Old Street Lane and Jack's Lane. Runoff from the north side of the village appears to have been accommodated by the drainage system. Surface water flooding affected up to eight properties.

At this time the Sheppey was well below bankfull but the highway drainage was unable to convey the flood water to the river and so residents created a gap in the river wall to allow the majority of the flood water to drain down.

There are conflicting reports of the relative timing of the peak surface water runoff and peak levels in the Sheppey. As the river responds to a much larger catchment, taking runoff from Shepton Mallet and beyond, it would be expected to peak later than the surface runoff. Flooding to Long Street from the surface water peaked before 8:00am and from photographs of flooding to the Manor House garden, peak levels in the Sheppey were sometime after 8:30am and remained near that level until after 9:00am with one, possibly two, properties upstream of Jack's Bridge being flooded from the river as well as surface water.

There were also reports of overflow from foul manholes in the vicinity of Townend Bridge.

2.3. Rainfall Analysis

The rainfall that affected Croscombe on 11th July 2012 was a fast moving (west-east) narrow band.

The nearest intensity rain gauge to Croscombe is Doulting and the data recorded by this gauge for the rainfall event is summarised below:

Doulting Intensity Rain Gauge

Event Duration	02:30 hrs – 08:00 hrs
Event Total	29.2mm
Max. 30-minute intensity	15.2mm/hr
Rainfall rarity (Event)	3 years

Rainfall rarity (Max. 30 minute Intensity) 1 year

Rainfall return periods calculated using FEH CD ROM 3.0. DDF analysis Sliding scale for 1km grid point centred on NGR ST 65000 42000.

With this type of rainfall pattern it is likely that individual rain gauges will not record the highest totals and a useful second source of data is the HYRAD imagery of the rainfall radar data. HYRAD data has been provided by the Environment Agency for the grid cells that cover Croscombe for the event and calibrated against the rain gauge. These data are summarised below:

HYRAD Rainfall Radar Data

Event Duration	05:15 hrs – 07:45 hrs
Event Total	24.4mm (adjusted)

Max Average 30-minute intensity – 20.5mm/hr (adjusted)

Rainfall rarity (Event)	4 years

Rainfall rarity (Max. 30 minute average intensity) 2 years

(max average of 5-minute period observed rainfall intensities which in this event occurred between 06:55 and 07:25 hrs.)

The rainfall event was characterised by relatively high intensities over short-durations. The radar 5-minute intensities over the area of interest had an average intensity of 24.4mm/hr and an associated rarity of 2 years over a 30-minute period. However, within this period the maximum 5-minute intensity was 45 mm/hr (it is not appropriate to use the FEH methods to calculate return periods for such short durations).

The rainfall radar averages intensities over a 1km grid and it is possible that with the catchment to the south of Croscombe being only 0.5km, the actual intensity could have been higher and the event much rarer than the analysis suggests. Certainly the radar images show occasional intensities up to 64mm/hr.

3. Probable Causes

Undoubtedly, the cause of the majority of the flooding was high volumes of surface water runoff resulting from locally intense rainfall. It is likely that the rainfall was more extreme than indicated by the analysis of the rain gauge and radar data as the flooding was the most severe experienced in the past 20 years, although the flooding in 2008 was almost as severe.

The natural drainage of the area has been modified through development so that most of the high ground to the south of the village drains to Jack's Bridge, with a total of 34.5Ha draining to this point, as shown in Figure 3 below.

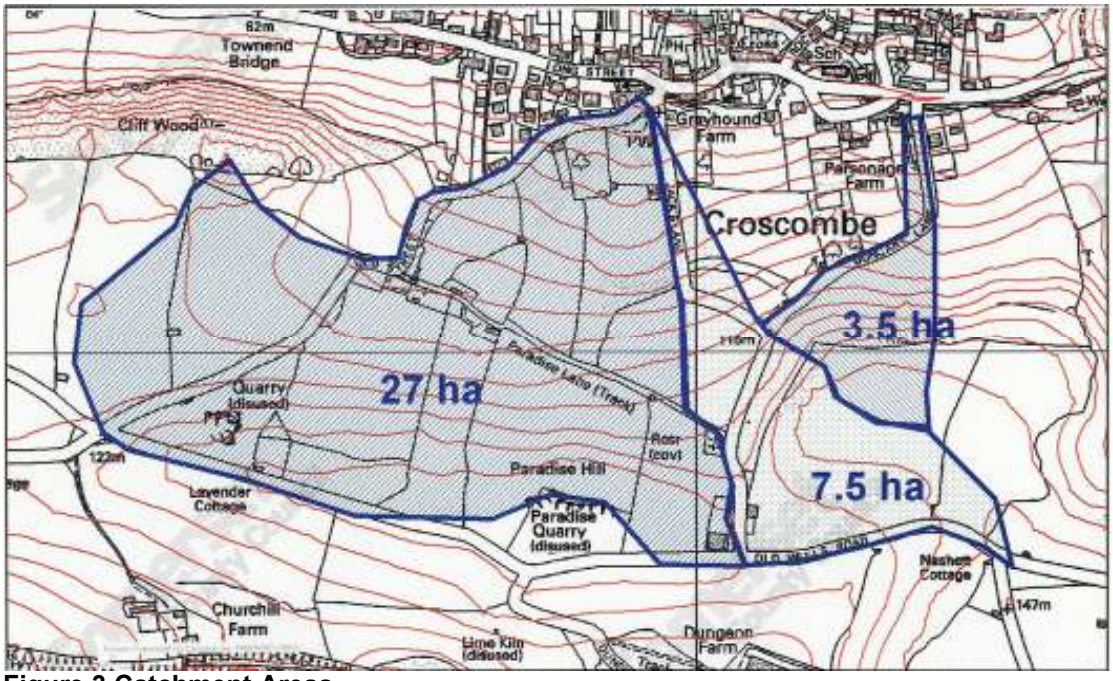


Figure 3 Catchment Areas

The steepness of the catchment results in the highway drainage either being bypassed or blocked with debris washed down from upstream.

High levels in the River Sheppey resulted in flooding to two properties. The most severely affected property was the Old Forge that lies immediately upstream of Jack's Bridge. A post event survey showed the afflux across Jack's Bridge was less than 300mm and therefore the bridge is not a major restriction to the flow, although it does contribute to the flooding. This property was also affected by surface water flooding. The Manor House, downstream of Jack's Bridge, was flooded through the wall and floor as flow spilled from the millstream to the river. It is likely that had levels in the Sheppey not been raised then this flooding would not have occurred.

During periods of heavy rain, flows in the foul drainage system increase through connection of roof and yard drainage to the foul system. Combined Storm Overflows (CSO) are used to allow diluted flows to overflow into watercourses to prevent the system becoming overwhelmed. There is a CSO into the Sheppey downstream of Townend Bridge. High levels in the Sheppey will have restricted the discharge from the CSO and this, together with the high volume of surface water entering the foul system, could have caused the overflowing of foul manholes observed in this area.

4. Rights and Responsibilities

4.1. Lead Local Flood Authority

Somerset County Council, as Lead Local Flood Authority, has powers relating to surface water flooding and a coordinating role in the investigation to ensure all the relevant risk management authorities are aware of the incident. In relation to the surface water element, the team has obtained LIDAR data of the catchment so that modelling of the topography and water flow paths can be used to determine and recommend measures to mitigate the residual flood risk.

4.2. Environment Agency

The Environment Agency have powers to undertake flood risk management to main rivers. The River Sheppey through Croscombe is classified as main river and therefore flooding from the river is within the Agency's remit. It is likely that two properties were flooded from the river, however it is very unlikely that improvement work to the river to reduce the risk of flooding to these properties can be justified and may not be technically possible. The only option for these properties is to undertake individual property protection measures to increase flood resistance and/or resilience. The Environment Agency is not proposing to exercise its powers as a result of this incident.

4.3. District Council

As Local Drainage Authority, Mendip District Council has powers to carry out maintenance works and localised improvements to ordinary watercourses. As this event did not involve an ordinary watercourse there is no action required by them.

4.4. Highway Authority

The Highway Authority is responsible for the management of the adopted highway. The volume of surface water reaching the highways was significantly

in excess of the national standard to which these systems are designed. However highways are assisting in the development of options for works to manage surface water in this location.

4.5. Water and Sewerage Company

Wessex Water are responsible for flooding from their foul, combined and surface water sewers. As there are no surface water sewers in Croscombe the surface water flooding that occurred is not Wessex Water's responsibility. The overflowing of foul manholes observed during the event was possibly due backing up when high levels in the Sheppey prevented Combined Storm Overflows from operating. Wessex Water are confident that their system operates as it should and any overflowing of the foul system was due to the volume of surface water being discharged into it, together with high river levels reducing the capacity of the CSO. Wessex Water are carrying out an investigation into the performance of the foul system in Croscombe.

5. Options

The greatest flood risk in Croscombe is from surface water flooding so the highest priority is to deal with this, if possible. Options fall into two categories, pass the water that accumulates at Jack's Bridge into the river more efficiently or intercept it before it gets there.

Options for intercepting the flow include:

1) Diverting runoff from the upper catchment in Old Street Lane to a watercourse that flows through the grounds of Cliff View House.
2) Diverting runoff in Old Street Lane down Rookery Lane and dropping it into the culvert before it reaches Long Street
3) Installing cross drains in Old Street Lane and Jack's Lane with pipes to a new outfall into the millstream on the downstream side of Jack's Bridge.

Options for draining floodwater into the river include:

4) The installation of new gullies in Long Street at its junction with Old Street Lane.
5) Formalising the temporary opening in the river wall.

See Figure 6 for details. It is likely that a combination of these elements will be required to adequately deal with the problem.

5.1. Option 1

Approximately 11ha drains directly to Old Street Lane upstream of the "cemetery". The flow from this catchment could be picked up in Old Street Lane and diverted via a new/increased channel to the River Sheppey at Cliff View House. This would reduce the surface water flow arriving at Jack's Bridge by one third. Depending on the fall in Paradise Lane, it may be possible to pick up a further 8ha of the catchment and reduce the flow at Jack's Bridge still further.

Improvements would still be required to the drainage near Jack's Bridge to pick up the remainder of the catchment and the flow down Jack's lane, but these works will be much less than would otherwise be required.

5.2. Option 2

This is the same as Option 1 except that instead of diverting the flow into a new/enlarged watercourse, the surface flow is diverted into Rookery Lane and then allowed to drop into the River Sheppey culvert through new collecting drains. It will need to be checked to make sure the flow would not damage the surfacing in Rookery Lane. This is not designated as a highway but is a public right of way. Ownership would need to be checked if this option were to be considered further.

With only modification to Old Street lane to direct flow into Rookery Lane, this could be a back up to Option 1

5.3. Option 3

At times of high flow road gullies can be bypassed through blockage or volume of flow. This problem can be reduced by installing grated channels across the full width of the road. These would be connected to a new outfall into the river. As it would not be possible for the pipe to cross the millstream, the outfall would be into that rather than the River Sheppey. Work would also be required in the grounds of the Manor House to allow flow from the millstream to the river.

5.4. Option 4

A new gully in Long Street to a flapped outfall in the river will prevent the build up of flood water in the road.

5.5. Option 5

During the flood event an opening in the upstand to the river wall was created to allow flood water that had accumulated in the road into the river. Formalising this opening would keep flood depths in the road down to the level of the river bank. This should not be considered as a primary option for dealing with flood water as ground levels adjacent to the river are higher than the road, so water has to build up before it can spill into the river. However it would function well as a backup to other options.

In certain circumstances the opening could increase the flood risk by allowing the river to flood onto the road. The frequency of river levels being above the opening has to be balanced against the frequency of surface water flooding. A removable barrier could be installed across the opening and this could be used at times when the river level is high, however someone would need to be responsible for operating it.

5.6. Other work

As well as the above options there may be other minor works that can be carried out and these will be developed as options are assessed further. These minor works could include very local measures to direct surface water away from properties, such as short lengths of wall and kerb raising.

6. Conclusions and Recommendations

1) The majority of the flooding on 11th July was due to surface water.
2) Two properties were flooded from the river, one of which was also flooded by surface water.
3) The authorities with relevant powers in this instance are the Environment Agency for river flooding and the County Council as Lead Local Flood Authority for surface water.
4) There is low confidence in the analysis of the rarity of the rainfall event.
5) SCC will carry out a detailed appraisal of options for mitigating the surface water flood risk in consultation with stakeholders including local residents.
6) Should suitable options be agreed, these will be considered for inclusion in the LLFA work programme.

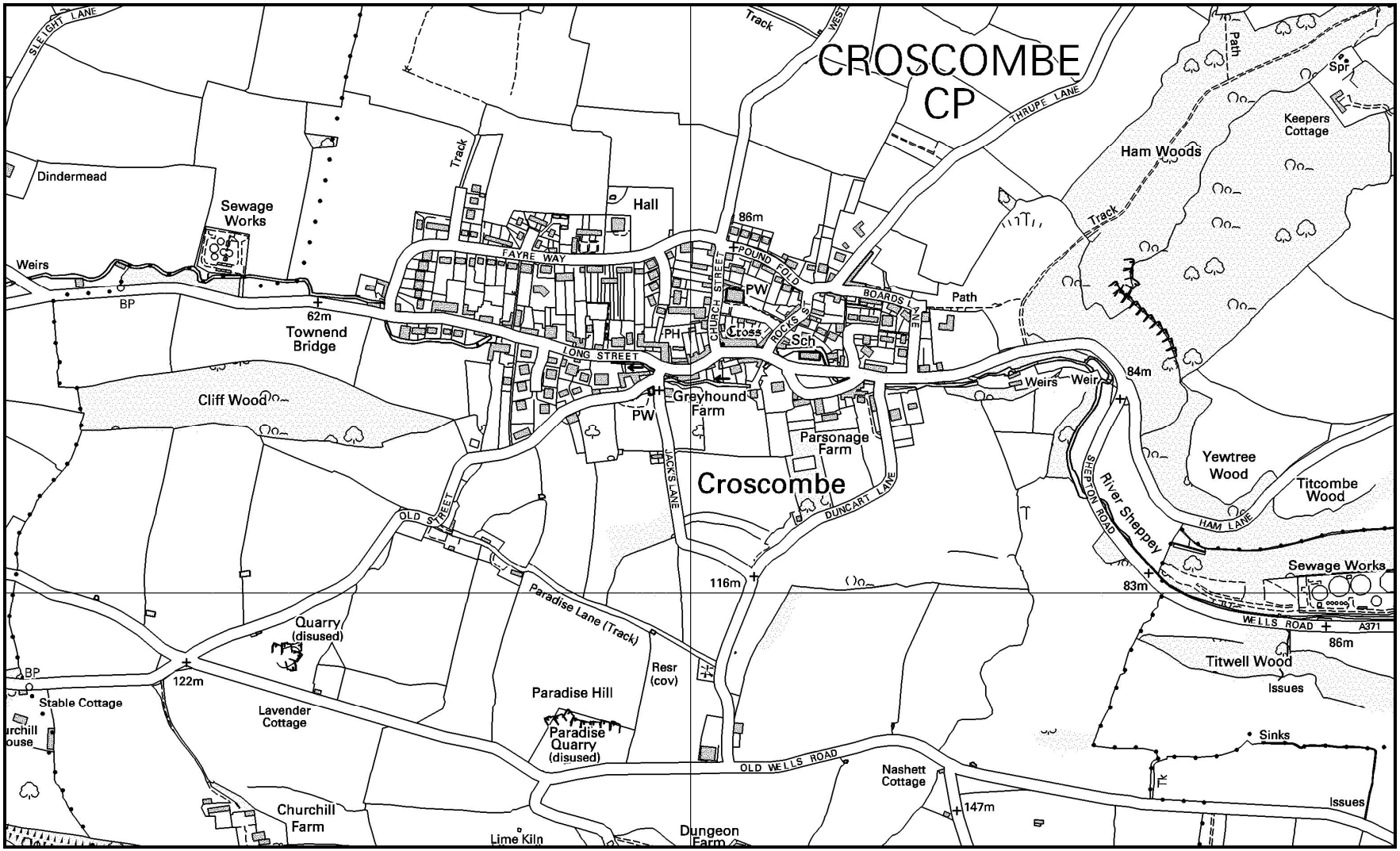


Figure 4 Study Area

Figure 5 Drainage Paths

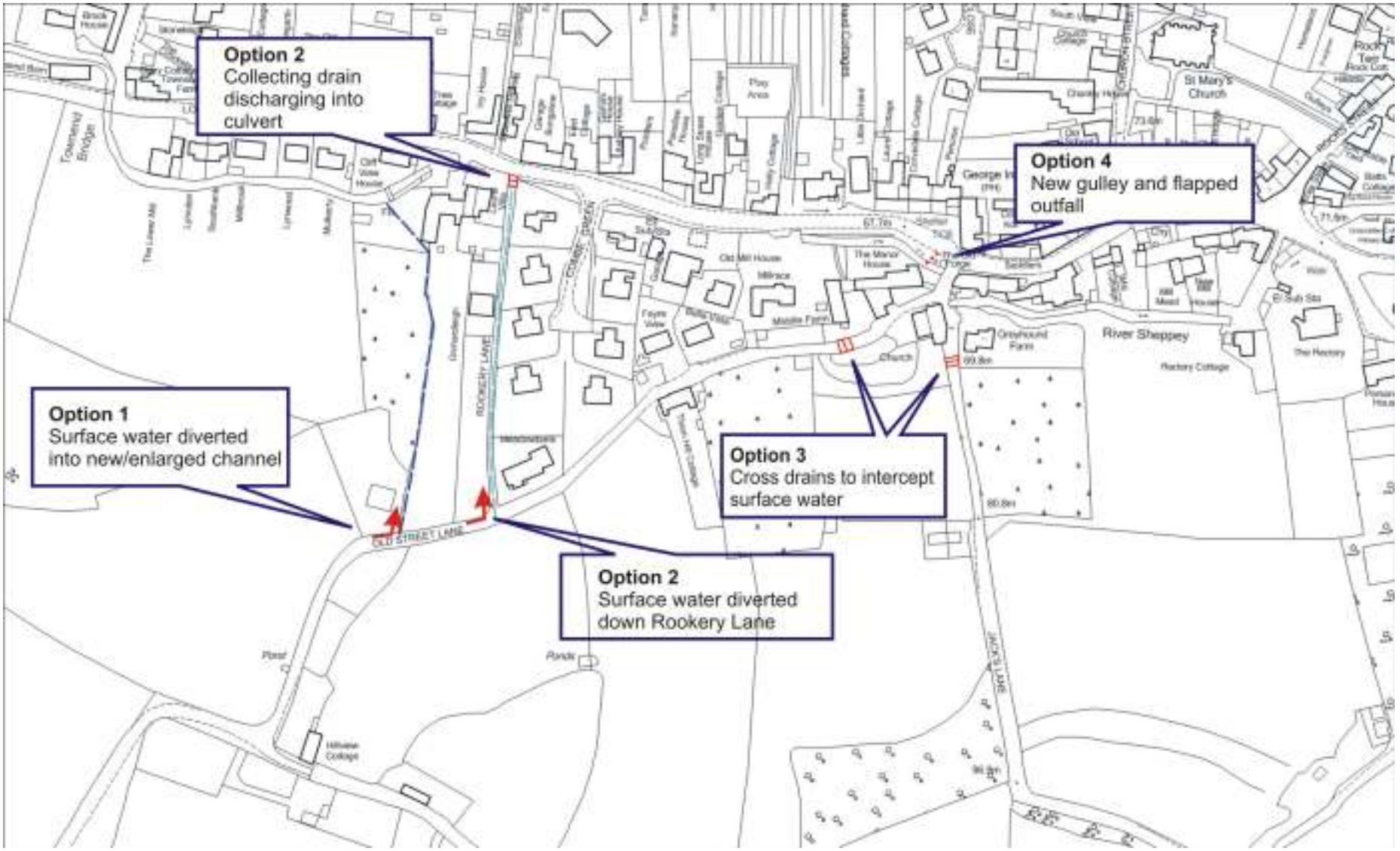


Figure 6 Options

Photographs
(Courtesy of residents of Croscombe)

Photograph 1 - The George at 07:52(BST)

Photograph 2 - The George at 07:58

Photograph 3 - Old Street Lane

Photograph 4 - Long Street showing opening through wall

Photograph 5 - Manor House at peak river levels

Photograph 6 Manor House at peak river levels looking downstream

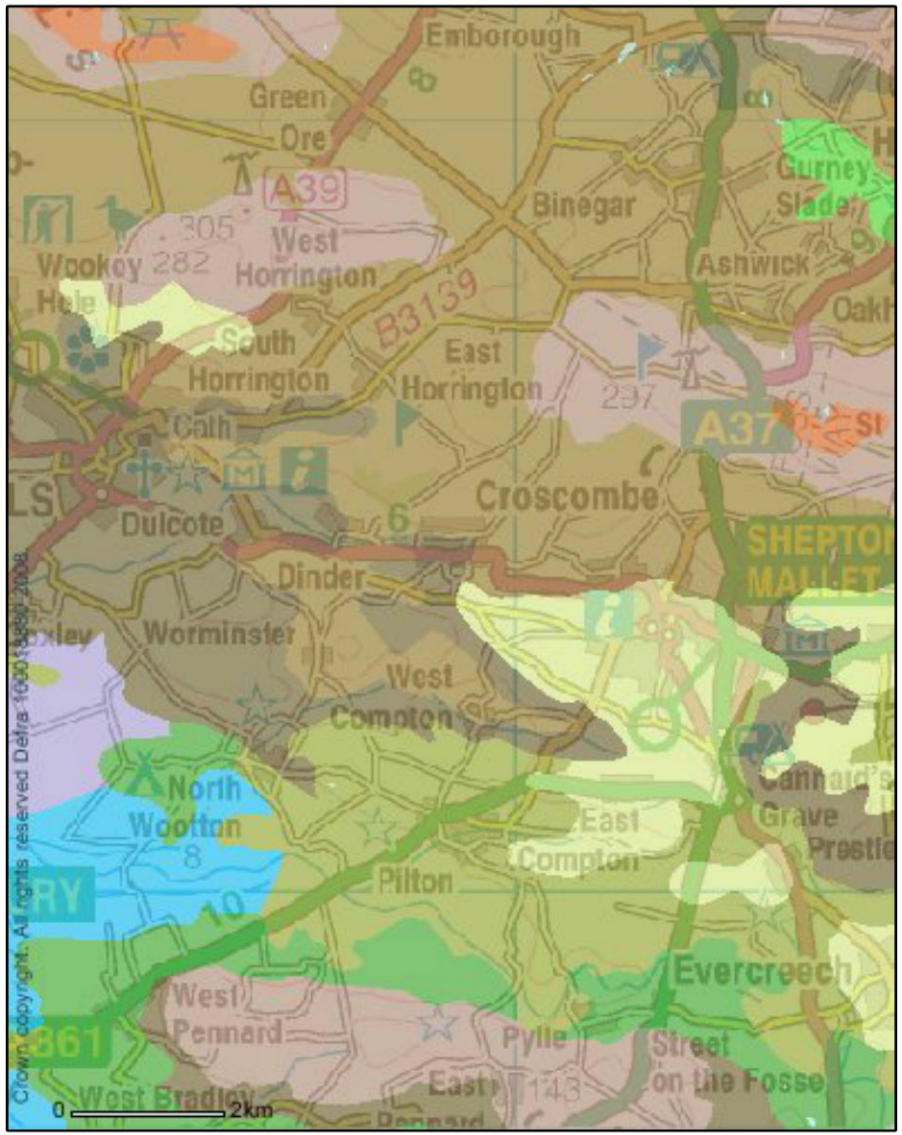
Photograph 7 - Old Forge at peak

Photograph 8 - Old Forge at peak

Appendix 1
Soil Maps

Soilscapes Viewer Report

National Soil Resources Institute



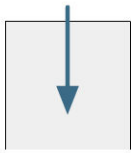
SELECTED SOILSCAPE:

Shallow lime-rich soils over chalk or limestone

HABITATS:
Herb-rich Downland and limestone pastures; limestone pavements in the uplands; Beech hangers and other lime-rich woodlands

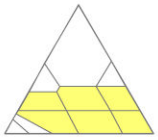
LANDCOVER:
Arable and grassland

DRAINAGE:
Freely draining



FERTILITY:
Lime-rich

TEXTURE:
Loamy



COVERAGE:
England: 7%
Wales: 0%
E&W: 6%

Soilscapes is a 1:250,000 scale, simplified soils dataset covering England and Wales. It was created from the more detailed National Soil Map (NATMAPvector) with the purpose of effectively communicating a general understanding of the variations which occur between soil types, and how soils effect the environment.

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nsridata@cranfield.ac.uk

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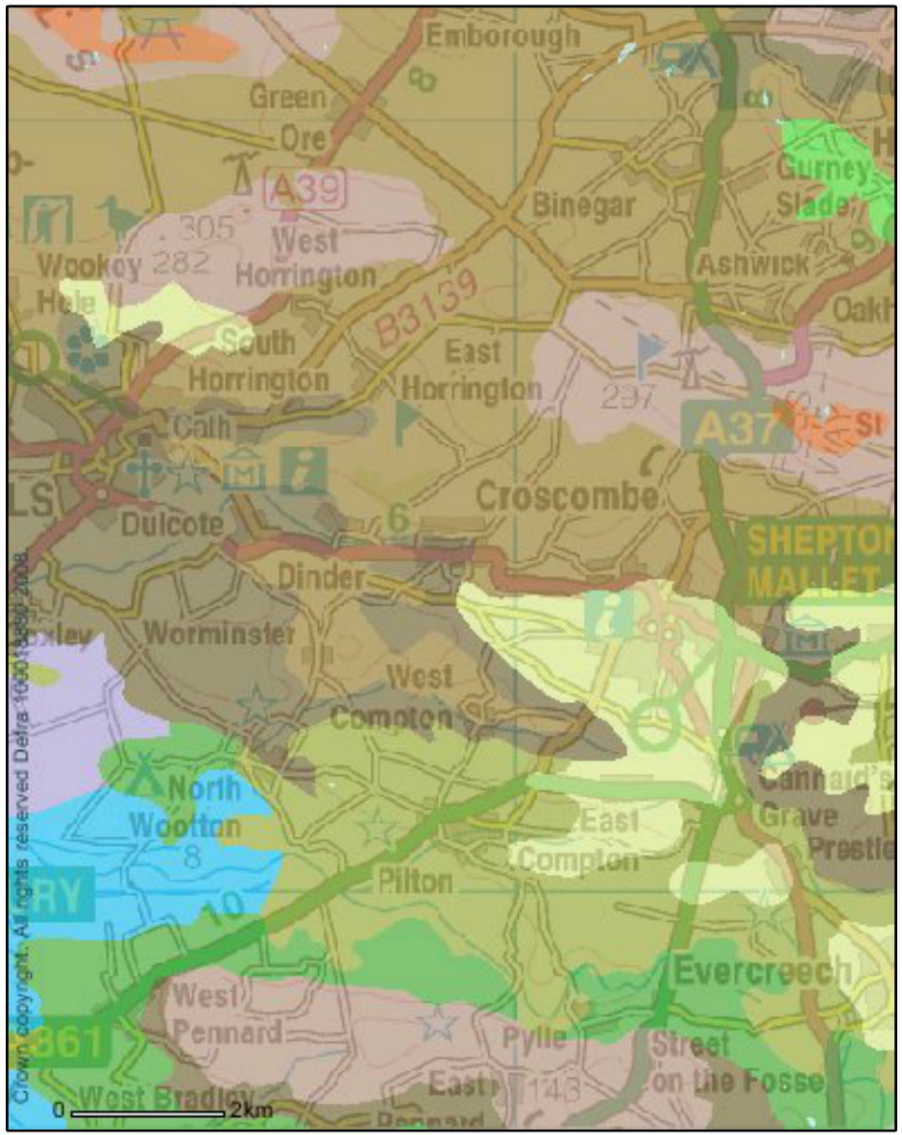


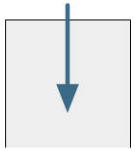
SELECTED SOILSCAPE:

Freely draining slightly acid but base-rich soils

HABITATS:
Base-rich pastures and deciduous woodlands

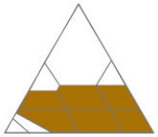
LANDCOVER:
Arable and grassland

DRAINAGE:
Freely draining



FERTILITY:
High

TEXTURE:
Loamy



COVERAGE:
England: 3.1%
Wales: 3.1%
E&W: 3.1%

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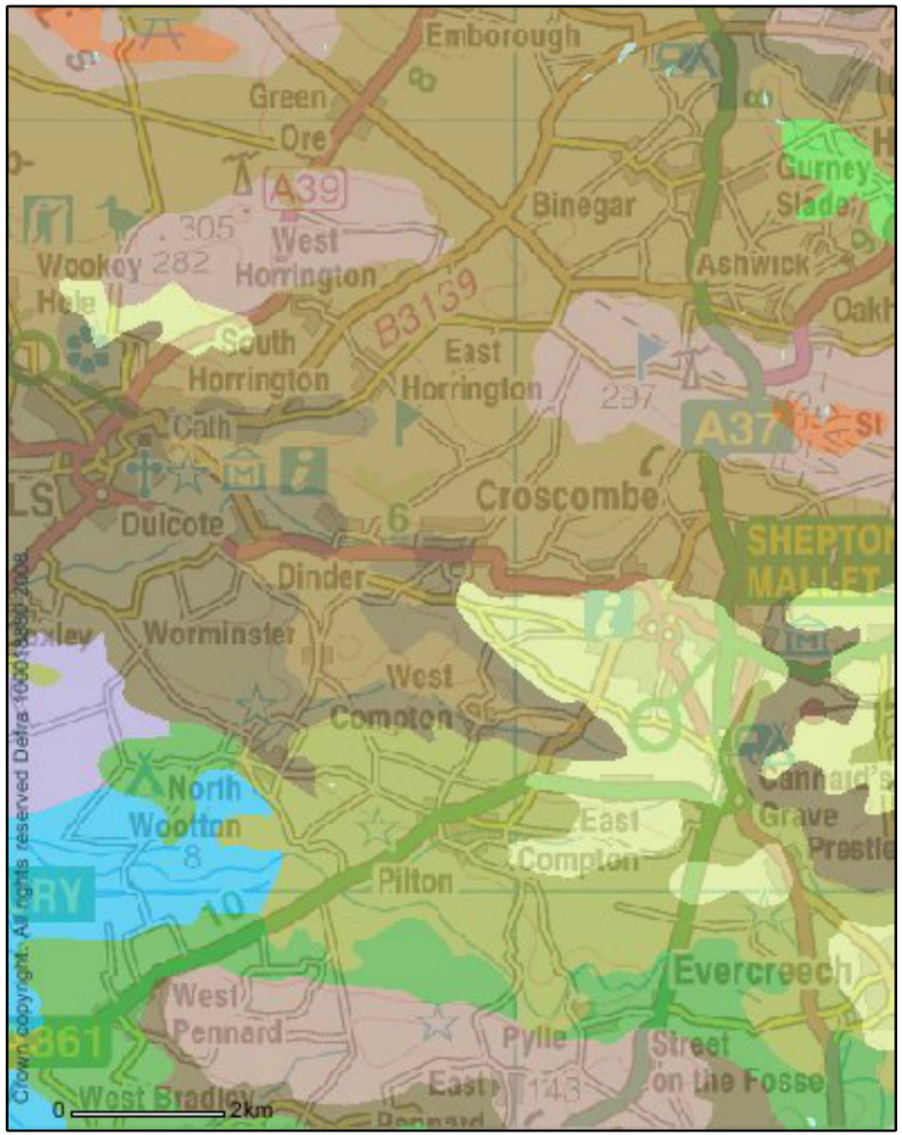


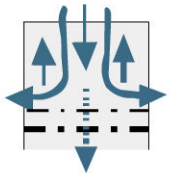
SELECTED SOILSCAPE:

■ Slightly acid loamy and clayey soils with impeded drainage

HABITATS:
Wide range of pasture and woodland types

LANDCOVER:
Arable and grassland

DRAINAGE:
Slightly impeded drainage



FERTILITY:
Moderate to high

TEXTURE:
Loamy

COVERAGE:
England: 10.6%
Wales: 1.9%
E&W: 9.4%

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Appendix 2
Raingauge Records and Radar Images

Station name	DOULTING TBR
Station number	406175
External number	
River	SHEPPEY
Operator	-
NGR	ST
Easting	64595
Northing	41748
Parameter-name	Tipping Bucket
Parameter Type	RE Primary
	406175.RE
Time series name	Primary.15.Total
Time series unit	mm
Time level	High-resolution
Time series type	Total
Equidistant time series	yes
Time series value distance	15 Minute(s)

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11/07/2012 02:45	.
11/07/2012 03:00	0.4
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11/07/2012 04:30	.
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11/07/2012 08:30	.

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Sequence	05:00 GMT 11 Jul		
Period	2012	09:55 GMT 11 Jul 2012	
Output Interval	5 minutes		
Number of Images	60		
Location details			
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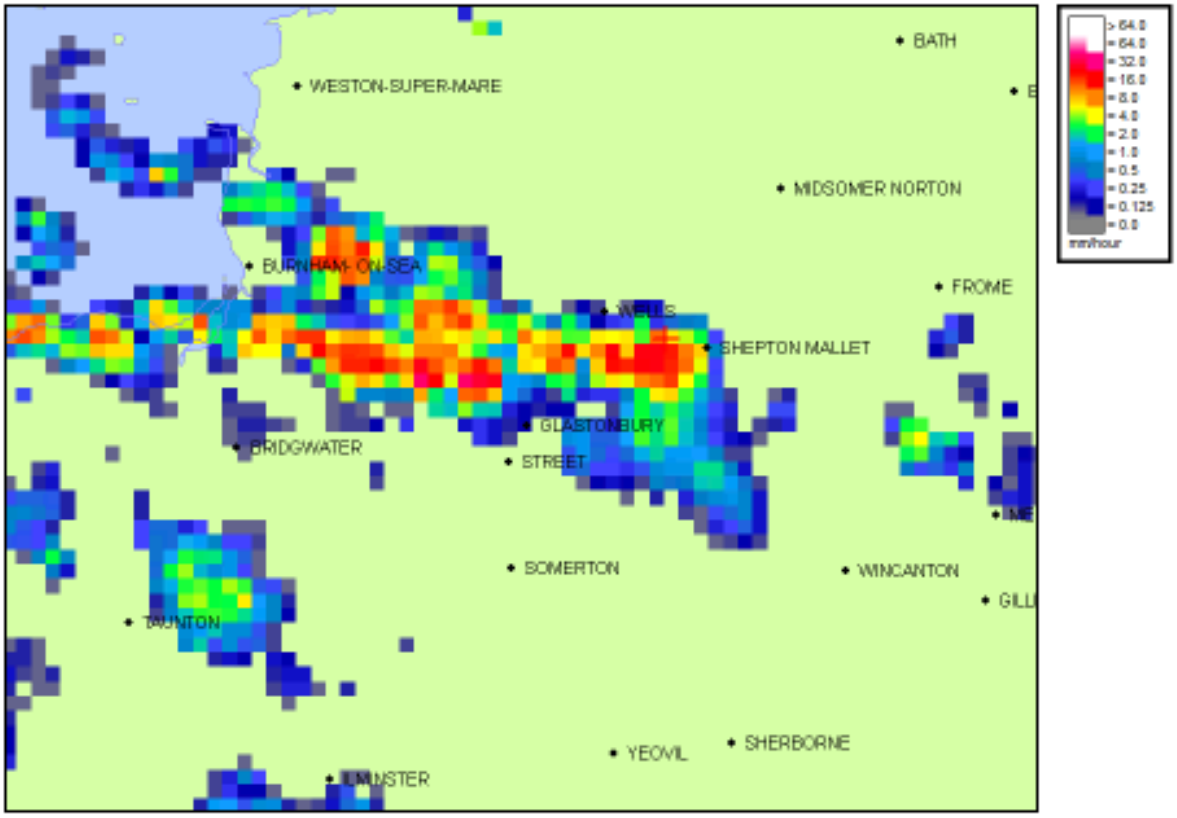
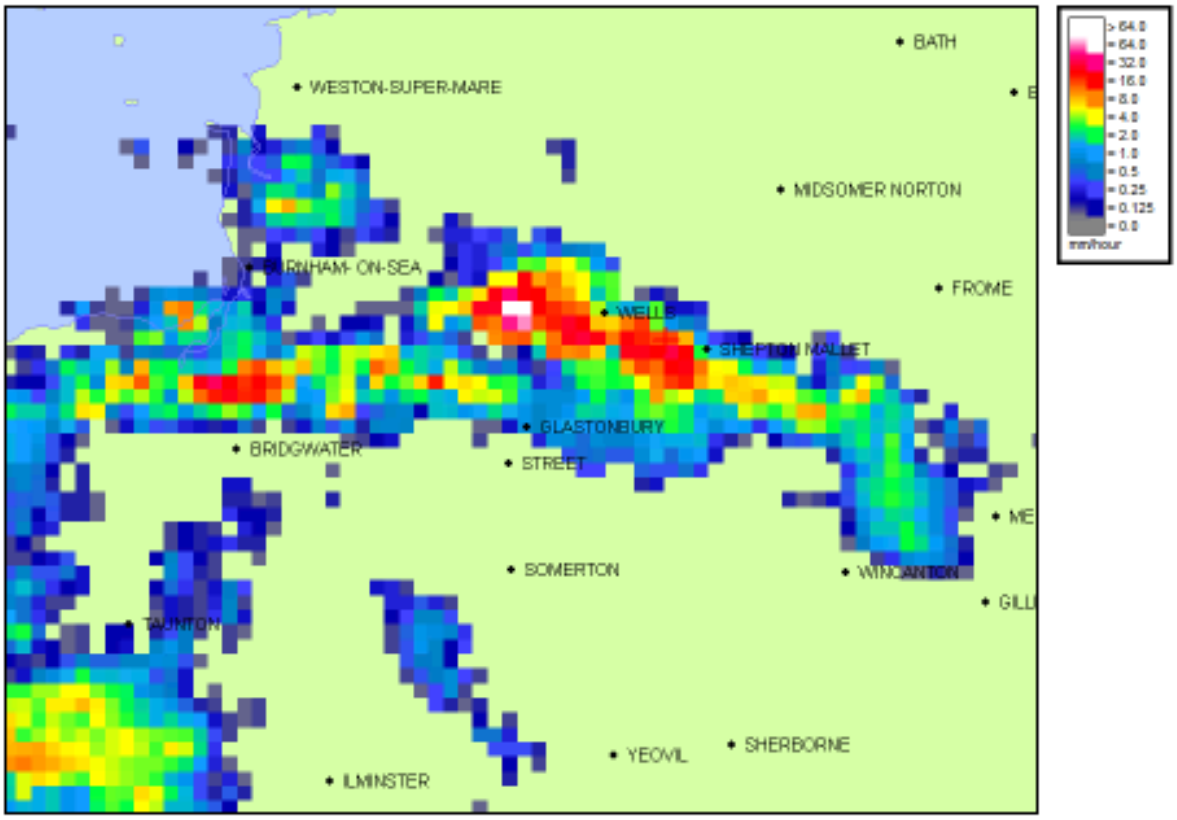
11-Jul-12	08:10 GMT	0	0
11-Jul-12	08:15 GMT	0	0
11-Jul-12	08:20 GMT	0.22	0.27
11-Jul-12	08:25 GMT	0.66	0.82
11-Jul-12	08:30 GMT	0	0

Nimrod products - UK 1/2/5km composite QC



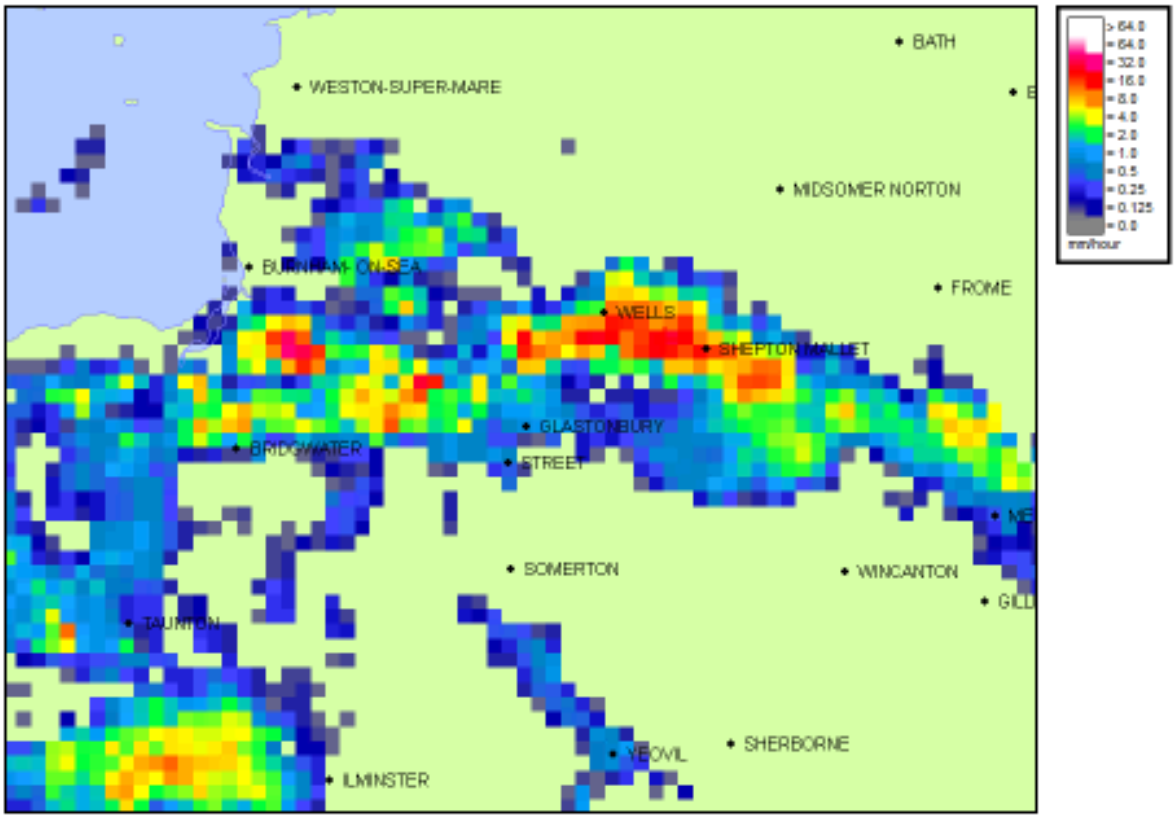
05:20 GMT Wed 11-Jul-2012

Nimrod products - UK 1/2/5km composite QC



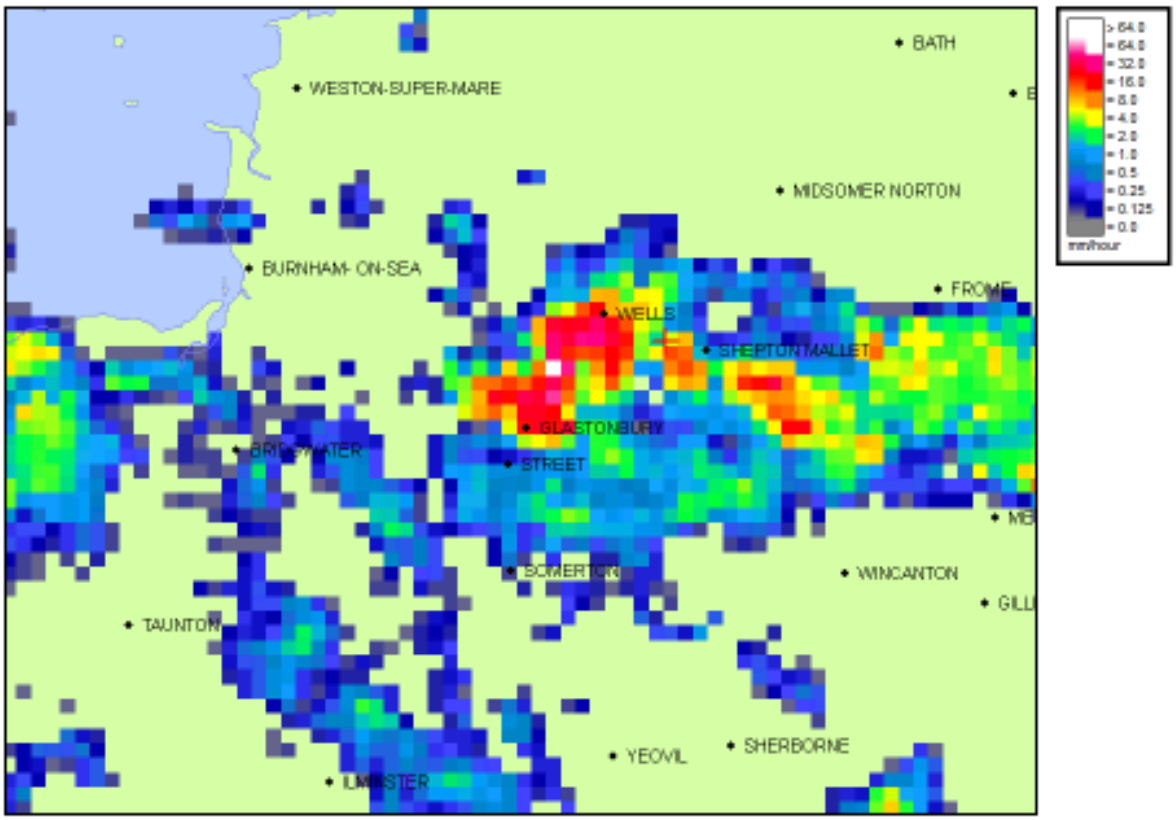
05:40 GMT Wed 11-Jul-2012

Nimrod products - UK 1/2/5km composite QC



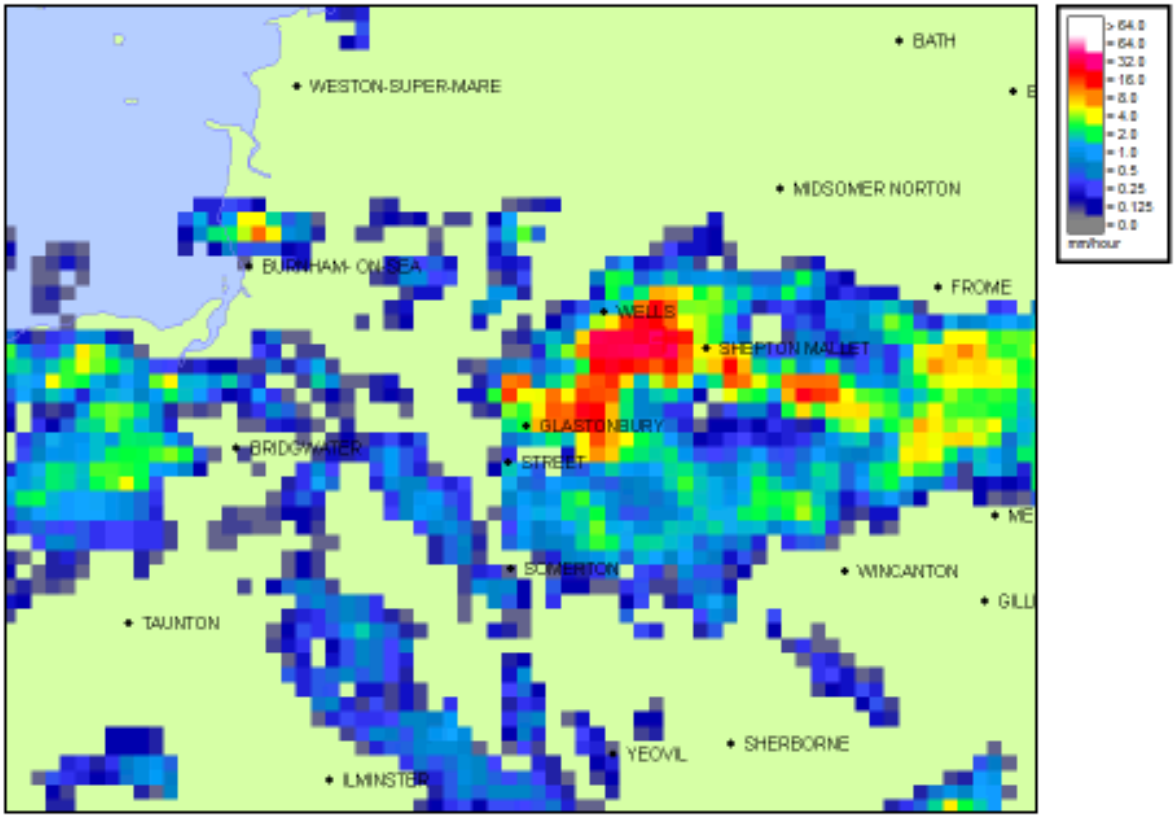
05:50 GMT Wed 11-Jul-2012

Nimrod products - UK 1/2/5km composite QC



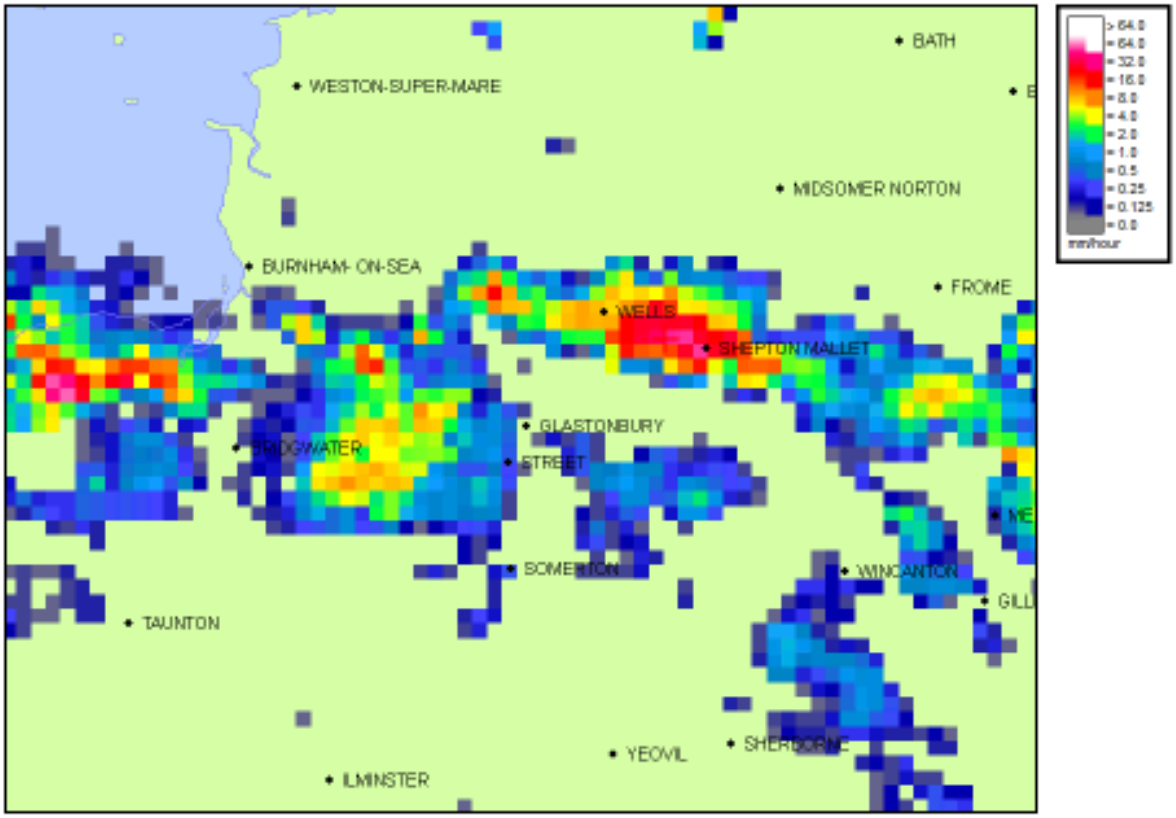
06:15 GMT Wed 11-Jul-2012

Nimrod products - UK 1/2/5km composite QC



06:20 GMT Wed 11-Jul-2012

Nimrod products - UK 1/2/5km composite QC



07:05 GMT Wed 11-Jul-2012