

Environment Agency South West Region

Autumn 2000 Floods Review Regional Report



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Cover: River Taw at Umberleigh

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CONTENTS

EXECUTIVE SUMMARY 1

1.0 INTRODUCTION

1.1 Event Management 2

1.2 Flood Forecasting 2

1.3 Flood Warning 2

1.4 Event Impact 2

1.5 Emergency Response 3

1.6 Public Relations 4

2.0 EVENT MANAGEMENT

2.1 Procedures 5

2.2 Liaison (Internal/External) 5

2.3 Communications 6

2.4 Numbers of Staff Deployed 7

2.5 Range of functions and Inter Regional Co-Operation (event management only). .. 7

2.6 Scale (number if possible) of Calls Received 8

2.7 Issues Arising 8

2.8 Recommendations 8

3.0 FLOOD FORECASTING

3.1 Accuracy and Timeliness of the Met Office Short and Medium Term Forecasts
(forecast v actual precipitation) 9

3.2 Impact of Any Inaccurate Forecast 9

3.3 Agency Telemetry and Outstation Robustness and Availability 10

3.4 Ability of Agency to Predict The Actual Flood Levels Using Their Current
Models (predicted v actual levels & flows) 11

3.5 Issues Arising 12

3.6 Recommendations 13

4.0 FLOOD WARNING

4.1 Trigger/Threshold Levels for Warnings 15

4.2 Warnings Issued, Target Lead Times v Actual Lead Times 15

4.3 No. Properties Flooded Following Warning
(not including properties that also received severe warning) 18

4.4 No. Properties Flooded Without Warning 18

4.5 No. Properties Not Flooded But Warned (not severe warning) 18

4.6 No. Properties Flooded Following Severe Warning 18
(do not include properties that also received warning) 18

4.7 No. Properties Flooded Without Severe Warning 18
(do not include properties that also received warning) 18

4.8 No. Properties Not Flooded But Received Severe Warning 18

4.9 Automatic Voice Messaging (AVM) 18

4.10 Floodline 19

4.11 Flood Wardens 19

4.12 Loud Hailers 20

4.13 Local Media (flood warning dissemination purposes only) 20

4.14 Sirens and Public Address 20



4.15 Issues Arising.....	20
4.16 Recommendations.....	22
5.0 EVENT IMPACT	
5.1 Rainfall.....	23
5.2 River Flow (tides, surge, wind, waves)	25
5.3 Flooding (quantity, timing, duration, return periods - comparison with forecast..	26
5.4 Source of Flooding.....	34
5.5 No. Properties Not Flooded Due To Agency Defences.....	35
5.6 No. Properties Not Flooded Due To Third Party Defences.....	35
5.7 No. Properties Flooded Due To Failure (Not Exceedence) Of Agency Defence ..	35
5.8 No. Properties Flooded Due To Failure (Not Exceedence) Of Third Party Defences.....	35
5.9 No. Properties Flooded Due To Exceedence of Agency Defence Standards	35
5.10 List of Towns Affected Without Adequate Defences, Viability (cost benefit) of Scheme.....	36
5.11 Major Infrastructure Affected (roads, rail and where used as a secondary defence).....	41
5.12 Incidence of Repeat Flooding.	41
5.13 Issues Arising.....	42
5.14 Recommendations.....	42
6.0 EMERGENCY RESPONSE	
6.1 Major Incident Plans Activated	43
6.2 Gold and Silver Controls opened.....	43
6.3 Gold and Silver Controls with Agency Attendance.....	43
6.4 Agency (staffing, equipment and plant).....	43
6.5 Adequacy of Agency Resources	44
6.6 Numbers of Staff Deployed	44
6.7 Range of Functions and inter Regional Co-Operation (emergency response only)	45
6.8 Emergency Services, Local Authority, Other Response Organisations	45
6.9 Property Evacuated (no. of people) and Type (houses, hospitals, old peoples homes, factories etc.)	45
6.10 Issues Arising.....	46
6.11 Recommendations.....	47
7.0 PUBLIC RELATIONS	
7.1 Links to the Media, Coverage by the Media (except for flood warning dissemination).....	48
7.2 Number of Interviews by Media Type.....	48
7.3 Issues Arising.....	48
7.4 Recommendations.....	49
8.0 INCIDENT SPECIFIC	
8.1 Major Industry/Infrastructure	50
8.2 Legal Recommendations – Issue / Action / Ownership / Review Date.....	50
8.3 Retrospective View by Others of the Event and how it was Handled Overall. Standard Letter to all Professional Partners, Local Authority Chief Executives,	

Police and Fire Chief Officers, Army Commanding Officers etc– all Responses to
be Included as Appendix to the Report..... 50
8.4 Issues Arising..... 51
8.5 Recommendations..... 51

- APPENDIX A - DEVELOPMENT IN THE FLOODPLAIN**
- APPENDIX B - PUBLIC RESPONSE**
- APPENDIX C – ORGANISATIONAL ISSUES**
- APPENDIX D – ECONOMIC IMPACTS**
- APPENDIX E – HISTORY OF FLOODING**
- APPENDIX F – VIEWS OF PROFESSIONAL PARTNERS**

EXECUTIVE SUMMARY

The period covered by this report extends from 28 October to 20 November 2000, to be consistent across the Agency. However it should be noted that the South West Region continued to be affected through December and into January 2001. In fact over 400 warnings have been issued between 20 November and the end of January 2001, some continued to be in force after this date. Whilst most of the issues and lessons relate to the flooding in general, others that were specific to the later events are not covered here.

- In the subsequent 10 days after 29 October 2000 there was 270mm of rain, 90mm of this rain falling in a 30 hour period.
- The last comparable event across the region was almost 40 years ago when thousands of properties were flooded.
- 346 warnings were issued, 18 of these severe warnings and 4 Major Incident Plans (MIPs) were activated.
- There were 5 multi agency Silver Controls and 2 Gold Controls established during the period, the Agency attended each one apart from one where regular contact was maintained.
- 550 properties were reported as being flooded across the region.
- Media interest was considerable with 140 television and radio interviews provided and countless news releases.
- All major schemes passed their severest test to date, there was minimal flooding as a result of Agency defences being exceeded/failing.
- Relationships between the Agency and emergency services/LAs etc were generally very good.
- The estimated cost of emergency repairs to Agency defences is £836 000 and the cost of the Agency response estimated at £768 000.
- New pre feasibility flood defence schemes have been identified and some previously existing schemes are now on an accelerated programme.
- Staff resources were stretched so a review is recommended, especially numbers of Silver and Gold Control liaison officers.
- It is recommended that procedures are developed for the purpose of bringing in supplementary equipment at strategic locations, such as pumps. This is to ensure that equipment can easily and quickly be in position and operating.
- There is a need to identify in more detail the problems associated with groundwater flooding.

CHAPTER 1 - INTRODUCTION

1.1 Event Management

The Regional Incident Room (including the Regional Communications Centre and Flood Warning Office) and Area Incident Rooms were all active throughout the event. Feedback from the Regional de-brief was that internal procedures, including Regional Incident Procedures generally worked well.

1.2 Flood Forecasting

The Met Office forecasts were 75% accurate or better and issued on time and the telemetry system performed well during the event.

1.3 Flood Warning

The new flood warning codes were fully tested with all the categories of warning being used. Altogether 346 separate warnings were issued, for over 100 locations, including 18 Severe Flood Warnings. This involved, for example, the issuing of over 9000 fax messages. It was also necessary to invoke Major Incident Plans, involving the police and local authorities in implementation. The Agency's Floodline 0845 988 11 88 was also widely used and publicised by the media.

1.4 Event Impact

Like much of the country, the South West faced some of the worst flooding for many years during the end of October and beginning of November 2000. The Agency and emergency services were on almost continuous alert between Sunday 29 October 2000 and Thursday 9 November, although the Agency monitored conditions, and issued Flood Watches, before then in anticipation of the developing event. In the 10 days since 29 October there was up to 270mm of rain with 90mm of this rain falling in a 30 hour period in some parts of the South West Region around 30 October. Whilst there are local variations the regional average rainfall for the same period is about 34mm. Many of our rivers have seen the highest levels for many years, and in some cases have been the highest on record.

Flood Defence schemes across the Region performed well and proved their worth. The last comparable event was almost exactly 40 years ago when thousands of properties were then flooded across the Region. Schemes at Exeter and Tiverton passed their severest tests yet, as did the defences at a number of locations down the River Stour. All over the Region flood storage areas have been impounding, flood relief channels flowing, all pumping stations were running and flood defences contained the extreme flood levels.

Cornwall was probably the least affected Area, although it took the first brunt of storms as they came through. Forty three properties were reported flooded and there have been dramatic rescues.

Some of the most extreme river flows in the Region were in Devon. The River Taw at Umberleigh, for example saw the highest levels since records began in 1958, with a gauged flow of 600 cubic metres per second, figure 1.1 illustrates the height of the river at this location. Flows through Exeter were over 500 cubic metres per second. The River Otter also saw its highest flows at Fenny Bridges, with an estimated return period of 80-100 years. On Monday 30 October severe flood warnings were in force on the East Lyn, the Axe, the Lower Exe and the Lower Taw. Flooding occurred in particular on the Exe at Bickleigh, at North Tawton and on the Lower Torridge. The Exe and Tiverton schemes saw their highest flows yet and performed well. Rivers recovered well but levels rose again on Sunday 5 November, particularly in East Devon. Severe flood warnings were issued for the Otter at Ottery St Mary and the Axe at Axminster.

In North Wessex the event started on Sunday 29 October with concerns about storm induced tidal flooding on the Somerset coast, with issue of a severe flood warning. This was followed on Monday 30 November by conditions on the Tone leading to a Major Incident Plan being invoked at Taunton. A severe flood warning was also issued for the Chew, and by Monday afternoon for the (Bristol) Avon. River levels then gradually fell (although with the Moors filling) until further heavy rain on Sunday 5 November brought a return to flood conditions and a severe flood warning for the River Wriggle (Yeo). Emergency works were undertaken to bolster Baltmoor Wall with sandbags, and efforts were undertaken to complete the earlier Parrett Bank and Brue Emergency Repairs. Pumping out of moors, as conditions allowed, continued for some weeks after the event.

The first 'wave' of heavy rain and flooding did not affect South Wessex Rivers too severely, although the beaches at Preston, Chiswell and West Bay gave cause for concern with the high tides and storms. The Stour and (Hampshire) Avon were monitored carefully when they responded by the Tuesday, requiring assistance, close co-operation with emergency services and evacuation plans for the caravan parks on the River Stour at Christchurch. Action by the Emergency Work Force (EWF) undoubtedly averted considerable damage. Heavy rainfall on Sunday 5 November led to conditions on the River Frome in Dorchester requiring a severe flood warning and the Major Incident Plan to be invoked. As river levels fell attention was paid to strengthening beaches. Material from Freshwater was taken to East Beach at West Bay and material at Preston beach was re-profiled.

Approximately 550 properties were reported as flooded, spread across the region in small groups. Most of these locations are known to the Agency and there have been no significant new problem areas. This is a tribute to the work that has been done in investigating flooding problems, identifying flood risk areas, and delivering improvements. We will need to review the priority at these locations; some of which are becoming chronic problems.

1.5 Emergency Response

The Emergency Workforce needed all its training and experience in dealing with potentially dangerous situations. Their actions in clearing screens, removing trees and placing sandbags were vital and they worked well beyond normal hours.

1.6 Public Relations

A major Public Relations effort was required throughout the event. The Agency took on a proactive stance from the outset with early warning of the severe weather expected. A constant flow of information followed with countless news releases and media briefings. Media interest was considerable with 140 television and video interviews provided by Agency staff.

While there is a natural tendency for the media to concentrate on areas flooded, the PR team sought to raise the profile of places where flood defence schemes had prevented flooding. This is an aspect of PR worthy of further development.

The event did stimulate a large number of letters from the public to newspapers, these carried a wide variety of suggestions to the causes and solutions of the flooding. Most general reporting has been factual and supportive of Agency activity.

FIGURE 1.1 – FLOODING ON THE RIVER TAW AT UMBERLEIGH



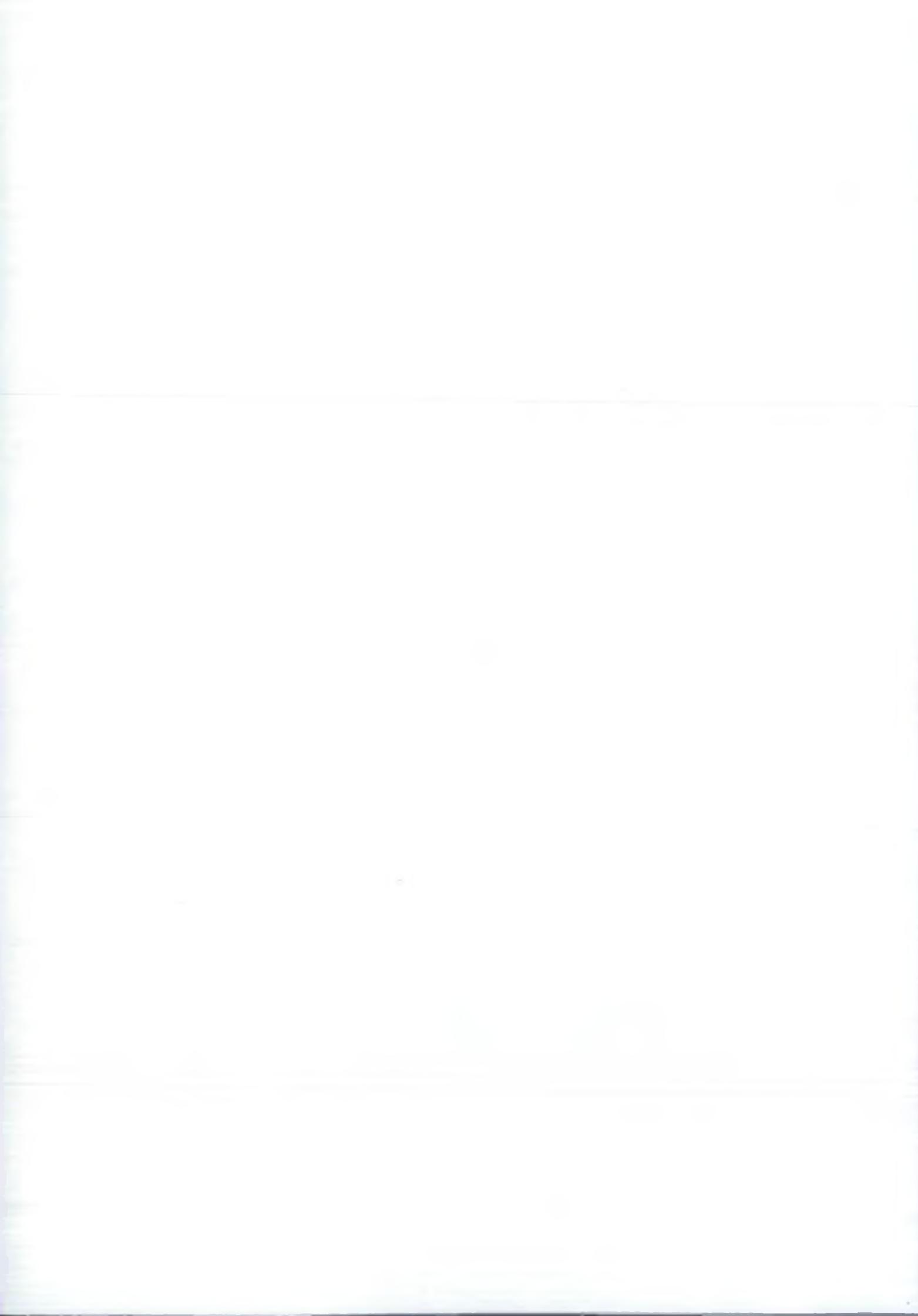


FIGURE 1.1 – FLOODING ON THE RIVER TAW AT UMBERLEIGH





CHAPTER 2 – EVENT MANAGEMENT

2.1 Procedures

(Regional) Feedback from the Regional debrief was that internal procedures, including Regional Incident Procedures (RIPs) generally worked well. Some Operational Duty Officers still tended, on occasions, to leave opening their incident rooms until late. This not only puts them under pressure, when they finally open, but also means the calls that they should be handling are having to be initially dealt with in the Regional Communications Centre (RCC). In addition Areas need to improve their feedback to Region on the situation, it should be two way communication not one and situation reports are required at least at 0900 and 1400.

(Regional)The Flood Warning Office was active for a large proportion of the event and made particular comment on how useful the Regional Base Controller was, when they were active and actually running the Regional Incident Room (RIR). This is something that has been developed over the last few years and is beginning to show its benefits now that people are more aware of the role.

It should be noted that Devon and Cornwall Areas comprise typically of fast reacting spate rivers; North and South Wessex by contrast are slower to respond, but can then remain at warning levels for many days.

(North Wessex) Procedures and Management systems need to be robust enough to ensure the Working Time Directive is followed. While rota systems worked, specific detailed local knowledge is often concentrated in relatively small numbers of staff. This also has implications when identifying staff to deliver the Flood Warning Service from the Area from September 2001.

(South Wessex) Generally the production, dissemination and updating of duty rotas was very time-consuming and stretched resources when 24hr shift working was in place.

2.2 Liaison (Internal/External)

The South West Region has been pro-active in encouraging LAs to develop Major Incident Plans (MIPs) and currently has 62 in place across the Region. This preparation proved valuable, although the need for more trained liaison officers was apparent.

(Regional) In the main liaison with external partners, particularly for activation of MIPs etc was good, although problems were encountered in Dorset. A full debrief has now been held with the police/county/district on this issue and a way forward identified, although it was disappointing that certain organisations did not seem to have learnt from the exercises that had taken place previously – 2 weeks in one case. Even though numbers are checked every quarter there were still problems getting through to some organisations as they do not have, or would not give their ex-directory numbers. With the present high profile of flooding a further push is being made on this issue.

(North Wessex) As would be expected there have been considerable requests from the general public raising queries on the flooding experience and also internal Agency demands for information over the phone. With the event still going on these can be problematic to deliver, a screening process could be beneficial.

(South Wessex) There was a distinct change in emphasis for these events at Area over previous floods. Public accountability, through Floodline, recent media campaigns etc means that there is far more traffic to the AIR to be responded to. A dedicated phone answering resource was set up to act as a filter. The incident was kept going longer as a result of the need to deal with public enquiries and the deployment of field staff to act as a visible presence.

(South Wessex) It is considered that communication between the Agency and relevant local bodies (LA's, Parish Councils and the Emergency Services) was seamless; prior, during and post event. Meetings have taken place both on site, at formal meetings and at public meetings.

(South Wessex) Have Good working relationships with the Local Flood Defence Committees.

(South Wessex) Particular attention was paid to keeping "stakeholders" including MPs briefed. All recipients appreciated the MP's update prepared by Public Relations and sent daily during the event. The resource implications during and after need to be recognised.

2.3 Communications

(Regional) Both the RCC and RIR had problems at times contacting Area Incident Rooms as the previous dedicated numbers were not being used. To improve communication links between the RCC/RIR and the Area Incident Rooms these dedicated numbers between offices are being re-introduced. Correct numbers for various "other" organisations need to be identified where there are currently problems with communications due to unknown or unavailable ex directory numbers.

(Devon) Some communication problems were evident between the AIR and EWF. This is being resolved.

2.4 Numbers of Staff Deployed

Table 2.1 Summary of the key estimated statistics for the event

Table 2.1 – Key Statistics for the Event					
	Regional Office	South Wessex	North Wessex	Devon	Cornwall
Dates Agency Incident Rooms opened	28/10/00 to 20/11/00	29/10/00 to 01/11/00 05/11/00 to 07/11/00	First opened on 30/10/00 and on several occasions during event.	29/10/00 to 31/10/00 05/11/00 to 06/11/00	30/10/00 and 5/11/00
Staff number worked in incident room	40	18	45	9	9
Staff time (hours) worked in incident room	1500	500	See note 1	215	270
Number of EMF staff involved	0	26	70 (includes up to 1/1/1)	24	30
Time (hours) worked by EMF staff	0	3600	40 000 (includes up to 1/1/1)	1200	1600
Number of additional staff involved with flood recon, PR, river monitoring etc)	10	15 See note 2	15 See note 1	23	-

Note 1 – Within N Wessex 5000 staff hours were employed in manning the incident room and also for flood reconnaissance, PR, river monitoring etc

Note 2 – Within S Wessex 2350 hours were used in flood reconnaissance, PR, river monitoring etc.

In the Regional flood warning office in Exeter during the peak event periods a three shift team was in operation, the duty team tended to cover the night and others covered the early and late finish daytimes. This system worked well. It is estimated that all team members assisted during the period therefore approximately 12 different duty officers and twenty four different duty assistants were used. Four Floodline staff were also used.

The Regional Communications Centre (RCC) was, as normal, active throughout the event. During peak call times additional, either Communications Operators or support people, were utilised to help, with Emergency Officers also assisting.

(South Wessex) The extended nature of recent events has stretched the FD and EWF staff. Maintaining a 24hr rota, responding to the number of telephone calls and maintaining a presence in the field made use of all available staff. To respond to this demand use was made of staff from other functions, e.g. Fisheries, EP and Business Services, to supplement FD in the office and EWF in the field. This helped to maintain a working framework and helped to take some of the weight of basic enquiry calls out of the incident room. This was implemented to good effect in the events later in December.

2.5 Range of functions and Inter Regional Co-Operation

Inter Regional Aid was provided in the form of staff to help in an Area Incident Room in the Midlands and PR office in Southern. These placements were successful, although becoming an ABC in a strange Area at short notice, can be quite stressful, particularly if a major pollution incident occurs at the same time!

Subsequently (after this period) the Region requested National sand bag and pumping support which was provided efficiently and selflessly, for which the Region is grateful.

2.6 Scale (number if possible) of Calls Received

Figures not available.

2.7 Issues Arising

- Staff resources were stretched and severe problems could have been encountered if the event had been more prolonged.
- Both the RCC and RIR had problems at time contacting Area Incident Rooms as there were no "dedicated" numbers between these key rooms.
- Communication problems were encountered with external partners in Dorset as a result of poor information relating to their telephone numbers.
- Feedback to Region from Areas requires improvement.
- Numerous calls were received from the general public with questions on the floods, these were difficult to deliver during the event.
- (South Wessex) There is a need to pick up on news bulletins via TV/Radio/Satellite broadcasts to help ensure that as much information as possible is available for duty staff.
- (South Wessex) There is a requirement to be aware of infrastructure problems and try to improve access to highway information, particularly unpredictable road closures from fallen trees etc. This will aid effective deployment of staff both for emergency response and flood monitoring/recording.

2.8 Recommendations

- A review on the availability of staff resources should be undertaken.
- Dedicated numbers need to be re-introduced between the RCC and the Area Incident Rooms.
- Telephone numbers with partners in Dorset are under review.
- Areas should communicate to Region in a more formalised manner, it should be a two way communication and written at least at 0900 and 1400.
- A screening process could be beneficial in order to answer calls from the general public.
- An update could be sent to Professional Partners/MP's etc on a daily basis summarising the latest flood situation.

CHAPTER 3 - FLOOD FORECASTING

3.1 Accuracy and Timeliness of the Met Office Short and Medium Term Forecasts (forecast v actual precipitation)

Table 3.1 Summary of the rainfall during the period from 28 October to 20 November.

Date	Devon and Cornwall				North and South Wessex			
	Forecast	Actual	O	U	Forecast	Actual	O	U
28/10/00	8-35	6-40			8-25	1-29.6		
29/10/00	30-70	25-136		X	20-50	22-85.6		X
30/10/00	10-25	5-40		X	40-70	0.6-15.4	X	
31/10/00	2-20	2-13			2-18	0.2-17.2		
1/11/00	3-30	3-17			3-35	5.6-23.6	X	
2/11/00	8-30	2-16			5-30	0-26		
3/11/00	0-8	0-12			0-8	0-13		
4/11/00	2-5	0.4-6			2-10	0-3		
5/11/00	15-50	1-40			15-40	16-47		
6/11/00	5-35	1-20			4-25	2-15		
7/11/00	2-25	1-31			2-15	0-10		
8/11/00	1-20	0-15			0-8	0-5		
9/11/00	0-3	0-5		X	0-3	0-1.6		
10/11/00	7-18	1-38			7-18	2.4-22.2		
11/11/00	6-20	3-13			5-18	3.2-21.2		
12/11/00	Tr-25	0-4			0-15	0-1.2	X	
13/11/00	0-12	0-12			0-12	0-5.2	X	
14/11/00	0-18	1-16			0-8	0-6.4		
15/11/00	10-30	7-23			10-25	0-21.2		
16/11/00	0-20	1-15			0-16	0-14.4		
17/11/00	2-8	0-9			2-6	0-2.2		
18/11/00	5-12	0.8-13			3-10	0.4-11.8		
19/11/00	1-25	2.4-28			0-15	0.2-23.6		
20/11/00	0-20	1.6-26			0-20	0.2-9.4	X	
Area Success Rate	88%				75%			

O = significantly over estimated

U = significantly under estimated

Generally the weather forecasts were reasonably accurate for the period.

Availability to talk directly with a local duty forecaster at the Met Office is greatly appreciated.

3.2 Impact of Any Inaccurate Forecast

3.3 Agency Telemetry and Outstation Robustness and Availability

3.3.1 Rainfall sites

During the peak flooding period (28th Oct – 5th Nov) the following tipping bucket rain gauges were out of action for some or all of this period:

(North Wessex Sites)

Downhead

Fulwood

Tetbury

Treborough (still out at the time of writing)

Somerford raingauge recorded substantially less rainfall than neighbouring rain gauges and did not tie in with the radar rainfall plot for that area.

Frampton raingauges recorded particularly high amounts of rainfall indicating a possible fault with the equipment.

(South Wessex sites)

Lodge House Farm - BT fault

(Devon sites)

Ashcombe

Hillerton

Kenwith Valley

Mole Mills

Parkham (still out at the time of writing)

Upton Hellions

Austins Bridge - spurious amount of nearly 500mm in 1 hour on 11:45 24th Oct

Bickington - spurious amount of nearly 175mm in 1 hour on 12:45 24th Oct

(Cornwall sites)

Bridgerule

Luxulyan

Yeolmbridge raingauges recorded particularly high amounts of rainfall indicating a possible fault with the equipment.

3.3.2 River level sites

Problems were identified with the telemetry system, Servelec Configurable Online Process Executive (SCOPE), for the following river level sites for all or part of the period 28th Oct-5th Nov:

(North Wessex sites)

Frenchay BT fault

Bathford, Topped out at 4.0m

Taunton Market Topped out at 2.5m

Ilchester Flat trace (display or outstation scaling problem)

Weston Bampfylde, Flat trace (display or outstation scaling problem)

Tubbs Bottom Flat trace (display or outstation scaling problem)

Clyse Hole Flat trace (display or outstation scaling problem)

Huish Episcopi	Flat trace (display or outstation scaling problem)
Westover	Problem identified
Great Somerford	Mains Failure
Bitton	Problem identified
West Luccombe	Mains Failure
Chetnole	Mains failure
Brockenborough	BT fault
Milverton	BT fault
East Harptree	BT fault

(South Wessex sites)

Upavon (East/West)	Problem identified
Maiden Newton	Problem identified
Norton Bavant	BT fault
Dewlish	BT fault
East Stoke Flume	BT fault

(Devon sites)

Harbertonford	Noisy level. Too dangerous to check to replace transducer New platform needed and junction box needs raising by at least 1m
Newnham Bridge	BT Fault
Upton Hellions	BT fault
Barbrook	Mains timer faulty - Fixed

(Cornwall sites)

Yeolmbridge	Water in junction box (failed) New platform needed and junction box raising by at least 1m
Boscundle	OSTN faulty and has been replaced.

3.4 Ability of Agency to Predict The Actual Flood Levels Using Their Current Models (predicted v actual levels & flows)

12 out of the 33 Weather Radar Interpretation Programmes (WRIP models) predicted the right level of warning for the flood events on the 30th Oct and 5th Nov. The main problem with WRIP is that the Flood Warning Duty Officer can either select a Winter/Saturated model or an Autumn model and will get very different results depending on which model is chosen. More guidance is needed on which model to use during a flood event. In summary, the following models predicted the right level of warning for the Oct/Nov 2000 flood event.

Table 3.2 Summary of models

Model	Catchment	Best model to use
Brushford	Barle, Devon	Winter /Saturated
Pixton	Exe, Devon	Winter /Saturated
Stoodleigh	Exe, Devon	Autumn
Chiselborough	Parrett, NW	Winter/Saturated
Lovington	Brue, NW	Winter/Saturated
Pen Mill	Yeo, NW	Winter/Saturated

Semington	Semington, NW	Winter/Saturated
Stanley	Marden, NW	Winter/Saturated
Tellisford	Frome (Som), NW	Winter/Saturated
Ashford Mill	Isle, NW	Autumn
Bishops Hull	Tone, NW	Autumn
Netherbury	Brit	Winter/Saturated
Hammoon	Stour, SW	Winter for starting stage < 0.6m (?)
Hammoon	Stour, SW	Autumn for starting stage > 2.6m (?)

Further information on the performance of the 33 winter and autumn models can be found in figures 3.1 to 3.4.

3.5 Issues Arising

3.5.1 Telemetry and outstation reliability and coverage

- The telemetry system performed well during the flood event. Communications with outstations was generally reliable as was the receipt of alarms.
- A number of outstations went out of service during the event. Ten sites experienced a BT fault and four sites suffered mains failure during the event. This caused problems, particularly when the station was a "criteria site" and there was not a nearby gauge to use. Some warnings were issued on the "experience" of the FWDO due to the loss of an outstation. This may have resulted the delay in the issue of warnings.
- Two sites were unable to measure the peak water level as the instrumentation topped out and two sites suffered damaged platforms and junction boxes.
- Outstation coverage across the region is generally good for flood forecasting. However, a concern has been raised in South Wessex area that an increased number of monitoring points are required along the Hampshire Avon and Stour catchments to monitor the progress of the flood peak down the river system. This improved coverage would assist in operational response and flood warning as well as for evaluating flood forecasting accuracy.
- Cornwall feel that there are large inputs from the Devon tributaries of the Upper Tamar, but no telemetry sites exist.
- The Region is part way through a major investment programme for telemetry as an Easter Flood Action.

3.5.2 Flood Forecasting Models

- 31 rainfall runoff forecasting models are available for use in the South West region, covering approximately 15% of the 200 flood warning areas/reaches in the region. Of these only 13 are considered to be calibrated adequately. Therefore coverage of the region with forecasting models is between 5-10%. Of the 33 forecasting models, with hindsight 12 predicted the correct level of warning. This does not mean that the models would have correctly predicted the warning level during the event. This has not been evaluated.

- Many of the forecasting model available have been coarsely calibrated and therefore do not forecast well in an operational situation.
- Manual methods of flood forecasting are available to the FWDO for only a small number of catchments. These methods have not been collated and made available to the FWDO in a consistent and organised manner.
- In the SW region flood warnings are disseminated by regional FW duty teams. Given the number of warnings issued and the scale of the dissemination process, the FWDO did not have the time during the event to consider forecasting using computer models. Forecasting tools have rarely been used in past events and therefore little experience has been gained in their use.
- Area Operations teams, with a eye on the dissemination of flood warnings becoming an area task in future, had a high expectation for flood forecasting from the regional FWDOs. The expectation far outweighed the ability for the regional team to provide forecasts.

Many, if not all of the above issues are due to the fact that in the past 2-3 years, initiatives undertaken by the Environment Agency in the field of flood warning have concentrated on Dissemination Techniques and raising Flood Awareness. As a result development of flood forecasting has taken a "back seat" in the allocation of available resources.

3.5.3 General forecasting and threshold/criteria setting

- Data to set thresholds/criteria for extreme events was lacking. This is being addressed in picking up the data and setting up empirical models. Criteria for the initiation of Major Incident Plans was hazy. This is being addressed by calibration of outstations for flow - as per the Easter Floods action.
- A need has been identified for the ability to carry out historical matching in real time. Display hydrograph with actual rainfall profile at any given time through an event and be able to call up one or more similar events from the record.
- Need for earlier/ more reliable warning for storage scheme overtopping. Inflow hydrograph v storage is required. Consideration should be given to undertaking this for eight flood storage structures.
- More data on scheme performance and their progressive failure mode as the flow increases is required. This can and is being picked up in the reports and should be included in procedures.
- Cornwall is difficult to forecast because of its quick response catchments and prevailing weather arriving from the west or south west (beyond the range of STORM radar which only extends about 100 miles out to sea.
- Devon encountered problems with STORM and SCOPE crashing.
- South Wessex feel that there is a need to improve flood forecasting models, especially for chalk rivers.

3.6 Recommendations

3.6.1 Met Office Forecasts

- Ensure feedback on accuracy of forecasts is provided to Meteorological Office.

- Ensure that region meets with local weather centre at least annually to discuss issues arising from the forecasting service provided by the Meteorological Office.

3.6.2 Telemetry and outstation reliability and coverage

- Despite the good performance of the regional telemetry system (SCOPE), it is accepted that the system is based on outdated technology. Continued support should be given to the Telemetry Replacement Partnership set-up jointly with Anglian Region which aims to replace the South West regional telemetry system by 2003.
- The region must continue with the programme of telemetry improvements identified in surveys undertaken in response to Easter Flood Actions A1.16. These improvements are designed to increase the range of water levels that can be monitored at each station. This programme includes the sites which "topped out" during the event and those that suffered damage.
- Further improvements to outstations or installing additional sites to improve coverage (eg South Wessex) should be co-ordinated regionally to ensure it fits in with the Flood Warning Levels of Service (FWLOS) study.
- Due to the large number of warnings issued in a short space of time it has been agreed that the telemetry system should provide a pro-active prompt for all flood warning thresholds (floodwatch, flood warning and severe flood warning). Work is already underway to ensure that a telemetry prompt will be provided for every flood warning area and every flood warning stage.

3.6.3 Flood Forecasting Models

- There is a clear requirement to improve the tools available to Flood Forecasting Duty Officers to undertake and improve the flood forecasting service. It is questionable as to whether improved tools would have greatly improved the service for this flood event as the South West regional "forecasting" team is still undertakes the dissemination of flood warnings. All resources were utilised in providing the flood warning service and time was not available to provide flood forecasting.
- It is recommended that a 3 stage approach is taken to improving forecasting:
 - 1- Produce and collate appropriate charts, graphs and hydrographs that together allow the Forecasting team to produce rudimentary forecasts. This is primarily a task of data collation and presentation.
 - 2- Calibrate and evaluate existing rainfall runoff models. Data collected from this event should be included in the calibration data.
 - 3- Develop further models, including routing and hydrodynamic techniques, where a need has been identified for improved forecasting capabilities.

Progress in this three stage approach should be integrated into a medium term strategy for flood forecasting for the South West Region.

FLOOD FORECASTING AND HYDROLOGICAL RESPONSE

Figure 3.1

Performance of WRIP system - Winter/Saturated models

Event 17 - 29th Oct - 02nd Nov 2000

Event 19 - 3rd-8th Nov 2000

wat = flood watch; wrn = flood warning; upd = flood warning update

-ve lead time means that model predicts warning later than actual warning

Operational WRIP models Latest update: 25/1/00				Event	Starting	Predicted	Actual	Predicted	Actual	Lead time
Area	WRIP Model Site	Catchment	Flow/Level	Number	stage (m)	peak (m)	peak (m)	warning	warning	at threshold (hr)
Devon	Brushford	Barle	Flow	17	0.75	2.34	2.39	WRN	WRN	-1 and 3 early
Devon	Pixton	Exe	Flow	17	0.56	1.86	2.19	WRN	WRN	-1
Devon	Stoodleigh	Exe	Flow	17	1.81	4.34	3.75	UPD	UPD	5 early
N Wessex	Ashford Mill	Isle	Flow	17	0.33	3.24	2.16	UPD	UPD	-1
N Wessex	Bishops Hull	Tone	Flow	17	0.39	3.36	2.59	UPD	UPD	7 early
N Wessex	Chiselborough	Parrett	Flow	17	0.6	2.4	2.5	WRN	WRN/UPE	0
N Wessex	Compton Dando	Chew	Flow	17	1.09	3.34	4.28	WRN	UPD	-1
N Wessex	Frenchay	Frome (Bristol)	Flow	17	1.44	3.55	n/a	UPD	n/a	2 early
N Wessex	Great Somerford	Avon (Bristol)	Flow	17	0.7	1.3	2.09	WRN	UPD	-3 late
N Wessex	Greenham	Tone	Flow	17	0.4	1.45	1.61, 1.93	WRN	WRN x 2	-4 and -10 late
N Wessex	Iwood	Congesbury Yeo	Flow	17	0.3	1.07	1.33	WAT	WRN	0
N Wessex	Lovington	Brue	Flow	17	0.51	3.25	3.54	WRN	WRN	1
N Wessex	Midford	Midford	Flow	17	1.45	3.79	3.54	UPD	WRN	1
N Wessex	Pen Mill	Yeo	Flow	17	0.98	4.21	4.1	WRN	WRN	0
N Wessex	Semington	Semington	Flow	17	0.68	2.78	2.67	UPD	UPD	3.5 early
N Wessex	Stanley	Marden	Flow	17	0.98	2.61	3.28	WRN	WRN	-2 late
N Wessex	Tellisford	Frome (Soms)	Flow	17	1.55	3.81	3.75	UPD	UPD	0
N Wessex	Trowbridge	Biss	Flow	17	0.51	1.89	2.1	WAT	WRN	-2 late
N Wessex	Vallis	Mells	Flow	17	0.42	1.36	1.79	n/a	WRN	n/a

FLOOD FORECASTING AND HYDROLOGICAL RESPONSE

Figure 3.3

Performance of WRIP system - Autumn models

Event 17 - 29th Oct - 02nd Nov 2000

Event 19 - 3rd-8th Nov 2000

wat = flood watch; wrn = flood warning; upd = flood warning update

-ve lead time means that model predicts warning later than actual warning

Operational WRIP models				Event Number	Starting stage (m)	Predicted peak (m)	Actual peak (m)	Predicted warning	Actual warning	Lead time at threshold (hr)
Area	WRIP Model Site	Catchment	Flow/Level							
Latest update: 25/1/00										
Devon	Brushford	Barle	Flow	17	0.75	2.01	2.39 WRN	WRN		-7 late
Devon	Pixton	Exe	Flow	17	0.56 n/a		2.19 n/a	WRN	n/a	
Devon	Stoodleigh	Exe	Flow	17	1.81	3.57	3.75 UPD	UPD		-3 late
N Wessex	Ashford Mill	Isle	Flow	17	0.33	3.01	2.16 UPD	UPD		-2 late
N Wessex	Bishops Hull	Tone	Flow	17	0.39	2.72	2.59 UPD	UPD		2 early
N Wessex	Chiselborough	Parrett	Flow	17	0.6	1.98	2.5 WAT	WRN/UPD		-5 late
N Wessex	Compton Dando	Chew	Flow	17	1.09	2.64	4.28 WAT	UPD		-4 late
N Wessex	Frenchay	Frome (Bristol)		17	1.44	2.8 n/a	WRN	n/a		-4 late
N Wessex	Great Somerford	Avon (Bristol)	Flow	17	0.7	1.02	2.09 WAT	UPD	n/a	
N Wessex	Greenham	Tone	Flow	17	0.4	0.77 1.61, 1.93	n/a	WRN x 2	n/a	
N Wessex	Iwood	Congesbury Yeo	Flow	17	0.3 n/a		1.33 n/a	WRN	n/a	
N Wessex	Lovington	Brue	Flow	17	0.51	2.74	3.54 WRN	WRN		-1.5 late
N Wessex	Midford	Midford	Flow	17	1.45	2.96	3.54 WAT	WRN		-6 late
N Wessex	Pen Mill	Yeo	Flow	17	0.98	3.41	4.1 WAT	WRN		-6 late
N Wessex	Semington	Semington	Flow	17	0.68	1.91	2.67 n/a	UPD	n/a	
N Wessex	Stanley	Marden	Flow	17	0.98	2.06	3.28 WAT	WRN		-5 late
N Wessex	Tellisford	Frome (Soms)	Flow	17	1.55	2.74	3.75 n/a	UPD	n/a	
N Wessex	Trowbridge	Biss	Flow	17	0.51	1.23	2.1 n/a	WRN	n/a	
N Wessex	Vallis	Mells	Flow	17	0.42	0.96	1.79 n/a	WRN	n/a	

CHAPTER 4 - FLOOD WARNING

4.1 Trigger/Threshold Levels for Warnings

Refer to figures 4.1 to 4.4 at the back of this chapter.

4.2 Warnings Issued, Target Lead Times v Actual Lead Times.

Table 4.1 Number of severe flood warnings by location and frequency

Date Warning issued	River	Location	Frequency
30/10/00	Lyn (East)	Brendon to Lynmouth	1
30/10/00	Axe (Upper)	Winsham to Axminster	1
30/10/00	Axe (Lower)	Axminster to Axmouth	1
30/10/00	Taw (Lower)	Newnham Bridge to Barnstaple	1
30/10/00	Torridge (Lower)	Dolton to Bideford	1
30/10/00	Tone	At Taunton	1
30/10/00	Chew	Chewstoke to Keynsham	1
30/10/00	Bristol Avon (Upper)	At Malmesbury	1
30/10/00	Bristol Avon (Mid)	Melksham to Bathford	1
30/10/00	Bristol Avon (Mid)	At Bradford Upon Avon	1
30/10/00	Somerset Coast	At Portishead	1
30/10/00	Dorset Coast	At West Bay	2
31/10/00	Stour (Lower)	At Christchurch and Bournemouth caravan parks	1
5/11/00	Otter (Lower)	At Ottery St Mary	1
5/11/00	Axe (Mid)	At Axminster	1
5/11/00	Wriggle	At Chetnole and Yetminster	1
6/11/00	Dorset Frome (Lower)	At Dorchester	1

Table 4.2 Total number of severe flood warnings and flood warnings by river in Cornwall

River	Flood Warning	Severe Flood Warning
Camel	1	0
Kensy	1	0
Lyd	1	0
Lynher	1	0
Neet	1	0
Ottery	1	0
Strat	1	0

Tamar (lower)	1	0
Tamar (middle)	1	0
Tamar (upper)	3	0
Total	12	0

Table 4.3 Total number of severe flood warnings and flood warnings by river in Devon

River	Flood Warning	Severe Flood Warning
Axe (lower)	3	1
Axe (mid)	0	1
Axe (upper)	3	1
Barle	1	0
Bradiford Water	1	0
Bray	1	0
Clyst	2	0
Coly	2	0
Creedy	1	0
Culm (lower)	2	0
Culm (upper)	1	0
Dart	3	0
Exe (lower)	4	0
Exe (middle)	1	0
Exe (upper)	2	0
Lemon	1	0
Lowman	2	0
Lyn (East)	2	1
Mole	1	0
Otter	2	0
Otter (lower)	3	1
Taw (lower)	2	1
Taw (upper)	5	0
Teign	2	0
Torridge (lower)	3	1
Umborne Brook	3	0
Yarty	3	0
Yeo (Barnstaple)	1	0
Yeo (Creedy)	2	0
Total	59	7

Table 4.4 Total number of severe flood warnings and flood warnings by river in South Wessex

River	Flood Warning	Severe Flood Warning
Asker	1	0
Bride	2	0
Brit	2	0
Char	2	0
Dorset Frome (lower)	1	1
Dorset Frome (upper)	2	0
Hampshire Avon (mid)	2	0
Hampshire Avon (upper)	2	0
Lodden	2	0
Nadder	2	0
Stour (lower)	2	1
Stour (middle and lower)	4	0
Stour (upper)	3	0
Wey	2	0
Wylde (upper)	1	0
Total	30	2

Table 4.5 Total number of severe flood warnings and flood warnings by river in North Wessex

River	Flood Warning	Severe Flood Warning
Biss	1	0
Bristol Avon (lower)	3	0
Bristol Avon (mid)	3	2
Bristol Avon (upper)	7	1
Bristol Frome	2	0
Brue (middle and lower)	2	0
Cam	2	0
Chew	3	1
Congresbury Yeo	2	0
Halsewater Stream	3	0
Hallifarrance Brook	1	0
Isle	4	0
Midford Brook	1	0
Monksilver and Doniford stream	2	0
Parrett (lower)	2	0
Parrett (upper)	2	0
Semington Brook	2	0
Somerset Frome	6	0
Tone (lower)	2	0
Tone at Taunton	1	1
Tone (upper)	2	0
Washford	1	0

Wriggle	4	1
Yeo	2	0
Yeo (upper)	1	0
Total	61	6

Table 4.6 Flood warning summary of performance

Analysis concentrates on areas where either 10 or more properties were flooded or where a severe flood warning was issued.

		Cornwall		Devon		N Wessex		S Wessex	
		FWS	No FWS	FWS	No FWS	FWS	No FWS	FWS	No FWS
4.3	Props flooded following a flood warning	17		110		109		63	
4.4	Props flooded without a flood warning	7	16	16	34	67	52	4	15
4.5	Props not flooded but received a flood warning	> 100		>500		>500		>100	
4.6	Props flooded following a severe flood warning	No SFW		3		45		12	
4.7	Props flooded without a severe flood warning	No SFW		12		2		0	
4.8	Props not flooded but received a severe flood warning	No SFW		67		105		26	

Notes: FWS = Flood Warning Service

Properties may have received several warnings or flooded more than once, but number of properties recorded once warning received means direct warnings only.

4.9 Automatic Voice Messaging (AVM)

The Automatic Voice Messaging system performed faultlessly throughout the flood events.

Table 4.7 AVM Statistics 27th October – 20th November

	N& S Wessex	Devon & Cornwall
No. Groups Issued	135	140
No. Recipients contacted	1758	2132
No. of successful recipients	1327	1688
% successful	75.5	79.2

4.10 Floodline

The following are general comments made in relation to the operation of Floodline as made by both Region and Area offices.

(Region) Floodline, button 2 (meant to be for flooding reports) calls all continued to come through the Regional Communications Centre, to aid in the filter process. People continue to use button 2 to get updates on what is happening (instead of using button 1, because there is possibly a need for more information on this button eg. time of last update, getting worse/better etc and when). It was also used to try and get updates on the road-flooding situation (a lot of these calls were directed to the Agency by the police advising the public to call Floodline). All these calls put an additional load on an already busy operator and more ways of filtering these calls need to be identified. There is also a requirement to make improvements to the information provided on button 1 of Floodline such as time of last update, improving/deteriorating situation etc.

(Region) During the period 29th-31st Oct, there were numerous reports of warning messages not transferring to Floodline boxes or only transferring after a very long delay. The bottleneck was caused by there only being one computer (LAN) communications port used to transfer messages. IMS, the suppliers of the Floodline system are looking into providing more LAN ports to speed up transfers at busy times, but in the interim they suggest that deleting the current message before attempting to record another message should prevent the box locking up.

(Devon) A lot of incoming telephone business was as a result of the implementation of Floodline. Many should not have been received in the Area Incident Room (AIR) and this is being taken up with the Regional Floodline Representative. Floodline will require some modifications to avoid unnecessary calls reaching the AIR.

(North Wessex) There are concerns on the resource implications of delivering the information required through the Floodline service as the flood warning service has to ensure that it can deliver the relevant messages given available time and resources.

4.11 Flood Wardens

(South Wessex) Although there are no official flood wardens the field contacts were a useful source of up to date information and could be relied upon to report important monitoring information. Continued liaison will help formalise these and develop new contacts. Twenty-six communities within the Area have been identified as requiring debriefing, support and investigation following recent flood events. Establishment of flood warden schemes will be the outcome in many instances.

(North Wessex) There are few flood wardens. At a subsequent meeting it is intended that the warden scheme in certain appropriate locations will be created as a back up to the AVM rather than as a primary mechanism for dissemination of flood warnings.

(Devon) None used.

(Cornwall) None used.

4.12 Loud Hailers

(South Wessex) Loud hailers were placed on standby with pre-recorded messages for:

- West Bay, 30th October
- Chiswell (Portland), sirens ready but not used

Loud hailers were used with a pre-recorded message for:

- Dorchester, 6th November.

(North Wessex) Vehicle mounted loudhailers were deployed in two locations, Taunton and Malmesbury. The loudhailers were, in the end, only used in Taunton. The reliance on loudhailers is to be investigated as problems were encountered where roads had been closed creating traffic congestion. The size of North Wessex also has implications if the location to be warned is on a fast reacting river.

Flood warnings in the Somerset Moors and Levels were issued using hand delivered flood warning flyers. These A4 sheets had the Environment Agency flood warning details on one side and the local authority advice on the reverse, these proved successful. However, this method was only suitable due to the slow reacting nature of the area.

(Devon) None used.

(Cornwall) None used.

4.13 Local Media

A major Public Relations effort was required throughout the event. The Agency took on a proactive stance from the outset with early warning of the severe weather expected. A constant flow of information followed with countless news releases and media briefings. Media interest was considerable with 140 television and video interviews provided by Agency staff.

4.14 Sirens and Public address

Not applicable.

4.15 Issues arising

4.15.1 Duty teams

- The magnitude of the flood event, resulted in an unprecedented number of warnings to be issued, particularly during the early hours of 30 October.

Table 4.8 Flood warning issuing intensity

Time Period (29/30 October)	Number of warnings issued from Regional Flood Warning Office
2300hrs –0000hrs	10
0000hrs-0100hrs	12
0100hrs-0200hrs	11
0200hrs-0300hrs	5
0300hrs-0400hrs	11
0400hrs-0500hrs	15
0500hrs-0600hrs	11

- The flood warning teams were severely stretched in keeping up with the pace of the event. Some warnings were missed or issued late due to the workload and time not being available to closely study all actions detailed in the Flood Warning Procedures. This was most apparent where alarms have not been set up to draw attention to the need for action.
- Improved training in the dissemination systems, particularly for duty assistants has been identified as a requirement.

4.15.2 Dissemination

- The fax dissemination system (Autofax) also had problems keeping pace with the developing situation. As a result warning faxes stacked up in the system resulting inevitably in the delayed dissemination.
- Amount of paperwork needs to be cut down. Too many faxes going to professional partners. There needs to be flexibility in format to enable the identifying of important faxes. Critical warnings must specifically be brought to Professional partners attention. This issue is being addressed with procedures for Pre-Mips - A scripted telephone call to a dedicated destination for example is what is requested for Major Incident Plans in Devon.
- The AVM system operated well. However post event reporting from the system is poor.
- Floodline Duty Assistants struggled to keep pace with the developing event. Update of messages did not keep pace with warnings issued. During the 30 October event numerous difficulties were experienced in accessing the system. The length of message and time taken to record the message resulted in some messages not being available for AVM customers when they rang following receipt of the AVM. Delaying the issue of the AVM until the Floodline message was recorded was not deemed a viable solution.
- There is a need to ensure that all warnings are prompted on the telemetry system rather than rely on reading text in a manual.
- Consider setting up warnings separately to warn for separate locations, even if using the same telemetry.
- There are limitations with the battle board (large board in RCC that summarises warnings issued). Order can be unclear – difficult to find reaches. Separate slots for 'group' flood watches, local flood watches/warnings and MIPs, covering same locations. There is a need for a Flood Warning Management System.

- (South Wessex) Problems highlighted regarding the deployment of loud hailers.

4.15.3 Public perception/action

- It can be difficult to get across degree of severity of a flood event. There is a need to look at what constitutes a severe flood in the eyes of the public perhaps rather than adhering strictly to guidelines. On the River Tamar in Cornwall a flood warning where only a handful of properties were flooded – however one resident had to be rescued from his house by helicopter! The general perception is that a severe flood warning should have been issued, however only a few properties were affected.
- The public did actually start taking action themselves. They wanted to know what to do. All very encouraging. Our Regional media are becoming a real asset now - particularly local radio. Product of our excellent PR Department. This must continue.

4.15.4 Event management/report

- The insatiable appetite for information during the event from internal and external sources has resulted in an increase workload for all duty teams. There is an urgent need for an event management and reporting system that assists this task. The IT systems used should provide real-time summary reports thus reducing the duty teams requirement to manually collate information.

4.16 Recommendations

- Experience gained during this event should be considered when resourcing flood warning duty teams. The resourcing of new Flood Warning duty teams, currently being set-up in Areas should account for the volume of flood warning issued during this event.
- Robust, reliable and easy to operate dissemination systems are required as duty personnel must disseminate information quickly under pressure. The next generation of dissemination systems must keep to this principle, but must also have improved real-time and post event reporting capabilities.
- Floodline must be improved in terms of technical robustness. Standard messages must be more streamlined for recorders and listeners.
- Flexibility is required in setting the severity of flood warnings/sever flood warnings to tune in the public's perception of severity.
- Continued work is required to encourage those at risk from flooding to undertake self-help measures prior to flooding.
- Improved IT systems to assist with event management and reporting is a very high priority – the need for this can not be underestimated.
- Procedures for readying and preparing staff for loud hailing duties need to be examined and more vehicles need to be guaranteed available for this task.
- Consideration should be given to simplify Flood Watch arrangements to ensure greater emphasis on Flood Warnings.

Figure 4.1

Cornwall

Flood Report Statistics for period 28 October to 20 November 2000

Applies to Severe Flood Warnings & Flood Warnings where more than 10 properties affected

No Flood Warnings were issued that meet the above criteria

Figure 4.2 Devon

Flood Report Statistics for period 28 October to 20 November 2000

Applies to Severe Flood Warnings & Flood Warnings where more than 10 properties affected

Reach and Warning Details

Oct-00

Lead Times

Area/Type	River Coast	Reach_From	Reach_To	Flood Warning Trigger	Time Reached	Severe Flood Warning trigger	Time Reached	Customer Charter Lead Time	Achievable Lead time with current limitations	Actual Event Lead Time
Devon Rivers	Axe (Lower)	Axminster	Axmouth	1.70	30/10/00 01:55	No Criteria	30/10/00 07:49	2	-1 to 1.5	-4 est
Devon Rivers	Axe (Mid)	At Axminster	At Axminster			2.70	30/10/00 07:49	2	1.5	0 est
Devon Rivers	Axe (Upper)	Winsham	Axminster	1.70	30/10/00 01:55	No Criteria	30/10/00 07:49	2	-1 to 2.5	-1.5 to 1 est
Devon Rivers	Bathern	Shillingford	Bampton	2.40	not reached	3.50	not reached	2	0.3 to 0.5	0
Devon Rivers	Shuttern Brook	NMR						2	n/a	0
Devon Rivers	Culm (Lower)	Cullompton	Stoke Canon	2.40	30/10/00 05:43	4.00		2	2 to 4	1.5 to - 2.5 est
Devon Rivers	Exe (Upper)	Exford	Exebridge	1.40	29/10/00 17:17	No Criteria		2	1.5 to 5	1.5 to 5 est
Devon Rivers	Lyn (East)	Brendon	Lynmouth	2.00	30/10/00 00:42	2.50	30/10/00 01:50	2	?	n/a
Devon Rivers	Taw (Lower)	Newnham Bridge	Barnstaple	3.50	30/10/00 03:39	No Criteria	30/10/00 ?	2	?	1 to 4
Devon Rivers	Torridge (Lower)	Dolton	Bideford	3.00	29/10/00 23:25	3.60	30/10/00 03:10	2	4 to 6.5	4 to 6.5 est

Nov-00

Area/Type	River Coast	Reach_From	Reach_To	Flood Warning trigger	Time Reached & (issued)	Severe Flood Warning trigger	Time Reached	Customer Charter Lead Time	Achievable Lead time with current limitations	Actual Event Lead Time
Devon Rivers	Axe (Mid)	At Axminster	At Axminster			2.70	05/11/00	2	1.5	1.5 est
Devon Rivers	Bathern	Shillingford	Bampton	2.40	not reached	3.50	not reached	2	0.3 to 0.5	0
	Shuttern Brook	NMR						2	n/a	0 NMR
Devon Rivers	Otter (Lower)	At Ottery St Mary	At Ottery St Mary			2.50	05/11/00 18:49	2		n/a

Notes NMR Non-main river

Figure 4.3

N Wessex

Flood Report Statistics for period 28 October to 20 November 2000

Applies to Severe Flood Warnings & Flood Warnings where more than 10 properties affected

Reach and Warning Details

Oct-00

Lead times

Area/Type	River_Coast	Reach_From	Reach_To	Flood Warning trigger	Time Reached	Severe Flood Warning trigger	Time Reached	Customer Charter Lead Time	Achievable Lead time with current limitations	Actual Event Lead Time
N Wessex Rivers	Bristol Avon (Lower)	Bathford	Bristol	3.00	29/10/00 13:03 30/10/00 09:11 30/10/00 21:14			2	?	0 to 5 est
N Wessex Rivers	Bristol Avon (Mid)	Melksham	Bathford	2.20	30/10/00 08:16	3.30	30/10/00 16:08	2	0 (? -ve)	0 comment
N Wessex Rivers	Bristol Avon (Upper)	Luckington	Melksham	1.20	30/10/00 04:27			2	0 to 2	-2 comment
N Wessex Rivers	Cam	Weston Bampfylde	Bridgehampton	2.30	30/10/00 03:45			2	0 to 1 & 1	0.5 comment
N Wessex Rivers	Chew	Chewstoke	Keynsham	3.00	30/10/00 00:43	4.10	30/10/00 04:43	2	0 (? -ve)	Chew(?)/Pensford(0)
N Wessex Rivers	Tone (Lower)	At Creech St Michael & Ham Villages	At Creech St Michael & Ham Villages		N/I		N/I	2	4	0 not issued
N Wessex Rivers	Bristol Avon (Upper)	At Malmesbury	At Malmesbury	1.50	30/10/00 04:27	1.90	30/10/00 10:08	2	?	0
N Wessex Rivers	Tetbury Avon	NMR							n/a	0 NMR
N Wessex Rivers	Tone	At Taunton	At Taunton	1.90	30/10/00 01:33	2.50	30/10/00 06:41	2	4	4 est
	Tribs	around Taunton						2		0
N Wessex Rivers	Tone (Lower)	Bishops Hull	North Curry	1.72	30/10/00 00:09			2	4	4 est
N Wessex Rivers	Halsewater Stream	Norton Fitzwarren	Bishops Hull	1.20	30/10/00 00:51			2	0 to 2	0 to 2 est
N Wessex Tides	Somerset/Avon Coast	At Porlock	At Porlock				30/10/00 ?	2	6	6
N Wessex Tides	Somerset/Avon Coast	At Portishead	At Portishead				30/10/00 ?	2	6	6
N Wessex Tides	Somerset/Avon Coast	At Clevedon	At Clevedon				30/10/00 ?	2	6	6
N Wessex Tides	Somerset/Avon Coast	At Weston Super Mare	At Weston Super Mare				30/10/00 ?	2	6	6

Reach and Warning Details

Nov-00

Area/Type	River_Coast	Reach_From	Reach_To	Flood Warning trigger	Time Reached	Severe Flood Warning trigger	Time Reached	Customer Charter Lead Time	Achievable Lead time with current limitations	Actual Event Lead Time
N Wessex Rivers	Wriggle	At Chetnole & Yetminster	At Chetnole & Yetminster			2.00	05/11/00 18:26	2	1 to 1.5	1 to 1.5 est
N Wessex Rivers	Brue (Upper)	At Bruton Town	At Bruton Town			Any	05/11/00 ?	2	2.5	n/a

Notes

NMR

Non main river

Figure 4.4

S Wessex

Flood Report Statistics for period 28 October to 20 November 2000

Applies to Severe Flood Warnings & Flood Warnings where more than 10 properties affected

Reach and Warning Details

Oct-00

Area/Type	River_Coast	Reach_From	Reach_To	Flood Warning trigger	Time Reached	Severe Flood warning trigger	Time Reached	Customer Charter Lead Time	Lead Times	
									Achievable Lead time with current limitations	Actual Event Lead Time
S Wessex	Shreen Water	NMR								
S Wessex Rivers	Stour (Lower)	At Christchurch & Bournemouth Caravan Pks	At Christchurch & Bournemouth Caravan Pks		30/10/00 09:15		31/10/00 ?	2	24 to 36	> 2 from site obs
S Wessex Rivers	Stour (Upper)	Colesbrook	Hammoon	1.70	30/10/00 00:50			2	10 to 20	10 to 20 est
S Wessex Rivers	Stour (Upper) /Shreen Water	At Gillingham (Town Centre)	At Gillingham (Town Centre)		30/10/00 00:50	1.90		2	0.5	0 est
S Wessex Tides	Dorset Coast	At West Bay	At West Bay				30/10/00 ?	2	6	6
S Wessex Tides	Dorset Coast	At West Bay	At West Bay				30/10/00 ?	2	6	6

Reach and Warning Details

Nov-00

Area/Type	River_Coast	Reach_From	Reach_To	Flood Warning trigger	Time Reached	Severe Flood warning trigger	Time Reached	Customer Charter Lead Time	Lead times	
									Achievable Lead time with current limitations	Actual Event Lead Time
S Wessex Rivers	Dorset Frome (Upper)	Maiden Newton	Dorchester	1.84	05/11/00 19:39			2	0 to 8	0 to 8
S Wessex Rivers	Dorset Frome (Lower)	At Dorchester	At Dorchester	1.00	05/10/00 11:24	1.25	6/10/00 not reached	2	0	0

Notes

NMR

Non main river

CHAPTER 5 - EVENT IMPACT

5.1 Rainfall

Throughout the Region, October rainfall totals exceeded twice the average. On the 26th October, soil conditions had reached field capacity with flooding likely with appreciable rainfall. An unusually high volume of rain fell across the Region during the period 28th Oct to 5th Nov resulting in the reported widespread flood events on the 30th Oct and 5th Nov. Rainfall totals in Dartmoor, Exmoor and Bodmin Moor were greater than 200mm in places.

Initial return period analysis of the 9 day rainfall volumes has indicated a return period of about 100 years in Bodmin Moor, 60 years in Exmoor, 30 years in Dartmoor and Bristol Area and 20 years along the Somerset-Dorset Border.

The reason for the unusually high rainfall volumes conditions is because of cold air masses in the North Atlantic. This has meant that seasonal Atlantic lows that normally track in over Scotland have generally been further south and has resulted in far higher seasonal rainfall in the south. Unlike their Scottish counterparts the English and Welsh river systems have not been able to cope in the same way.

The tidal conditions at the end of October were characterised by High Spring Tides and strong Southwesterly winds up to Storm Force 10. In the early hours of the 30th Oct, the strong winds culminated in a highly variable surge of up to 1.8-2.3 metres on the North Wessex Coast and up to 0.8m on the South Wessex Coast. The tidal flood risk could have been greater if this surge had coincided with High Tide and if the wind direction had changed.

The period 27-Oct-2000 to 05-Nov-2000 was characterised by bouts of heavy rain particularly on the 29th Oct and 5th Nov. The monthly October rainfall totals for 2000 were comparable to those in Oct 1998.

Table 5.1 Rainfall totals

Area	Oct 2000 Rain (mm)	Oct 1998 Rain (mm)	Oct 2000 Rain (%LTA)	Oct 1998 Rain (%LTA)
Cornwall	119-325	134-293	214	147
Devon	151-522	99-544	206	177
Dartmoor	386-522	342-492	217	198
Exmoor	300-470	345-544	224	259
North Wessex	164	158	216	208
South Wessex	159	140	199	175
Region	221	179	225	179

Flood events occurred on the 30th Oct and 5th Nov. Isohyetal rainfall maps were produced for the following periods:

- i) the two day period of rain prior to the 30th Oct flood event (**figure 5.1**);
- ii) the 19 hour period of sustained heavy rain on the 29th/30th Oct (**figure 5.2**);

- iii) the unusually long 9 day period of rain between 28th Oct and 5th Nov (**figure 5.3**);
- iv) the 9 hour period of sustained heavy rain on the 5th Nov flood event (**figure 5.4**).

It can be seen that the rainfall event was widespread with particularly heavy rain on the 29th/30th Oct and 5th Nov. The return period of the 9 day period of rain has been estimated using the Flood Estimation Handbook and can be summarised as follows:

Table 5.2 Return Periods of 9 day rainfall between 28th Oct and 5th Nov 2000

Area	Sample	Return period range (yr)	Return period median (yr)
Cornwall	7	5-1614 (1)	32
Devon	12	3-57	19-20
North Wessex	9	9-405 (2)	31
South Wessex	7	4-34	10

Notes:

- (1) Yeolmbridge raingauge, Cornwall, had a rainfall amount of 287mm & an associated return period of 1614 years
- (2) Frampton raingauge, N Wessex, had a rainfall amount of 191mm & an associated return period of 405 years.

As the tipping bucket rainfall data has not been quality controlled, it may be suspect and hence misleading for the some sites including the two mentioned above.

The return period of the shorter duration rainfall was generally less than the 9 day period quoted above.

From the 27th Oct-1st Nov, conditions were very windy along the coastline and high ground. ie at least strong force 6 and peaking at storm force 10 on the 29th/30th Oct. A summary of the weather forecasts for 27th, 28th & 29th Oct is presented below:

27-Oct A weakening frontal system will become slow moving across the Region this afternoon, then reactivating overnight and moving north as a developing depression swings north across Ireland. A very unsettled outlook with low pressure near or over the country with a particularly nasty looking low crossing the country on Sunday afternoon (29th Oct).

28-Oct A deepening area of low pressure will move northeastwards to be centred over Scotland later tonight. Its associated frontal system will cross the area during today.

29-Oct A particularly wet and stormy 24 hours as 2 vigorous Atlantic systems cross the region. The first frontal system is expected to run across the region quickly this afternoon, the second affecting the region overnight.

Prior to the flood event on the 30th October, the soil moisture deficits (SMD) across Devon & Cornwall was zero, except for an anomaly in East Devon where the SMD was 29mm. In North & South Wessex the SMD were less than 10mm.

Catchment Wetness Indices (CWI) were calculated for a representative set of rain gauge sites across the Region. In summary, flooding was likely across the Region from the 22/23rd Oct. After the heavy rainfall event on the 29th Oct, the catchments became saturated resulting in flooding being likely with any more rainfall. The catchments varied in their risk to further flooding as follows:

Table 5.3 Table of high risk days based on CWI greater than 145

Area	Site	River	High risk dates
North Wessex, Avon	Chew Magna	Chew	30th Oct-2nd Nov
North Wessex, Avon	Tormaton	By Brook	30th-Oct-2nd Nov
North Wessex, Somerset	Porlock	Tone	29th Oct-3rd Nov
North Wessex, Somerset	North Brewham	Brue	30th-31st Oct; 6th Nov
South Wessex	Evershot	Frome	30th-31st Oct; 6th-7th Nov
South Wessex	Cannings	Avon	30th Oct
Devon	Allisland	Torrige	30th-31st Oct
Devon	Blackpits	Exe	29th Oct-4th Nov; 6th Nov
Cornwall	Bastreet	Tamar	30th-31st Oct; 6th-7th Nov
Cornwall	Cambourne	Hayle	30th Oct

5.2 River flow

See chapter 5.3 for information relating to rivers.

5.2.1 Tides

The peak of the Spring tides was on the 27th October falling to Neaps on the 5th November. Tidal conditions were above Flood Watch criteria for many of the tides between 27th October and 6th November. Strong winds of Force 6-10 meant that wave & surge effects would be significant. The surges were highly variable in magnitude even though the wind direction was generally constant and approximately South West. **Figures 5.5, 5.6 & 5.7** show time series graphs of recorded and predicted tidal level and surge for Hinkley & Avonmouth, North Wessex and Portland, South Wessex. **Figure 5.8** summarises the Tidewatches in North & South Wessex for the period 28th-31st Oct. It is worth noting that the tidal flooding could have been much worse if the maximum surges occurred at high tide.

Maximum recorded surge occurred about 05:00 on the 30th October. Surges peaked at 0.82m on the South coast at Portland, and 2.26m on the North Coast at Avonmouth. No data was readily available for Devon & Cornwall tidal sites.

Strong South West winds caused significant erosion of the east beach at West Bay (south Wessex) leading to a Severe Flood Warning being issued for the tides of the 30th October.

The tide levels did not directly lead to any significant flooding of land or property but did interact with the fluvial flood peaks to exacerbate the water levels on some of the rivers.

5.3 Flooding

The rainfall during mid October and over the 27 & 28th increased the soil moisture content and hence the responsiveness of the catchments. The rainfall of the 5/6th fell on catchments with little storage and antecedent high water levels.

Flood Peaks were higher for the 30th October than the 5/6th November except where stated.

(Devon) Mid and north Devon rivers in particular the river Taw, Torridge and Exe systems produced significant flooding peaks of between 10-100 year return period. South and east Devon rivers reacted less severely resulting in flood peaks of 1-10 year return period.

Flows along the Exe (at Pixton, Stoodleigh and Thorverton) ranked as 2nd and 3rd highest yearly values in data series of up to 44 years. At Trews Weir on the Exe flow reached 500 cumecs at its peak on Monday afternoon, with an estimated return period of 80-100 years. The water level in Exeter was the highest since 1965.

At Umberleigh on the River Taw the highest levels in the 42 year record were measured. Estimated flows here were 600 cumecs when the peak passed, at 1115 am. Analysis suggests this flow may be a 1 in 50-100 year flow, although there is some uncertainty attached to such infrequent events.

In comparison to December 1999 flood event south Devon rivers (Dart, Teign, Avon and Erme) and the river Creedy had greater flood peaks than October 30th and vice versa for the other Devon rivers (Table 5.4).

(Cornwall) The rivers in east Cornwall produced the most significant flows and return periods. The rivers Tavy, Lumburn, Ottery, Fowey and Thrushel had flood peaks on 30th October ranked 1-5 based on peaks over threshold. The return period estimates are in the range 10-25 years except for the Fowey 25-50 years. Table 5.5 details the flood peak analysis.

(South Wessex) There was a general NW-SE reduction in rainfall, with the highest totals being associated with the upper reaches of the Stour and Avon catchments. This resulted in peak flow return period estimates of 30-40 years on the Upper Stour and Upper Avon.

On the Stour system, Colesbrook gauging station on the Shreen Water headwater tributary recorded the highest level and flow in its 26 year period of record. This station drains both clay and chalk lithology and exhibits a relatively flashy response.

Hammooon gauging station is located at the end of the clay dominated upper Stour catchment and the large flow recorded there clearly accords with the flows recorded

upstream at Colesbrook and the other, even more impermeable upstream tributaries such as the Cale and Lodden.

The high flows recorded at Upavon East and West are more surprising, particularly that of Upavon East, which is a relatively permeable catchment (dominated by Chalk and Upper Greensand lithology). Thus, the large rainfall total of the 29th October combined with the high base flows to produce the exceptional peak flows of this event.

The flood peaks the rivers Frome, Wylde Nadder, Wey and the lower sections of the Hampshire Avon were higher on the 6th November were less than on 30th October. The return period estimates were less than 10 years except for the Nadder at 37 years. The level and flow recorded here was the second highest on record. Tables 5.6 and 5.7 summarise the peak flow analysis.

The rivers upper Avon, Wylde, Nadder and Stour flood peaks were greater for October 30th than December 1999 and vice versa for the other rivers.

(North Wessex) The most significant flood occurred on the Horner Water (West Somerset) at West Luccombe where the highest flow was recorded in a 22 year record (Table 5.9). This corresponded to a 75 year return period. The footbridge downstream of the gauging station was washed away by a tree.

Significant flooding occurred on the rivers upper Bristol Avon, Marden and Semington where the highest or second highest level was recorded in the record. On the upper Bristol Avon this resulted in a 30 year and on the Marden and Semington a 50 year return period.

The rivers Doniford, Tone, Cary, Sheppey, Land Yeo, Bristol Frome, Boyd, By, Mells, Midford and Chew recorded the 1-3 highest peak in the record. These corresponded to 10-20 year return period.

All rivers (Table 5.8) except for the Washford Stream, Yeo and Parrett had a larger peak on the 30th October than December 1999. These rivers the peak flow on the 30th October is almost identical to the peak of December 1999

Table 5.4 Devon Area - Summary of Flow Data – October 30th 2000

River	Station	Peak Level (m)	Peak Flow (m ³ /s)	Time of Peak (30 October)	No. Years of data	Rank in annual maxima series	Estimated Return Period (years)
Dart	Austins Bridge	3.226	287.2	0600	42	8	5
Barle	Brushford	2.333	139.2	0745	24	5	10-15
Yeo	Collard Bridge	1.913	50.0	0315	25	2	20
Creedy	Cowley	4.023	158.3	1130	36	4	15-20
Otter	Dotton	2.135	99.8	1100	38	6	5-6
Erme	Ermington	1.520	34.5	0600 29 Oct	26	-	1-2
Okement	Jacobstone	3.130	39.7	0545	17	-	1-2
Avon	Loddiswell	2.333	72.7	0730	20	5	5
Exe	Pixton	2.187	70.2	0730	34	2	25-30
Teign	Preston	2.942	155.2	1045	44	-	2
Exe	Stoodleigh	3.749	190.8	0715	38	3	18-20
Taw	Taw Bridge	3.226	139.2	0600	24	1	~100*
Exe	Thorverton	3.191	306.2	1245	44	3	45-50
Torrige	Torrington	5.713	508.5	1145	38	3	25-30
Exe	Trews Weir	4.616	502.0 approx.	1615 approx.	7	1	80-100 ²
Taw	Umberleigh	5.003	600.0	1115	42	1	50-100
Axe	Whitford	2.252	163.9	0915	35	4	8-10
Mole	Woodleigh	3.149	181.7	0730	35	3	18-20
Culm	Woodmill	3.050	138.9	1100	38	3	15-20

Notes

- 1: includes estimate of overspill at the gauging station
- 2: return period estimated using data from Cowley, Woodmill and Thorverton.
- = return period estimate is greater than twice the period of data record

Table 5.5 Cornwall Area - Summary of Flow Data – October 30th 2000

Station	River	Date	Time	Level [m]	Flow [m ³ /s]	Ranking in records	Return Period (yrs)
BEALS MILL	INNY **	30-Oct	12:15	2.166	50.9	1	10
CRAIGSHILL WOOD	ST. NEOT *	30-Oct	5:15	0.724	5.4	58	5
CROWFORD BRIDGE	TAMAR	30-Oct	3:45		20.3	4	10-25
DE LANK	DE LANK	30-Oct	6:00	1.122	17.6	12	5
DENBY	CAMEL	30-Oct	8:00	2.950	122.4	5	5-10
GUNNISLAKE	TAMAR	30-Oct	14:00	3.983	507.3	5	10-25
GWILLS	GANNEL	30-Oct	8:30	1.032	14.5	24	2
HAYNES BRIDGE	THRUSHEL	30-Oct	7:15	2.232	41.7	2	5-10
HORRABRIDGE	WALKHAM		Data not available				
LIFTON PARK	LYD	30-Oct	8:00	3.954	172.1	2	25
LUDBROOK	TAVY	30-Oct	6:15	2.471	185.3	2	10-25
LUMBURN BRIDGE	LUMBURN	30-Oct	7:00	1.635	15.5	4	10-25
PILLATON MILL	LYNHER	30-Oct	10:15	2.311	71.9	5	10
POLSON BRIDGE	TAMAR *****	30-Oct	11:45	4.890	229.5	3	10-25
PONSANOOTH	KENNAL	30-Oct	5:30	0.428	2.9	203	2
PUSLINCH	YEALM	30-Oct	8:45	1.819	23.0	21	2
RESTORMEL	FOWEY	30-Oct	9:00	2.014	103.4	3	25-50
ST. ERTH	HAYLE ***	30-Oct	12:00	0.698	3.2	433	2
TIDEFORD	TIDDY ****	30-Oct	11:15	0.646	6.1	50	2
TINHAY	THRUSHEL	30-Oct	6:15	2.004	80.7	1	10-25
TREBROWNBRIDGE	SEATON	30-Oct	10:00	0.827	11.3	6	10
TREGONY	FAL *****	30-Oct	10:15	1.638	16.9	21	2
TREKEIVESTEPS	FOWEY	30-Oct	7:15	1.669	28.8	5	10-25
TRENGOFFE	WARLEGGAN	30-Oct	4:30	1.043	16.0	4	10
TRURO	KENWYN	30-Oct	6:15	0.880	5.1	43	2
WERRINGTON PARK	OTTERY	30-Oct	7:00	2.909	118.8	4	25

* Craigshill Wood higher flow recorded 05/11/00, 5.641cumecs, 0.739m

** Beals Mill level based on chart recorder

*** St.Erth higher flow recorded 05/11/00, 4.328cumecs, 0.803m

**** Tideford higher flow recorded 05/11/00 6.653cumecs, 0.681m

***** Tregony higher flow recorded 05/11/00 20.908cumecs, 1.741m

***** Polson Bridge Level based on water mark on hut

Table 5.6 South Wessex Area – Summary of Flow Data – October 30th 2000

River	Station	Peak level (m)	Peak Flow (m ³ s ⁻¹)	Date of Peak	Time of Peak	Period of record (POR)	Rank in POR 1=high est	Estimated Return Period (years) ³
Avon	Upavon East	0.946	6.364	30.10.00	20:00	29	1	34
Avon	Upavon West	0.997	10.584	30.10.00	20:15	30	2	36
Avon	Amesbury	0.832	20.112	31.10.00	22:30	35	4	10
Avon	East Mills (Total)	N/A	37.378	02.11.00	12:15	35	26	1
Bourne	Laverstock	0.421	1.866	30.10.00	11:45	31	22	2
Piddle	Baggs Mill	0.789	6.433	30.10.00	15:00	35	32	1
Frome	Dorchester Total ¹	N/A	13.912	30.10.00	00:15	15	14	1
Frome	Louds Mill	0.498	9.137	30.10.00	00:15	31	17	1
Frome	East Stoke Flume	1.444	15.472	30.10.00	00:00	26	24	1
Frome	East Stoke Weir	0.380	1.972	31.10.00	15:45	31	12	1
Wylfe	Norton Bavant	0.645	6.980	30.10.00	19:15	31	3	17
Wylfe	South Newton	0.551	9.685	31.10.00	19:00	33	24	1
Nadder	Wilton	0.691	21.887	30.10.00	08:15	34	10	5
Shreen Water	Colesbrook	1.833	22.870	30.10.00	01:45	27	1	32
Stour	Hammoon	3.314	186.775	30.10.00	15:45	32	2	38
Stour	Throop	1.720	171.227	31.10.00	17:00	27	3	10
Allen	Loverley Mill ²	0.427	1.333	30.10.00	10:00	19	19	1
Allen	Walford Mill	0.477	4.801	30.10.00	10:00	26	22	1
Wey	Broadwey	0.380	1.307	29.10.00	06:00	23	17	2

Notes:

- 1 - Flows for Louds Mill and Stinsford combined.
- 2 - Annual maxima series at this site missing large periods and the rating history is suspect.
- 3 - Return period calculated using the FEH Generalised Logistic L-Moments statistical method within Winfap-FEH. FEH data sets updated to full POR and amended where necessary to match EA data.
- 4 - A combined data set for east Stoke does not currently exist. Total flow at this site is not a simple addition of the two data sets as the timing of the individual annual maxima events differ between the flume and weir.

Table 5.7 South Wessex Area – Summary of Flow Data – November 5 & 6th 2000

River	Station	Peak level (m)	Peak Flow (m ³ s ⁻¹)	Date of Peak	Time of Peak	Period of record (POR)	Rank in POR 1=highest	Estimated Return Period (years) ³
Avon	Upavon East	0.821	5.089	06.11.00	11:15	29	6	8
Avon	Upavon West	0.890	8.821	06.11.00	12:30	30	3	12
Avon	Amesbury	0.811	18.936	07.11.00	15:45	35	5	8
Avon	East Mills (Total)	N/A	49.814	08.11.00	02:15	35	14	3
Bourne	Laverstock	0.441	2.013	06.11.00	22:15	31	19	2
Piddle	Baggs Mill	0.849	7.220	06.11.00	04:45	35	29	1
Frome	Dorchester Total ¹	N/A	17.692	06.11.00	08:00	15	5	4
Frome	Louds Mill	0.538	10.278	06.11.00	09:30	31	16	2
Frome	East Stoke Flume	1.665	21.315	06.11.00	06:15	26	5	6
Frome	East Stoke Weir	0.603	4.242	06.11.00	09:15	26	8	3
Wylde	Norton Bavant	0.538	5.219	05.11.00	01:30	31	14	3
Wylde	South Newton	0.567	10.198	06.11.00	01:00	33	24	1
Nadder	Wilton	0.954	34.879	06.11.00	15:45	34	2	37
Shreen Water	Colesbrook	1.552	17.039	05.11.00	22:30	27	8	4
Stour	Hammoon	3.138	156.082	05.11.00	05:15	32	4	8
Stour	Throop	1.598	152.300	07.11.00	12:30	27	4	6
Allen	Loverley Mill ²	0.648	5.872	06.11.00	10:45	19	5	6
Allen	Walford Mill	0.590	6.763	05.11.00	02:00	26	16	2
Wey	Broadwey	0.495	2.315	05.11.00	19:15	23	7	4

Notes:

- 1 - Flows for Louds Mill and Stinsford combined.
- 2 - Annual maxima series at this site missing large periods and the rating history is suspect.
- 3 - Return period calculated using the FEH Generalised Logistic L-Moments statistical method within Winfap-FEH. FEH data sets updated to full POR and amended where necessary to match EA data.
- 4 - A combined data set for east Stoke does not currently exist. Total flow at this site is not a simple addition of the two data sets as the timing of the individual annual maxima events differ between the flume and weir.

Table 5.8 North Wessex Area – Summary of Flow Data – October 30th 2000

Station	River	Date	Time	Stage (m)	flow (m ³ /s)	rank	Return period (yrs)
West Luccombe	Horner Water	30-Oct	05:00	1.03	15.1	1/22	75
Beggearn Huish	Washford Stream	30-Oct	13:45	0.93	10.3	2/29	7
Swill Bridge	Doniford Stream	30-Oct	06:45	1.74	34.6	3/34	10
Ashford Mill	Isle	30-Oct	05:30	2.16	29.1	1/39	?
Pen Mill	Yeo	30-Oct		4.10	60.3	7/39	4
Chiselborough	Parrett	30-Oct	08:30	2.50	36.5	3/26	5
Greenham	Tone	30-Oct	06:30	1.95	15.0	6/27	5
Bishops Hull	Tone	30-Oct	09:15	2.59	71.8	2/40	15
Halsewater	Halsewater	30-Oct	09:45	2.49	12.5	12/39	4
Somerton	Cary	31-Oct	20:15	1.56	12.5	3/36	10
Lovington	Brue	30-Oct	11:30	3.54	66.4	7/37	5
Fenny Castle	Sheppey	30-Oct	10-12	1.15	8.8	3/36	10
Iwood	Congresbury Yeo	30-Oct	09:30	1.32	11.3	7/26	5
Wraxall	Land Yeo	30-Oct	07:45	1.54	6.7	2/24	15
Great Somerford	Bristol Avon	30-Oct	13:30	2.10	84.5	2/37	30
Bathford	Avon	31-Oct	00:00	4.42 ^{*2}	244.4	3/32	15
Frampton Cotterell	Bristol Frome	30-Oct	19:30	1.20	22.3	2/23	15
Frenchay	Bristol Frome	30-Oct	?	3.20 ^{*1}	57	?/40	20
Bitton	Boyd	30-Oct	06:30	1.46	25.4	3/28	20
Middlehill	By Brook	30-Oct		2.17	13.2	1/19	10
Fosseway	Sherston Avon	30-Oct	09:30	1.08	13.6	1/25	30
Stanley	Marden	30-Oct	10:45	3.28	43.3	1/32	50
Semington	Semington Brook	30-Oct	16:45	2.67	41.7	2/25	50
Trowbridge	Biss	30-Oct	11:45	2.10	15.7	4/17	5
Tellisford	Somerset Frome	30-Oct	09:45	3.75	82.6	6/40	8
Vallis	Mells River	30-Oct	08:45	1.79	33.5	1/21	10
Wellow	Wellow Brook	30-Oct	07:15	2.34	22.3	6/35	10
Midford	Midford Brook	30-Oct	09:45	3.54	53.1	2/40	20
Compton Dando	Chew	30-Oct	07:30	4.28	75.9	2/43	15

Key:

- *1 Estimated from rack mark
- *2 Level estimated from chart record

Table 5.9 Summary of river levels (does not compare 1999 water year)

River Gauging station	River	Maximum level recorded during incident	Time elapsed since river last exceeded this level	Water year when river level last exceed this level
Austins Bridge	Dart	3.226	8	1992
Collard Bridge	Yeo	1.913	0	NA
Cowley	Creedy	4.023	21	1979
Dotton	Otter	2.135	4	1996
Ermington	Erme	1.520	2	1998
Jacobstowe	Okement	3.130	2	1998
Loddiswell	Avon	2.333	2	1998
Pixton	Exe	2.187	18	1982
Preston	Teign	2.942	14	1986
Stoodleigh	Exe	3.749	20	1980
Taw Bridge	Taw	3.226	0	NA
Thorverton	Exe	3.191	35	1965
Torrington	Torridge	5.713	20	1980
Trews Weir	Exe	4.616	0	NA
Umberleigh	Taw	5.003	0	NA
Whitford	Axe	2.252	21	1979
Woodleigh	Mole	3.149	2	1998
Woodmill	Culm	3.050	21	1979
Beals Mill	Inny	2.166	0	NA
Craigshill wood	St Neot	0.724	19	1981
Crowford bridge	Tamar		9	1991
De lank	De lank	1.122	8	1992
Denby	Camel	2.950	8	1992
Gunnislake	Tamar	3.983	21	1979
Gwills	Gannel	1.032	2	1998
Haynes bridge	Thrushel	2.232	8	1992
Lifton park	Lyd	3.954	0	NA
Ludbrook	Tavy	2.471	8	1992
Lumburn bridge	Lumburn	1.635	2	1998
Pillaton mill	Lynher	2.311	8	1992
Polson bridge	Tamar	4.890	0	NA
Ponsanooth	Kennal	0.428	2	1998
Puslinch	Yealm	1.819	2	1998
Restormel	Fowey	2.014	2	1998
St erth	Hayle	0.698	2	1998
Tideford	Tiddy	0.646	2	1998
Tinhay	Thrushel	2.004	21	1979
Trebrownbridge	Seaton	0.827	2	1998
Tregony	Fal	1.638	3	1997
Trekeivesteps	Fowey	1.669	19	1981
Trengoffe	Warleggan	1.043	19	1981
Truro	Kenwyn	0.880	2	1998
Upavon East	Avon	0.946	0	NA
Upavon West	Avon	0.997	11	1989
Amesbury	Avon	0.832	6	1994
East Mills (Total)	Avon	na	24	1976
Laverstock	Bourne	0.441	2	1998
Baggs Mill	Piddle	0.849	2	1998

Louds Mill	Frome	0.538	2	1998
East Stoke Flume	Frome	1.665	2	1998
East Stoke Weir	Frome	0.603	2	1998
Norton Bavant	Wylde	0.538	2	1998
South Newton	Wylde	0.567	2	1998
Wilton	Nadder	0.954	21	1979
Colesbrook	Shreen Water	1.833	0	NA
Hammoon	Stour	3.314	21	1979
Throop	Stour	1.720	21	1979
Loverley Mill ²	Allen	0.648	2	1998
Walford Mill	Allen	0.590	2	1998
Broadwey	Wey	0.380	2	1998
West Luccombe	Horner Water	1.03	0	NA
Ashford Mill	Isle	2.16	0	NA
Pen Mill	Yeo	4.10	6	1994
Greenham	Tone	1.95	3	1997
Halsewater	Halsewater	2.49	21	1979
Lovington	Brue	3.54	6	1994
Iwood	Congresbury Yeo	1.32	2	1998
Great Somerford	Bristol Avon	2.10	33	1967
Bathford	Avon	4.42 ²	15	1985
Frenchay	Bristol Frome	3.20 ¹	33	1967
Bitton	Boyd	1.46	15	1985
Middlehill	By Brook	2.17	0	NA
Fosseway	Sherston Avon	1.08	0	NA
Stanley	Marden	3.28	0	NA
Semington	Semington Brook	2.67	21	1979
Trowbridge	Biss	2.10	6	1994
Tellisford	Somerset Frome	3.75	7	1993
Vallis	Mells River	1.79	0	NA
Midford	Midford Brook	3.54	33	1967
Compton Dando	Chew	4.28	33	1967

5.4 Source of Flooding

Table 5.10 Estimated sources of flooding

Area	Main river	Non main river	Ground water	Surface water
South Wessex	72	18	0	0
North Wessex	241	29	1	6
Devon	124	19	0	0
Cornwall	26	14	1	2
Total	463	80	2	8

Total number of properties flooded by combination of the above is estimated at 553

5.5 No. Properties Not Flooded Due To Agency Defences (Estimated)**Table 5.11**

Area	Properties
Cornwall	Not available
Devon	Not available
North Wessex	Not available
South Wessex	1800
South West	

5.6 No. Properties Not Flooded Due To Third Party Defences

Information not available.

5.7 No. Properties Flooded Due To Failure (Not Exceedence) Of Agency Defences (Estimated)**Table 5.12**

Area	Properties
Cornwall	11
Devon	3
North Wessex	2
South Wessex	0
South West	16

5.8 No. Properties Flooded Due To Failure (Not Exceedence) Of Third Party Defences (Estimated)**Table 5.13**

Area	Properties
Cornwall	0
Devon	7
North Wessex	0
South Wessex	0
South West	7

5.9 No. Properties Flooded Due To Exceedence of Agency Defence Standards (Estimated)**Table 5.14**

Area	Properties
Cornwall	0
Devon	39
North Wessex	186
South Wessex	0
South West	225

5.10 List of Towns Affected Without Adequate Defences, Viability (cost benefit) of Scheme.

Viability of scheme will be investigated through Pre Feasibility Study. Scheme with benefit:cost <1 will not be progressed by the Agency.

Table 5.15 Cornwall

Town	Scheme in place?	Pre Feas Study undertaken?	Notes
Bude	Yes		
Wadebridge	Yes		
Lifton			
Ladock		In progress	Likely to be viable
Gunnislake		In progress	Not likely to be viable
Polson		In progress	
North Petherwin			
Callington			
Pillaton Mill			
Coombe Cottage			
Luxulyan			
Stratton	Yes		
Yeolmbridge			

Table 5.16 Devon

Town	Scheme in place	Pre Feas Study undertaken	Notes
Exebridge		Yes	Scheme not viable
Bolham			
Bickleigh		Yes	Scheme on capital programme
Exeter	Yes		
Stoke Canon	Yes		
Bampton		Yes	Scheme on capital programme
Bishops Tawton		Yes	Scheme on capital programme
North Tawton		Yes	Scheme on capital programme
Umberleigh		Yes	Scheme on accelerated capital programme
Bridge reeve			
Alswear			
Braunton		Yes	Scheme on capital programme
Bradiford		Yes	Scheme on capital programme
Brayford			
Fremington			
Weare Giffard	Yes		
Taddipport		Yes	Scheme on capital programme
Brendon		Yes	Scheme not viable
Teigngrace			
Newton Abbot			
Bovey Tracey	Yes		
Weycroft			
Tipton St John	Yes		
Axminster	Yes	Yes	Recent Pre Feas found new scheme not viable
Chard Junction			
Ottery St Mary	Yes	Yes	Recent Pre Feas found new viable scheme
Cowley		2001/2002	Pre Feas study programmed
Yeoford	Yes	2001/2002	Pre Feas study programmed

Table 5.17 North Wessex

Town	Scheme in place	Pre Feas Study undertaken	Notes
Malmesbury		2001/2002	Pre Feas study programmed
Chippenham			
Bradford Upon Avon		2001/2002	Re-assess proposed scheme
Bath	Yes		
Swineford		In progress	
Keynsham		2001/2002	Pre Feas study programmed
Wellow			
Waterhouse			
Monkton Combe			
Chew Magna		2001/2002	Pre Feas study programmed
Pensford			
Chipping Sodbury		2001/2002	Pre Feas study programmed
Frampton Cotterell		2001/2002	Pre Feas study programmed
Winterbourne Down			
Itchington			
Weston Bampfylde			
Queen Camel			
West Camel			
Urgashay			
Bridgehampton			
Yeovilton	Yes		
Mudford			
Hambridge			
Bradford-upon-Tone	Yes		
Taunton	Yes		
Ruishton	Yes	Yes	Scheme on capital programme
Creech St Michael	Yes	Yes	Scheme on capital programme
Ham Village	Yes	Yes	Scheme on capital programme
Currymoor/north moor	Yes (pumping stations)		
Williton	Yes	Yes	Scheme on capital programme
Allerford	Yes		
Bossington	Yes		
Norton Fitzwarren		2001/2002	Pre Feas study programmed
Bathampton		2001/2002	Pre Feas study programmed

Brislington		2001/2002	Pre Feas study programmed
Calne	Yes		
Frome	Yes		
Hanham		2001/2002	Pre Feas study programmed
Nunney		2001/2002	Pre Feas study programmed
Midsomer Norton		2001/2002	Pre Feas study programmed
Saltford		2001/2002	Pre Feas study programmed
Swineford		2001/2002	Pre Feas study programmed
Wallbridge		2001/2002	Pre Feas study programmed
Ashford Mills		2001/2002	Pre Feas study programmed
Bradford Abbas		2001/2002	Pre Feas study programmed
Bruton	Yes		
Cam		2001/2002	Pre Feas study programmed
Cannington		2001/2002	Pre Feas study programmed
Congresbury		2001/2002	Pre Feas study programmed
Coxley	Yes		
East Lydford	Yes	2001/2002	Pre Feas study programmed
Mudford	Yes	2001/2002	Pre Feas study programmed
Nether Stowey		2001/2002	Pre Feas study programmed
Norton Fitzwarren		2001/2002	Pre Feas study programmed
Nynehead		2001/2002	Pre Feas study programmed
Sherborne	Yes	2001/2002	Pre Feas study programmed
Stoford	Yes	2001/2002	Pre Feas study programmed
Thorney	Yes	2001/2002	Pre Feas study programmed
Timberscombe		2001/2002	Pre Feas study programmed
Wooton Courtenay		2001/2002	Pre Feas study programmed
Yetminster	Yes	2001/2002	Pre Feas study programmed

Table 5.18 South Wessex

Town	Scheme in place	Pre Feas Study undertaken	Notes
Baford			
Bourton			
Charlton Musgrove			
Colesbrook			
Gillingham	Yes		
Hamoon		Yes	Scheme not viable
Hinton St Mary			
Iford	Yes	2001/2002	Protection for static caravans being considered
Mere			
Neatheravon			
Parley			
Sturminster Newton			
Tisbury			
Wimbourne			
Melcombe Bingham			
Stourpaine			
Maiden Newton		Yes	Scheme not viable
Dorchester	Yes	2001/2002	Pre Feas study programmed
Casterbridge			
Corfe Mullen			
Spetisbury			
Tarrant			
Wetmouth			
Sturminster Newton			
Wincanton		Yes	Scheme not viable
Marnhull			
Motcombe			
Blandford St Mary	Yes		Needs permanent pump for impounded surface water
Salisbury		Yes	Scheme on programme, inc town centre, Fisherton Island, Harnham, Wilton
Shapwick	Yes	2001/2002	Pre Feas study programmed

5.11 Major Infrastructure Affected (roads, rail and where used as a secondary defence).

(South Wessex) Disruption to all roads, both major and minor. As the event progressed flooding incidents increased and affected many roads to a significant depth making them impassable. By December all major routes east/west through the area were affected, particularly those crossing the River Avon from Salisbury to Christchurch. Trains to the west country were suspended to the west as a result of flooding in the Taunton area.

High winds brought down power lines, drainage systems were tested to the limit and there were numerous reports made of sewers backing up in properties and roads.

These problems have highlighted the need to be aware of infrastructure problems and try to improve access to highway information, particularly unpredictable road closures due to fallen trees etc. This will aid effective staff deployment for emergency response and flood monitoring/recording.

(North Wessex) Many roads across the area were affected from both surface water and from river water. Parts of the M5 were flooded causing some lane closures. The A361 between Burrowbridge and East Lyng was flooded for approximately one month. The centre of Bradford upon Avon was also severely affected by floodwater for a number of days. The centre of Taunton was closed to traffic due to the risk of flooding although the road did not eventually flood. There was also severe disruption to the rail network.

(Devon) The Westcountry was cut off from the national rail network as flooding at Cowley Bridge, Exeter severely affected the main line. There were temporary problems with regional lines, but these were soon restored to service. The problems at Cowley Bridge were repaired after the initial floods subsided, but the following event on the 5/6 November subsequently damaged all repair work leaving the line inoperable.

There was also severe flooding to a number of roads across the area, especially the A35 trunk.

There are reports of 20 000 homes being without electricity and severe loss of water supply to Exeter as a result of a burst main.

(Cornwall) Only reports of flooding to roads

5.12 Incidence of Repeat Flooding.

The only reported instances of repeat flooding were as follows:

- Dorchester – Property flooded 3 times in one week;
- Taunton – Property also flooded 18 months ago;
- Taunton – Property flooded fourth time in four years;
- Norton Fitzwarren – flooded twice in 2 years;
- North Tawton – Properties flooded for fourth time in four months;

Luxuylan – Property flooded twice in one week;

Ladock – Property flooded for five times in one week.

Bampton - Flooded in both October 30th and November 6th events.

Tipton St John – Flooded in both October 30th and November 6th events.

5.13 Issues Arising

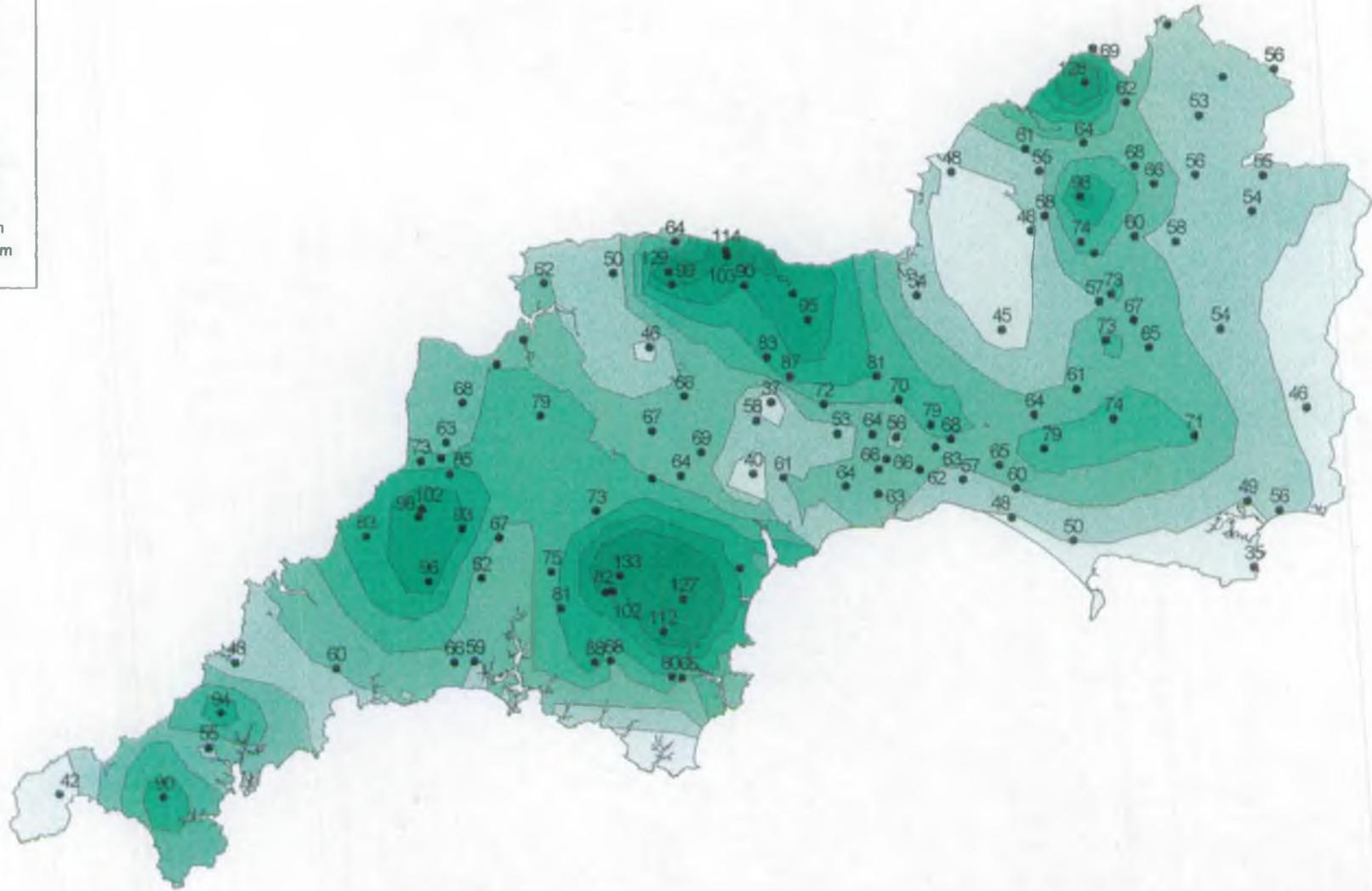
- (Devon) The incident was well managed with Agency defences working as designed. Some of the older schemes require re-appraising for the standard of protection they afford.
- (North Wessex) Considerable discussion has taken place on the strategic development of Flood Data Collection. The on-going event on the Somerset Levels and Moors has shown the importance of detailed data on property and road flooding thresholds. These have allowed more effective emergency planning and operational responses. Investigations will take place of the cost of providing similar high quality data in other flood risk areas.
- (South Wessex) Certain assets did not perform to their expected standards and there needs to be a means of investigating such weaknesses in future, beyond the visual inspection regime currently employed.
- (South Wessex) Groundwater issues have highlighted the need to establish a real time link between the South Wessex AIR and relevant LA's in order to effectively record events/issues not directly linked to Main Rivers.

5.14 Recommendations

- Re-appraise assets that performed poorly.
- Investigate methods of reporting and gathering data on groundwater flooding.

LEGEND :

- Point data
- Rainfall isohyets
 - 0 - 50 mm
 - 51 - 60 mm
 - 61 - 70 mm
 - 71 - 80 mm
 - 81 - 90 mm
 - 91 - 100 mm
 - 101 - 135 mm



20000 0 20000 40000 Metres

FLOOD FORECASTING AND HYDROLOGICAL RESPONSE

RAINFALL : PERIOD 1 [01:45 28/10/00 to 06:45 30/10/00 (2 days, 6 hours)]



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Note : Tipping Bucket rainfall data has not been quality controlled yet, ie raw data.

FIGURE 5.1

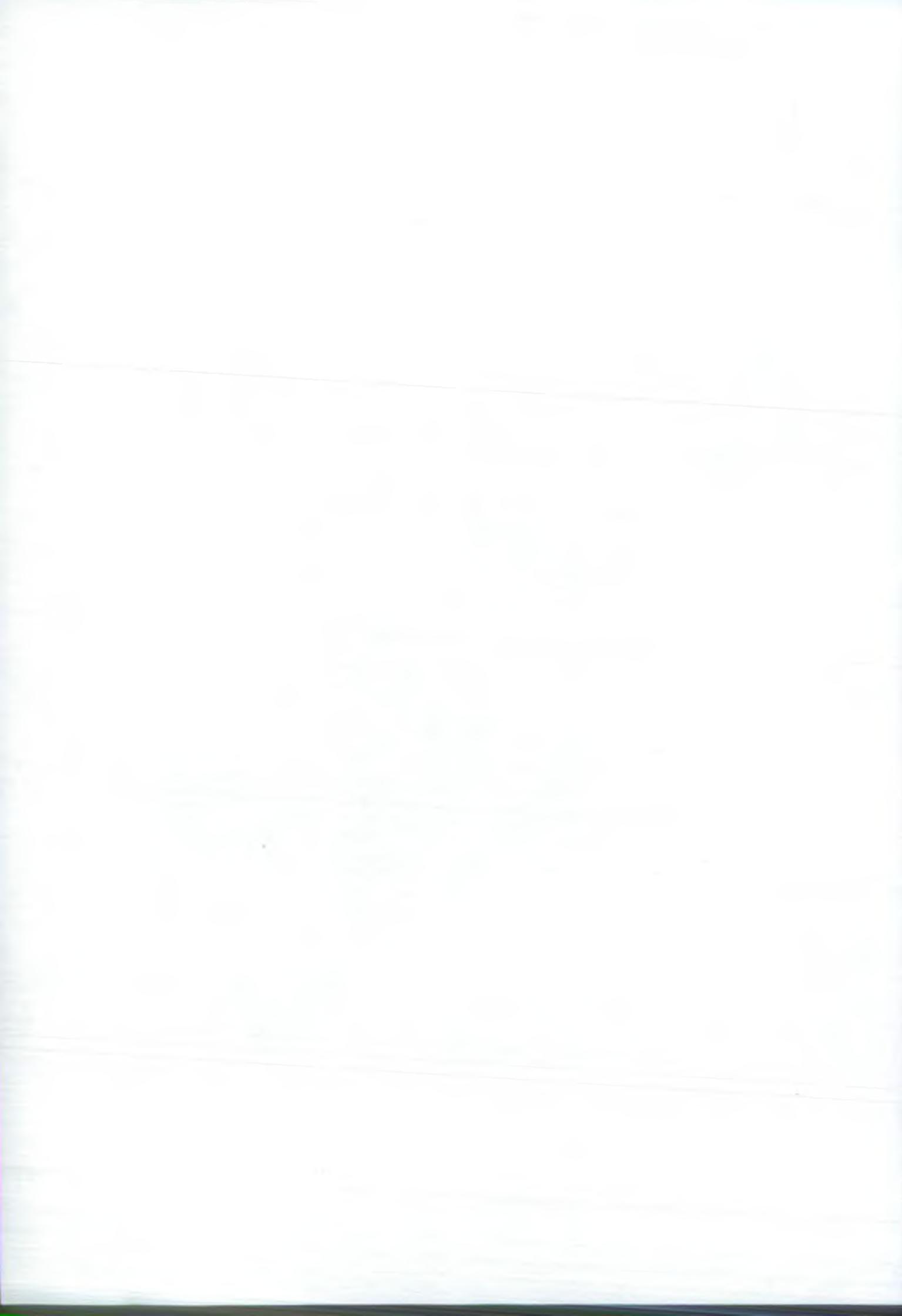
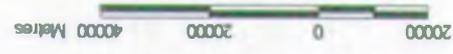
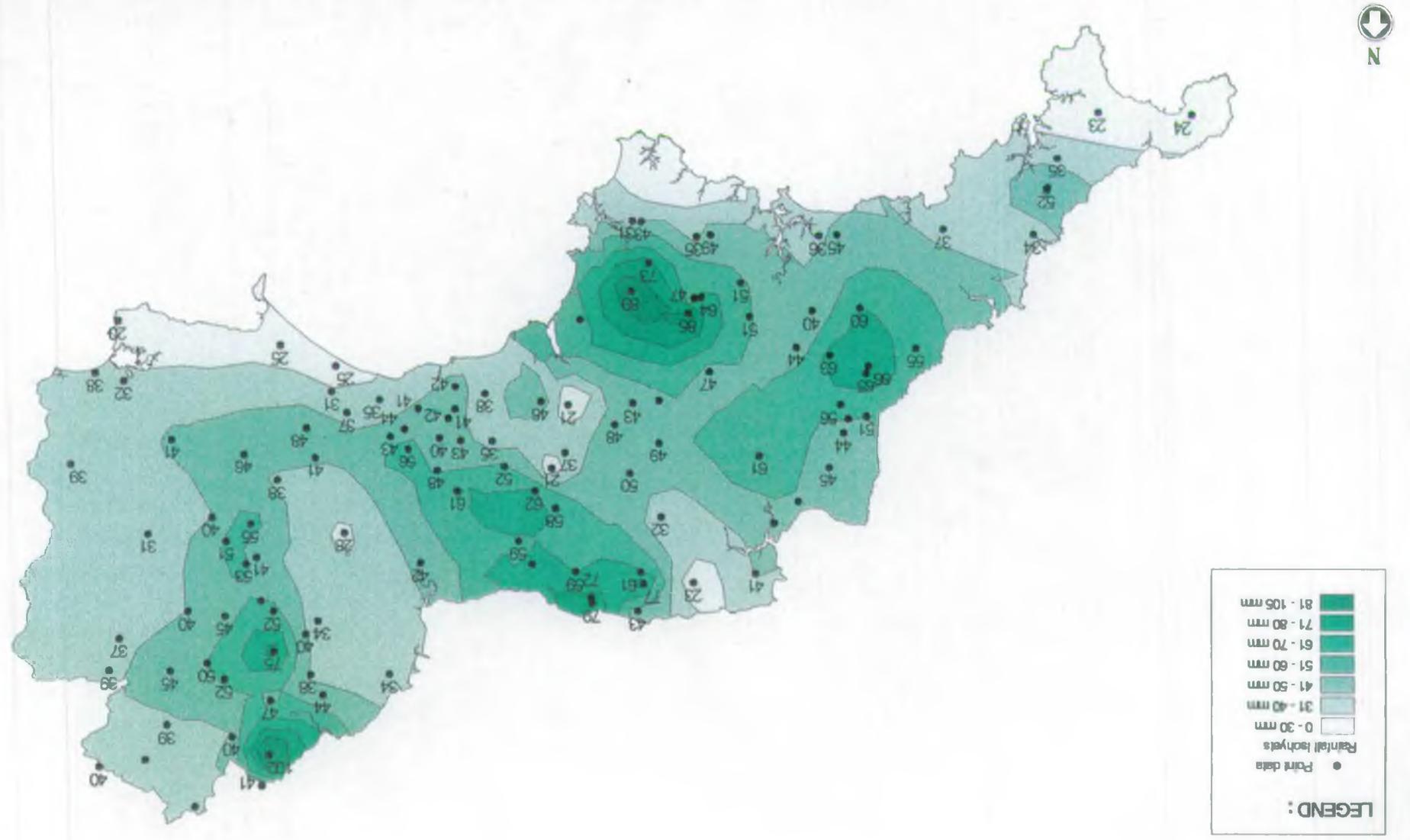


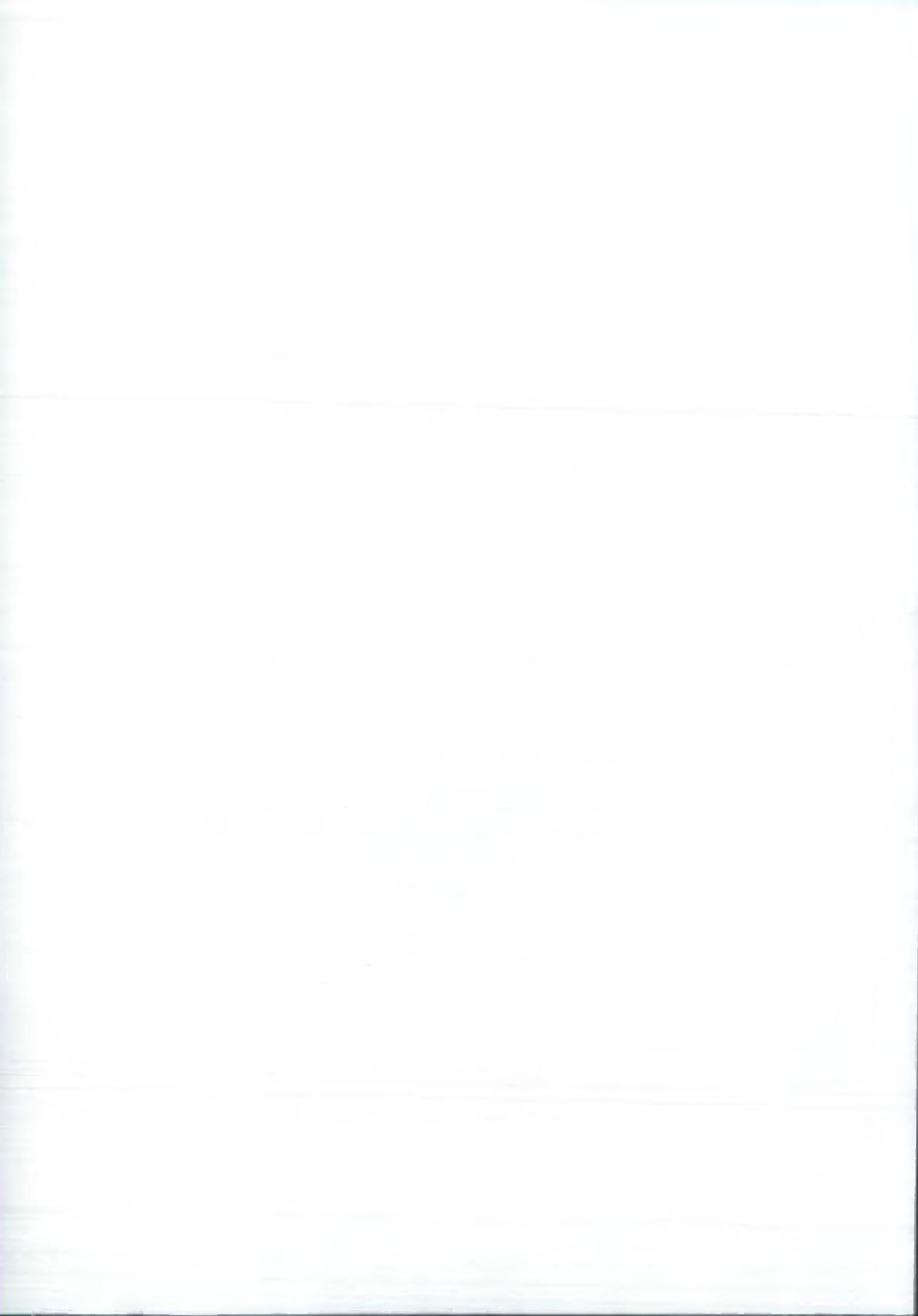
FIGURE 5.2



FLOOD FORECASTING AND HYDROLOGICAL RESPONSE
RAINFALL : PERIOD 2 [12:45 29/10/00 to 06:45 30/10/00 (19 hours)]

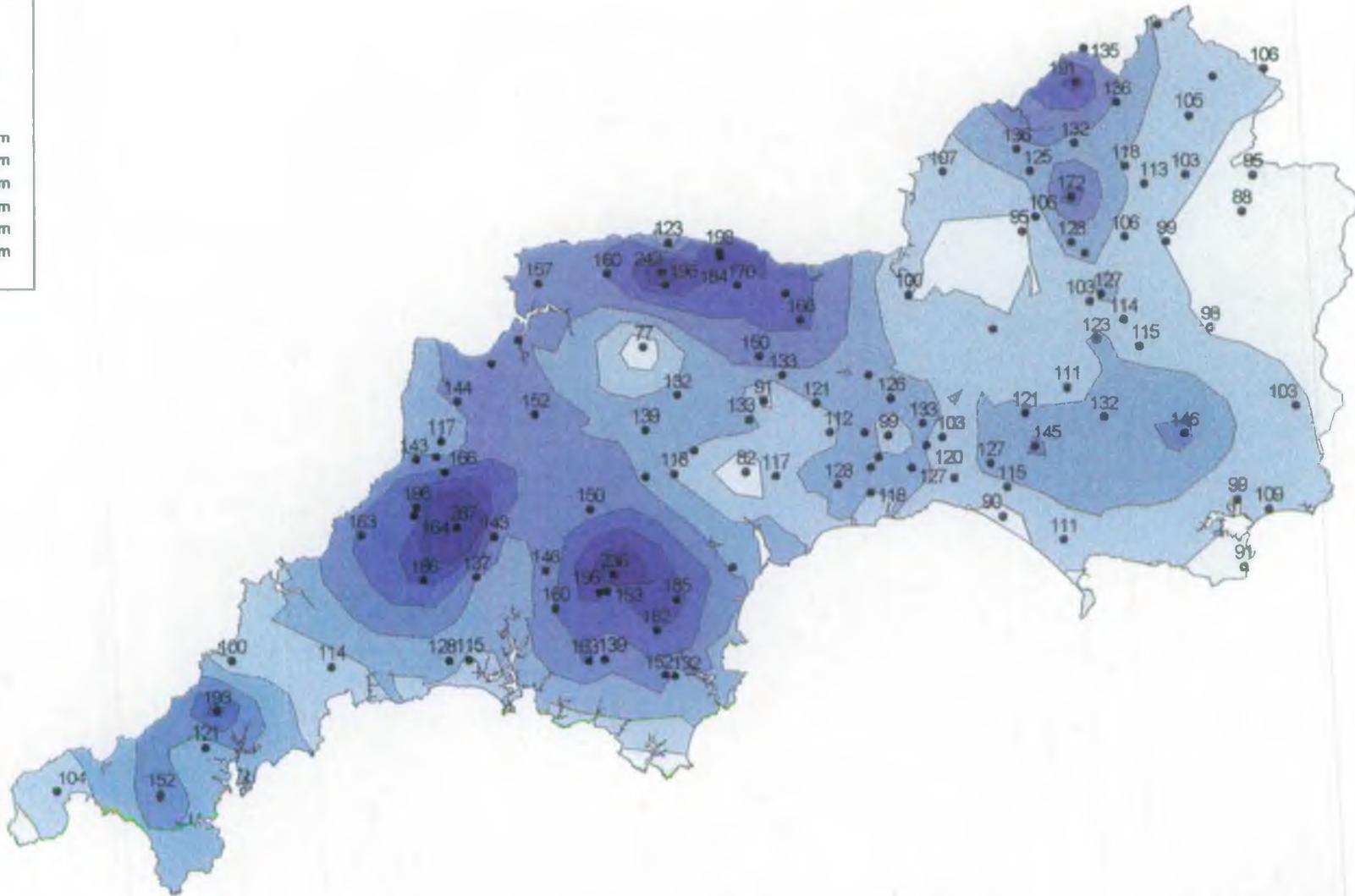
Note : Tipping Bucket rainfall data has not been quality controlled yet, ie raw data.





LEGEND :

- Point data
- Rainfall isohyets
 - 0 - 100 mm
 - 101 - 120 mm
 - 121 - 140 mm
 - 141 - 160 mm
 - 161 - 180 mm
 - 181 - 200 mm
 - 201 - 290 mm



20000 0 20000 40000 Metres

FLOOD FORECASTING AND HYDROLOGICAL RESPONSE

RAINFALL : PERIOD 3 [00:45 28/10/00 to 19:45 05/11/00 (8 days, 20 hours)]



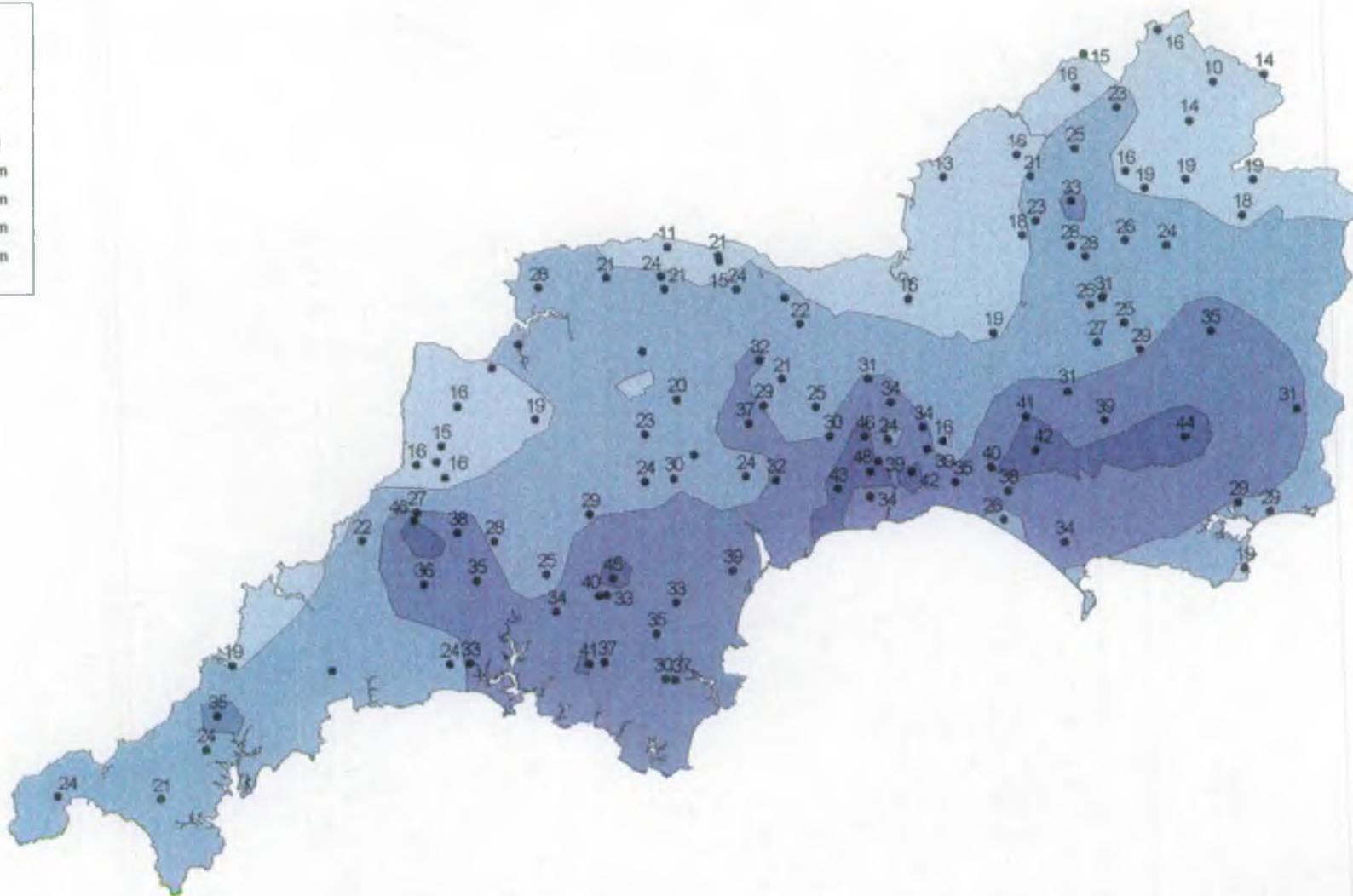
Note: Tipping Bucket rainfall data has not been quality controlled yet, ie raw data.

FIGURE 5.3



LEGEND :

- Point data
- Rainfall Isohyets
 - 0 - 10 mm
 - 11 - 20 mm
 - 21 - 30 mm
 - 31 - 40 mm
 - 41 - 50 mm



20000 0 20000 40000 Metres

FLOOD FORECASTING AND HYDROLOGICAL RESPONSE

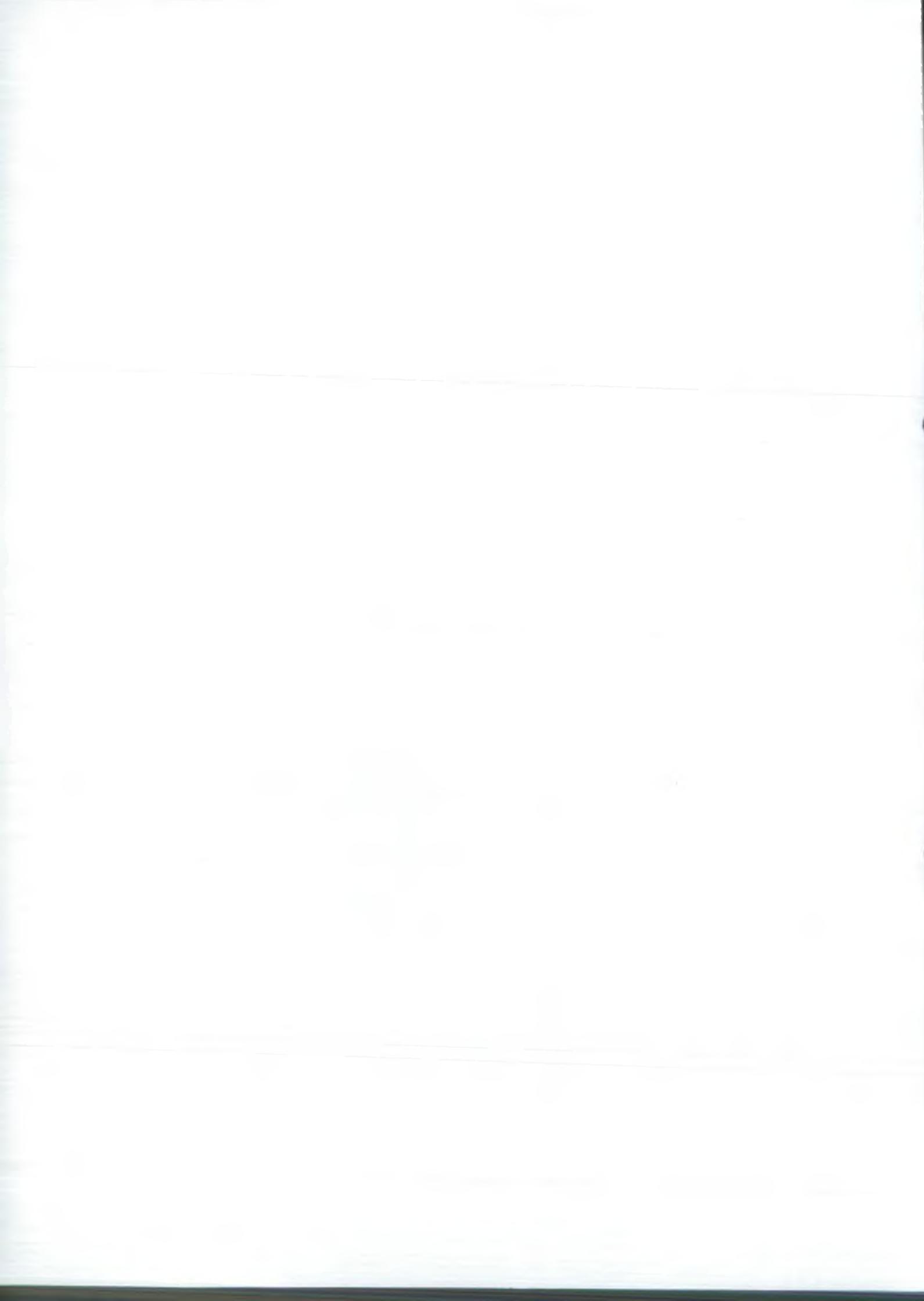
**RAINFALL : PERIOD 4 [10:00 05/11/00 to 18:00 05/11/00 (9 hours, Cornwall Area)]
[12:00 05/11/00 to 20:00 05/11/00 (9 hours, Rest of South West)]**

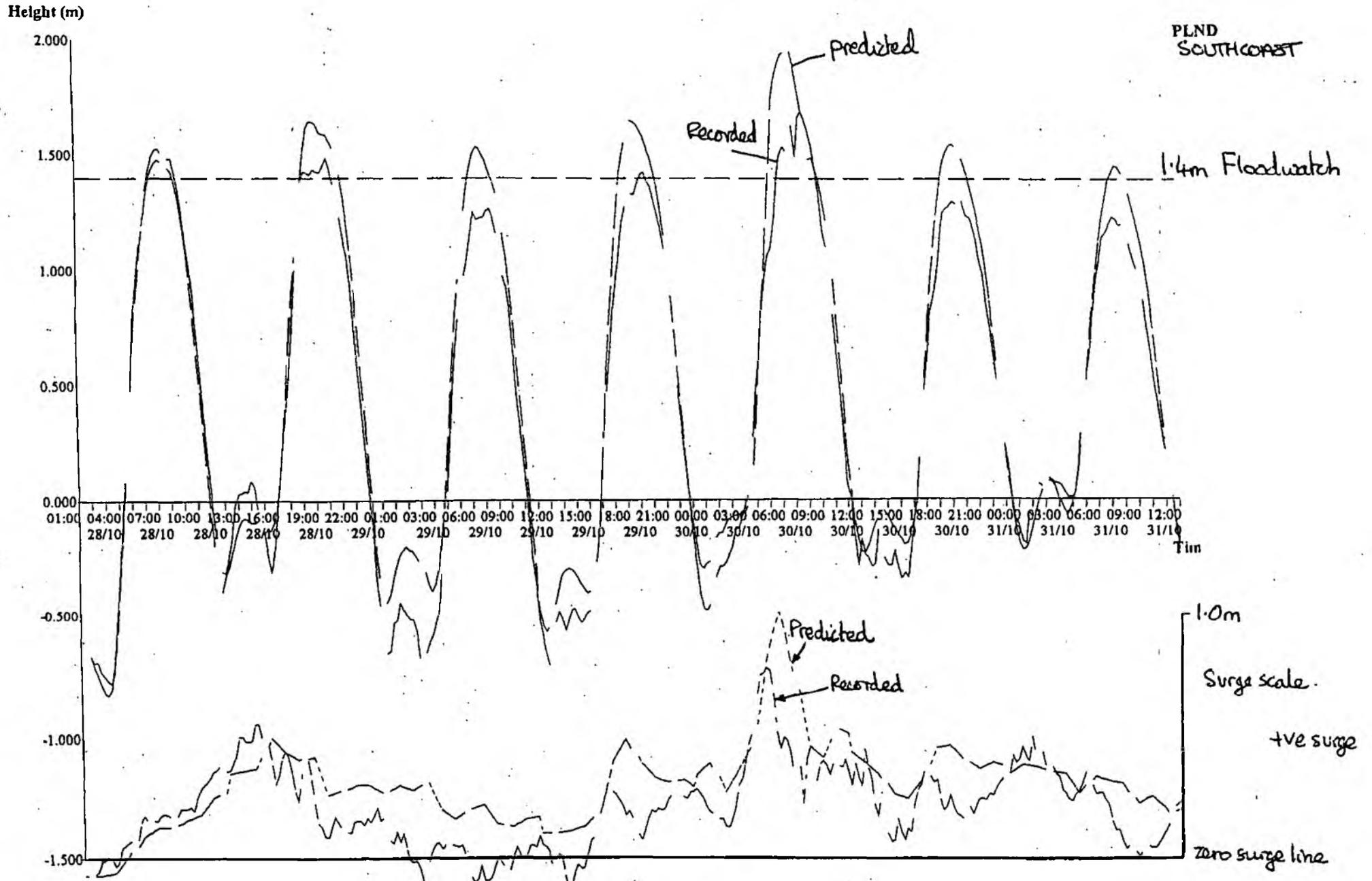


**ENVIRONMENT
AGENCY**

Note: Tipping Bucket rainfall data has not been quality controlled yet, ie raw data.

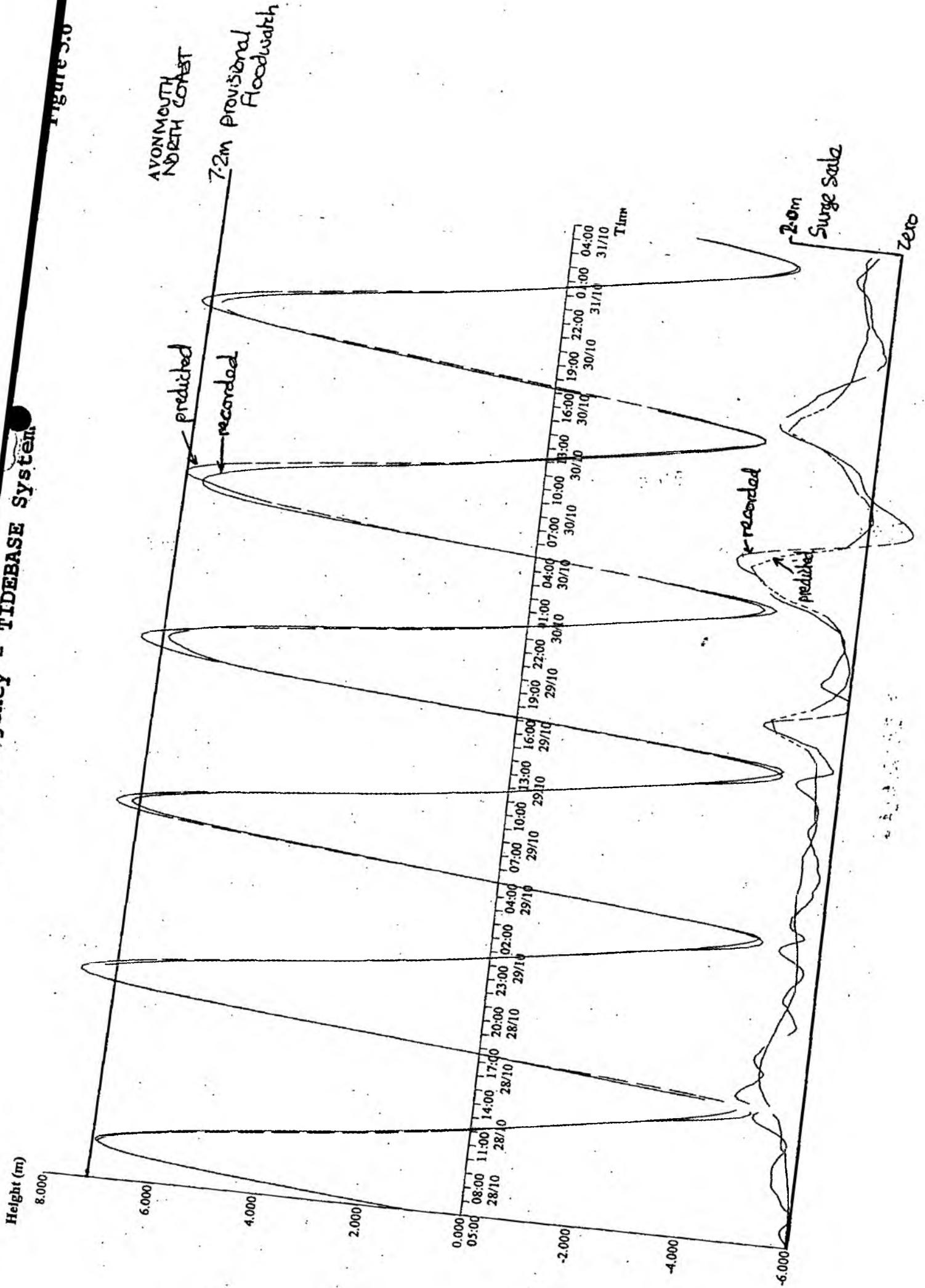
FIGURE 5.4





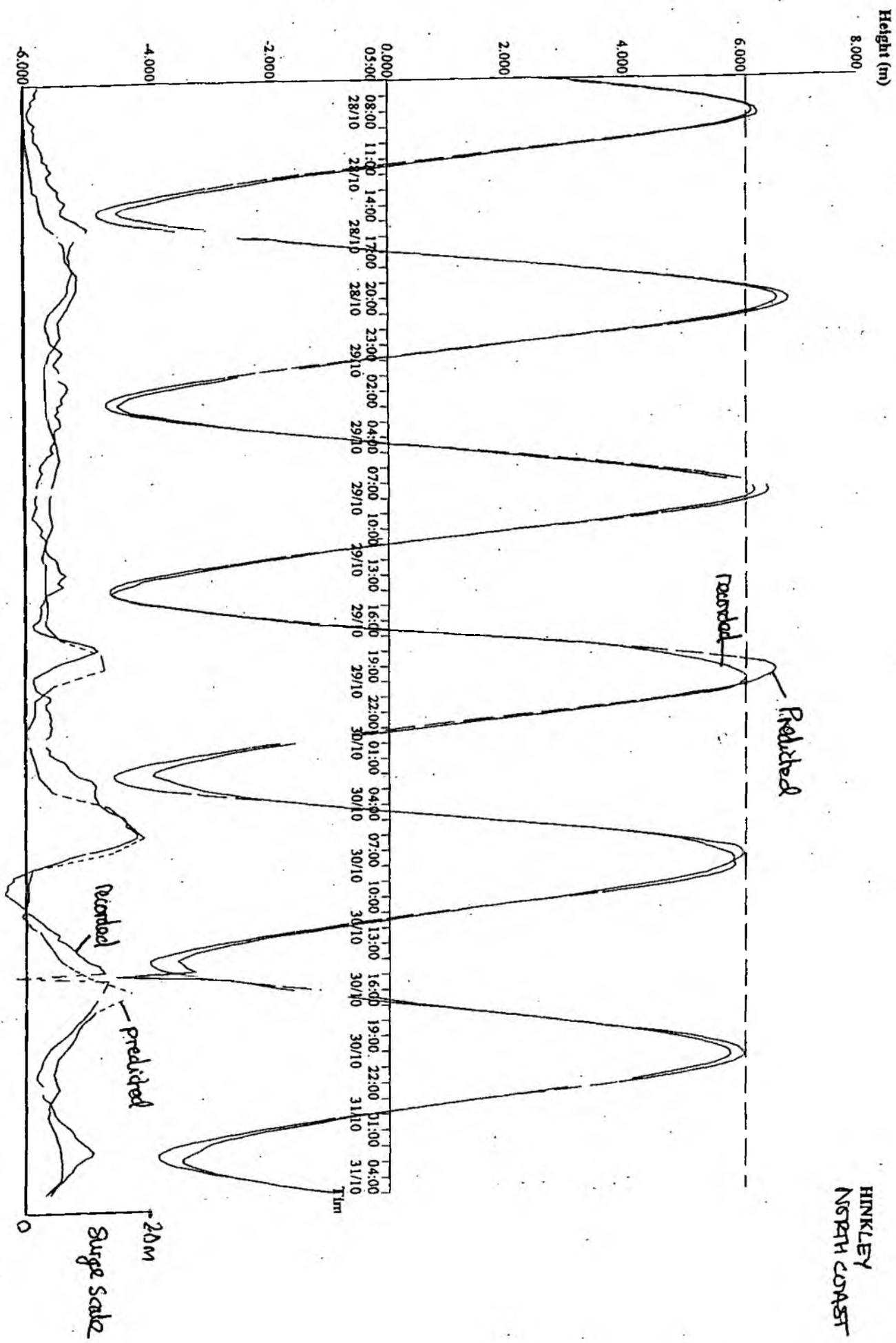
Environment Agency - TIDEBASE System

Figure 5.0



Environment Agency - TIDEBASE System

HINKLEY
NORTH COAST



Summary of Tidewatches

Portland Floodwatch criteria = 1.4

Hinkley Floodwatch criteria = 6.1m (provisional) & 6.6m (definite)

Avonmouth Floodwatch criteria = 7.2m (provisional) & 8.0m (definite)

Figure 5.8

Date	Time	Name	Area	Predicted Tide&Surge mODN	Recorded Tide & Surge mODN	Recorded Surge m	Tidewatch	Wind Speed	Direction
28-Oct-00	07:15	Portland	S Wessex	1.48	1.53	0.18	Yes	6-7	S-SW
	07:15	Hinkley	N Wessex	6.20	6.29	0.09	Yes	5	S-SE
	07:45	Avonmouth	N Wessex	7.08	7.15	0.09		5	S-SE
	19:15	Portland		1.64	1.43	0.09	Yes	6-8	SW
	19:30	Hinkley		6.84	6.63	0.46	Yes	5-7	SW
	20:00	Avonmouth		7.75	n/a	n/a	Yes	5-7	SW
29-Oct-00	06:45	Portland		1.53	1.23	-0.10	Yes	6-7	W-SW
	06:45	Hinkley		6.50	6.26	0.17	Yes	7	W-SW
	07:15	Avonmouth		7.48	7.20	0.18	Yes	7	W-SW
	18:45	Portland		1.65	1.33	0.07	Yes	9-10	SW
	19:00	Hinkley		6.44	6.12	0.16	Yes	9-10	SW
	19:30	Avonmouth		7.36	6.87	-0.05	Yes	9-10	SW
30-Oct-00	07:15	Portland		1.89	1.49	0.22	Yes	9-10	SW
	07:15	Hinkley		5.93	5.78	-0.04		7	W
	07:45	Avonmouth		6.92	6.24	-0.51		7	W
	19:30	Portland		1.54	1.30	0.16	Yes	7	W-SW
	19:30	Hinkley		6.08	5.85	0.28		6-8	W-SW
	20:00	Avonmouth		7.01	6.63	0.16		6-8	W-SW
31-Oct-00	07:45	Portland		1.45	1.20	0.03	Yes	6	W-NW

Maximum surges

Name	Date	Time	Predicted	Actual
Portland	30-Oct-00	04:30	0.79	0.82
Portland	30-Oct-00	05:30	1.01	0.45
Hinkley	30-Oct-00	05:00	1.90	1.79
Avonmout	30-Oct-00	05:00	2.00	2.23
Avonmout	30-Oct-00	05:30	1.74	2.26

CHAPTER 6 - EMERGENCY RESPONSE

6.1 Major Incident Plans Activated

Table 6.1 MIP summary table

COUNTY	MAJOR INCIDENT PLAN ACTIVATED	GOLD/SILVER OPEN	AGENCY ATTENDANCE
SOUTH WESSEX			
Dorchester	Yes	Silver	Yes
Westbay	No	Silver	Yes
NORTH WESSEX			
Taunton	Yes	Silver	Yes
Malmesbury	Yes	-	-
Bradford upon Avon	Yes	-	-
Portishead	No	Gold	Yes
Chippenham	No	Silver	Yes
DEVON			
Exeter	No	Silver/Gold	No presence, but regular contact

Four, site specific, major incident plans were activated (Taunton, Malmesbury, Bradford-on-Avon and Dorchester) during the period. At eight other locations the police and local authorities were put on "pre-mip" warning. The levels were such that the Agency believed a Severe Flood Warning (SFW) was likely to be issued in the near future, but in the end they did not reach MIP criteria.

6.2 Gold and Silver Controls opened

Five multi agency Silvers and two Gold Controls were established during the period. The Silvers were at Dorchester, West Bay, Taunton, Exeter and Chippenham (for Chippenham, Bradford-on-Avon and Malmesbury). The two Golds were at Portishead (for flooding in Taunton plus county wide flooding in Avon and Somerset) and Exeter (for the possible Exeter overtopping plus county wide flooding problems in Devon).

6.3 Gold and Silver Controls with Agency Attendance

The Agency attended all of the Golds and Silvers, except at Exeter where very regular contact was made with them in preparation for possible issue of a SFW. All involved were quite satisfied with this, particularly as there was a well documented response plan in place for Exeter.

6.4 Agency (staffing, equipment and plant)

(South Wessex) Within South Wessex major resources were required for the following locations;

- Dorchester (evacuation)
- Iford (evacuation)
- Westbay (tide watch/monitoring and beach profiling and nourishment)
- Grove farm (sand bags to reinforce defences, pumps)

- Christchurch (pump deployment)
- Preston Beach (tide watch/monitoring, profiling and nourishment)

(South Wessex) Supplementing the EWF with Fisheries and other field based staff was very successful. It allowed members of the workforce to rest whilst tide watches and gauge board readings continued.

(North Wessex) In terms of specific operational activities, 24 hour pumping was undertaken at relevant and appropriate pumping stations when conditions allowed. The permanent pumping capacity was enhanced by use of the 36" mobile pumps previously used elsewhere in the Agency. The installation and operation of these pumps required close liaison with the affected residents to ensure road access for such vehicles as school buses was maintained at key times of the day. In addition, the North Wessex Area staff worked closely with the IDBs to identify and utilise any available storage areas not previously flooded. There was also agreement to carefully manage upstream pumping operations to minimise the downstream impact on areas already severely flooded. This process of co-operation was enhanced at a briefing session held at the Agency offices to explain face to face ongoing operations and listen to solutions preferred by IDB representatives. Sandbagging along sections of the River Parrett was also undertaken.

(Devon) The emergency workforce was used to check bridges in all parts of Devon and to attend schemes at Axminster and Ottery St Mary. They were also used to provide assistance to Local Authorities in a number of locations, stretching man power resources to the limits.

(Cornwall) Flooding in Cornwall did not require any major deployment of resources.

6.5 Adequacy of Agency Resources

Agency resources were in the main sufficient to handle this event although appropriate staff, particularly for sending to Golds and Silvers, was limited and is an area that needs to be developed. There is a need to dedicate significant resources to Silver Control liaison officers, providing rotas, support, information (and training).

6.6 Numbers of Staff Deployed

The emergency workforce were employed in full during the events throughout the region. Staff tended to be drawn in from other functions in order to assist.

Table 6.2 Summary of EWF personnel involved in the event

Emergency Works Force	
Estimated number of people involved	S. Wessex = 26 N Wessex = 70 (includes up to 1/1/01) Devon = 24 Cornwall = 30
Estimated number of hours worked	S Wessex = 3 600 N Wessex = 40 000 (includes up to 1/1/01) Devon = 1 200 Cornwall = 1 600

6.7 Range of Functions and inter Regional Co-Operation (emergency response only)

No EWF staff were supplied as assistance to other Regions from either S Wessex, Devon or Cornwall. This information was not available from N Wessex.

6.8 Emergency Services, Local Authority, Other Response Organisations

(Devon) Devon County Council Bridges department have agreed to provide resources through 24 hours a day to remove blockages at highway bridges.

(Devon) Exeter Quay is a known low point in the Exeter Scheme and Exeter City Council have arrangements in place to provide sand bags to augment the defence when the Quay is at risk of flooding. These arrangements were put into action during the November flooding and the Agency attended in support of the Council with additional men equipment and materials.

(Devon) Sand bags were issued to assist Torridge District Council

6.9 Property Evacuated (no. of people) and Type (houses, hospitals, old peoples homes, factories etc.)

(South Wessex) Evacuation plans were initiated during the October/November period generally in direct response to the issue of a MIP and FW forecast triggers. In this respect 60 caravans were evacuated at Iford caravan park (31st October '00) and 20 were evacuated from 'at risk' retirement homes in Dorchester (6th November '00). The Dorchester event had plans in place to evacuate 200 homes/residences. Rest centres were set up in Dorchester and Bournemouth.

(North Wessex) Evacuation of individuals occurred in a number of localities but tended to be self-evacuations rather than formal evacuations as part of an organisation response. Although local authorities did evacuate some individuals, many chose to remain in the property to attempt to reduce the effects of flooding. There was one report of an individual on a drip being evacuated in Malmesbury. Close liaison with Sedgemoor District Council was maintained when levels on the Somerset Moors threatened widespread flooding in a number of villages. However, the slow nature of the flooding meant that again individuals tended to make their own arrangements, supported by the local authority.

(Devon) There are newspaper reports that approximately 30 people stayed the night in North Tawton Town Hall.

(Cornwall) Although properties were flooded, there were few reports of evacuation.

Table 6.3 Estimated number of people evacuated

Area	Number of people evacuated
South Wessex	110
North Wessex	20
Devon	56
Cornwall	2
Total	188

Table 6.4 Estimated number of properties evacuated by type

Area	Number of private houses	Number of caravan properties	Number of residential homes
South Wessex	0	60	1
North Wessex	10	0	0
Devon	27	0	0
Cornwall	2	0	0
Total	39	60	1

6.10 Issues Arising

- The Emergency Workforce, worked long hours for a prolonged period, mainly because of the nature of the catchments. This highlighted the problem of the limitations of the "Noble Numbers" in a prolonged event.
- There is a need to dedicate significant resources to Silver Control liaison officers, providing rotas, support, information (and training).
- (South Wessex) There is a need to enhance the contents of the MIP boxes available to take to such incidents. The pre-emptive meeting with District and County Councils and Emergency Services for Salisbury in preparation for a major incident being declared was very worthwhile. Inter-county liaison is required on the Hampshire Avon to tackle strategic traffic management on east-west routes.
- (Cornwall) There is a need to produce a generic MIP for small settlements where no specific MIP exists.
- (Cornwall) It is felt that a consistent approach is called for in the deployment of sandbags as there is difference between LAs.
- (Cornwall) A need to review the number of mobile pumps as strategic plant.
- (Devon) In general staff and the Emergency Work Force (EWF) coped with the event as required, but had the flooding gone on for a further 'shift' then resources available would not have been sufficient to cope. Staff included other functions, most notably Water Resources and Fisheries.

- (Region) Liaison with professional partners has pointed to the need for some revision to the Major Incident Plan procedures.
- (South Wessex) The names of suitable volunteer staff need to be accessible to duty officers to allow a prompt response as situations develop.
- (South Wessex) There is an insufficient number of available small boats.

6.11 Recommendations

- There needs to be an overall review of both staff resources and plant resources. This is particularly relates to suitably trained silver control liaison officers.
- When the need arises to install emergency plant, such as the Dutch pumps on the Somerset levels, all facilities should be in place to ease and quicken the response time e.g access arrangements already in place. A review should be undertaken in light of these floods to identify where such work is required.
- Consider the production of generic MIPs for small settlements where no MIP exists, this is particularly relevant to Cornwall.
- Review deployment of sandbags with LAs
- Revise MIPs as appropriate.

CHAPTER 7 - PUBLIC RELATIONS

7.1 Links to the Media, Coverage by the Media (except for flood warning dissemination)

A major Public Relations effort was required throughout the event. The Agency took on a proactive stance from the outset with early warning of the severe weather expected. A constant flow of information followed with countless news releases and media briefings.

While there is a natural tendency for the media to concentrate on areas flooded, the PR team sought to raise the profile of places where flood defence schemes had prevented flooding. This is an aspect of PR worthy of further development.

The general theme of newspaper reports initially concentrated on the effect on families whose homes were flooded and specific locations eg North Tawton which have suffered repeat flooding problems with none of the authorities taking any responsibility.

Pictures of dramatic rescues and famous buildings surrounded by flood water featured prominently.

The flooding coincided with the 40th anniversary of flooding in Exeter and Taunton and many reports linked this in.

Criticism of development in flood plain quickly started to follow particularly for Norton Fitzwarren in Somerset and Braunton in North Devon. Lots of detailed reports relating to the effects of climate change and global warming also emerged.

The event did stimulate a large number of letters from the public to newspapers. These carried a wide variety of suggestions from the public to the causes and solutions to the flooding ranging from 'its all due to the wrath of God' to blaming the environment Agency for opening sluices to protect certain places and causing flooding in others. Most general reporting has been factual and supportive of Agency activity.

7.2 Number of Interviews by Media Type

The liaison between PR and the flood warning duty team in the regional control centre both in and out of normal working hours was, as usual, very productive, informative and comprehensive. Media interviews were shared between staff from both functions, a total of 140 television and radio interviews were provided.

7.3 Issues Arising

- It is vital that the PR team receives accurate and up to date information to keep the media informed and to be able to produce useful news releases. Currently this relies on a combination of the duty officers providing the hard copies of the warnings and the PR officer physically cross-checking the battle board in

- the control room. This system could be improved greatly, in terms of time and accuracy, by a computerised method accessible to all staff involved.
- There was a scarcity of information from areas or region on the operation (successful or otherwise) of our flood defence schemes and how many staff we had out doing what, where. This type of detail is key in helping to portray the Agency positively during the flooding, stories of rescues etc are ideal opportunities to promote the organisation. A system to harness these facts would greatly help PR promote and maintain the Agency's reputation. One method could be to actually include specific questions in the HELP and situation reports, as this will stimulate the facts.
 - Both the Agency and Devon County Council challenged Carlton (Westcountry) TV after a news item stated the Agency didn't undertake flood improvement work at Umberleigh on the River Taw because the council erected scaffolding to paint a bridge. The TV piece declared that flooding resulted because of this. Carlton has offered the Agency an open opportunity for a positive follow up piece whenever we wish to take this up.
 - North Wessex area manager wrote to the Somerset County Gazette to set the record straight on behalf of the Environment Agency regarding correspondence from readers relating to incorrectly perceived causes of flooding to Creech St Michael and Queen and West Camel.
 - It is vital that a member of the Agency establishes an early and maintained presence on site to act as a point of contact for the community. This paid dividends at future public meetings and Agency credibility has benefited against other authorities.

7.4 Recommendations

- Up to date and accurate information is the key requirement for the PR team and a reliable system of producing this, together with information of the Agency's activities across the region would be a real step forward.
- Establish a system that ensures Agency staff attend sites of flooding at an early stage.

CHAPTER 8 - INCIDENT SPECIFIC

8.1 Major Industry/Infrastructure

There was flooding to between 5 and 10 industrial units on the Lowman Industrial Estate at Tiverton. These units are protected by a flood defence, but this was over topped.

8.2 Legal Recommendations – Issue / Action / Ownership / Review Date

No information.

8.3 Retrospective View by Others of the Event and how it was Handled Overall. Standard Letter to all Professional Partners, Local Authority Chief Executives, Police and Fire Chief Officers, Army Commanding Officers etc– all Responses to be Included as Appendix to the Report.

Standard letters were not sent to other parties, but the correspondence that does exist is included within appendix F.

(Region) General feedback of others (partners) of how the event was handled overall was good. There will always be the plea for more information on how much worse, long etc, but they are beginning to understand that it is not an exact science. One regular plea though was that they were deluged with faxes, which then ran the risk of an important one being missed (although a confirmatory call is always made on such faxes). It was requested by a number of police and local authorities that they would prefer to specify which faxes they received, as they did with the previous system.

(South Wessex) No specific views have been received from the emergency services, but relationships in general are good. Dealings with the Dorset police in particular have improved. One example has been the connection with the local police helicopter units who have supplied a number of aerial videotapes. However, it is thought that the Fire Service does not have the available resources to deal with events of an extended nature. They do not have access to the number of pumps required and the manpower to maintain a high level of service.

(North Wessex) The anecdotal information from the professional partners has been generally favourable. The severe conditions placed great strain on the resources of all organisations reinforcing the value of accurate flood forecasts and information. As noted previously, the prolonged nature of the flooding has impacted on debriefs with the professional partners. Several meetings including the Taunton MIP follow up debrief and a meeting to develop a flood warning system for the Somerset Levels and Moors were cancelled due to the continued flooding.

(Devon) no specific views have been obtained from the emergency services.

(Cornwall) Comments have not been sought as the scale of the flooding is not deemed to warrant it, but no adverse comments have been received.

8.4 Issues Arising

(Devon) The South West region has large areas of agricultural land where soils are vulnerable to soil structure degradation. These include the sandy soils in Devon and Somerset and the Chalky soils in Wiltshire. These soils do not normally have excessive surface water runoff. However, they are vulnerable to compaction and capping which reduces their ability to absorb rainfall. As a result there have been many areas in the region where there is surface water flooding of highways and local properties. The overall risk to flooding of main rivers further downstream is unknown but is dependent on the scale of the soil degradation in headwater areas (which can be extensive). Among the worst of the problems have been silage maize (most of which has been harvested in wet conditions with widespread soil damage and subsequent runoff), harvesting of potatoes in wet conditions, and outdoor pigs. Of the cereal crops that have been drilled this winter many of these have seedbeds with poor soil drainage due either to compaction or capping. There is a need to raise awareness with farmers about our concerns.

It was requested by a number of police and local authorities that they would prefer to specify which faxes they received, as they did with the previous system.

8.5 Recommendations

- Liaise with emergency services/LAs etc and determine if they would prefer only selected faxes.
- Approach organisations such as the police/television companies in relation to accompanying their aerial flights of floods for video recording purposes.

APPENDIX A - DEVELOPMENT IN THE FLOODPLAIN

Table A.1 Development in the Flood Plain				
	South Wessex	North Wessex	Devon	Cornwall
Estimated No. properties flooded built in last 5 years	0	Not known	Only 1 definitely known	0
Estimated No. properties flooded built in last 6-10 years	0	Not known	Only 1 definitely known	0
Estimated No. properties flooded built in last 11-20 years	0	Not known	Unknown	0
Estimated No. properties flooded built in last 20+ years	90	Not known	Unknown	43
Estimated No. properties flooded built against agency advice	0	Not known	2	Not known

(Devon) Excellent working relationships exist between Devon Area Development Control and all the Local Planning Authorities in Devon. This has ensured that there have been very few examples (that they are aware of) where flooding has occurred during the recent flood events due to development going ahead against the advice of the Environment Agency.

Comparison of flooding extent with S105 information, including the no. properties flooded not shown at risk on S105 maps

No changes have been identified to the S105 maps as a result of the October/November 2000 floods.

Land allocated for development that flooded or had severe flood warnings issued

(South Wessex) 3 sites identified, a former convent site near Bridport, a paper redevelopment site near Witchhampton and an unnamed site.

(North Wessex)

(Devon) Land at Score Farm in Braunton for approximately 5 to 10 dwellings.

(Cornwall) There are long standing planning approvals that they would like to see rescinded in view of current politics on flood plain protection. It is suggested that legislation could be brought in to review longstanding approvals in the floodplain in a similar way to the recent quarry site approvals.

APPENDIX B - PUBLIC RESPONSE

(South Wessex) Communication with the public has been through a number of different channels. Letters highlighting issues have been received by email, via MP's and collectively from Parish Councils.

(North Wessex) Considerable correspondence has been received within the Area. Subjects being raised cover the whole range of flood defence activities from maintenance, to formal schemes to the operation of flood warning system. A number of public meetings and organisational meetings have been held to discuss recent flooding or plans for future improvements.

Copies of letters from the general public and also a number of newspaper cuttings illustrating actions and the response of the public are available at our Exeter office.

APPENDIX C – ORGANISATIONAL ISSUES

The benefits of Changing Needs in Flood Defence came into play with reconnaissance with the new Improvement and Strategy team organising and managing intelligence gathering on the effects of the event whilst the Operations team focused on ensuring the defences were functioning correctly. All staff felt that the additional resources were of considerable assistance and were helped by the clarification of roles.

APPENDIX D – ECONOMIC IMPACTS

Costs of emergency response (Agency and others)

Table D1

Area	Avon & Dorset	Bristol Avon	Somerset	Cornwall	Devon	Totals
Year	2000/1	2000/1	2000/1	2000/1	2000/1	
Operational cost	122	26	432	75	28	683
Regional cost	17	17	17	17	17	85
Total	139	43	449	92	45	768

Costs of emergency repairs (Agency and others)

Table D2

Area	Avon & Dorset		Bristol Avon		Somerset		Cornwall		Devon	Total
Year	00/01	01/02	00/01	01/02	00/01	01/02	00/01	01/02	00/01	
Cost	50	73	52	141	45	165	180	105	25	836

For further information regarding details of the required repairs see table D3.

Extra flood defence scheme needs identified by the Environment Agency

As a result of the floods a number of previously identified flood defence schemes have been put on an accelerated programme for delivery. A summary of this information is available from Table D4 and D5.

Also as a result of the floods a number of new pre-feasibility studies have been identified and these are summarised in table D6.

Overall economic costs

Table D7 summarises the additional costs incurred or to be incurred by the Agency as a result of the Oct/Nov 2000 floods.

Overall economic costs, insurance claim level and distribution

No information available.

Impacts on employment (temporary and permanent)

No information available.

Region/LFDC	Cost 2000	Actual (A)	Spend to or Est. (E)	31.3.2001	Location of Rivers affected	Defence type	Length	Future of work done and why	Note 2 yes/no	Note 3 yes/no
South West RFDC										
Devon	10	E			Exwick	Wall		40 Copings to reinstate. Divers to be used to recover. EWF to carry out works.	no	yes
	5	E			Exebridge	Earth Bank		50 Re-facing of earth bank damaged by overtopping	no	yes
	5	E			Annery Kirt	Earth Bank		20 Re-facing of earth bank damaged by overtopping	no	yes
	5	E			Taw Banks	Earth Bank/Flap		20 Headwall/tideflap damaged as well as earth bank	no	yes
Total	25									
Corwall	15	E			Polson/St Leonard	Earth Channel		100 Earth Channel reinstatement	yes (£15k)	yes
	100	E			Helebridge	Earth bank/masonry wall		200 Earth bank / masonry wall repair	no	yes
	10	E			Pethericks Mill	Earth Bank/flapvalves		100 Earth Bank/flapvalves repair	yes	yes
	15	E			River Allen	Earth Channel		200 Earth Channel reinstatement	no	yes
	50	E			Hayle Banks	Earth bank		500 Earth Bank repair	no	yes
	10	E			Tinhay	Earth bank/masonry wall		75 Earth bank / masonry wall repair	no	yes
	10	E			Mawgan Porth	Earth bank / concrete wall		75 Earth bank / concrete wall repair	no	yes
	30	E			Par F.A.S.	Masonry wall		25 Masonry wall repair	no	yes
	20	E			Clawton	Earth bank/channel		100 Earth bank/channel repairs	no	yes
	25	E			Tamar Banks	Earth bank / flap valves		300 Earth bank / flap valves repair	no	yes
Total	285									
Avon/Dorset LFDC	68	E	£25k so far		Preston Beach	Beach		300 Reprofiling beach/ retrieve beach material	yes (£7k)	yes
	25	E	£25k so far		East Beach, West Bay	Beach		150 Reprofiling beach/ retrieve beach material	no	yes
	10	E			River Allen, Wimbourne	Embankment & walls		70 Earth bank/masonry wall repairs	no	yes
	15	E			River Allen, Horton Bridge	Embankment		50 Earth bank repair	no	yes
	5	E			Bridport FAS	Embankment & walls		1500 Desilting/flapvalve clearance	no	yes
Total	123									
Somerset LFDC	40	E			Tone Valley	Ring banks/earth embankments		Raising low spots, reinstating damaged defences	no	yes
	15	E	£7k so far		Cam Valley	West Camel, Queen Camel and Bridgehampton.		Tree felling, debris clearance, culvert unblocking desilting bypass channels	no	yes
	30	E			River Parrett	Earth embankment		700 Raise low spots on earth banks which have been sandbagged	no	yes
	15	E			Oath	Stonework to combat erosion		Repairs of stonework	no	yes
	15	E	£5k so far		West Somerset streams	shingle traps		Clear shingle traps filled by storms	no	yes
	10	E			River Parrett	Earth embankments		Repairs to embankment slips at spillways	no	yes
	40	E	£8k so far		River Parrett	Aller Moor spillway		Repairs to throttle on the relief channel	no	yes
	40	E			Moors near Langport	Earth embankments		Earth embankment repairs to ensure compartments are sound for flood storage.	no	yes
	5	E			River Parrett	Earth embankments Northmoor		Emergency trench sheeting	no	yes
Total	210									
Bristol Avon LFDC	1	E			Urchfont Watercourse -			Tree and vegetation clearance, silt and general debris	no	yes
	1	E			Pudding Brook, Chippenham			Tree and vegetation clearance required upstream of railway culvert, large blocks of masonry/concrete to be removed from channel at yard u/s of railway culvert, confined space survey.	no	yes
	5	E			Ladyfield Brook - Chippenham			Urban debris removal (inc. fly-tipped rubbish, trolleys, garden rubbish, blocks/bricks). Silt removal from channel bed, toe and faces of masonry revetments and bridge culverts. Removal of vegetation from revetments. Remove debris from length of Rowden Lane Culvert and investigate need for a trash screen to be installed. Reinstat wall lengths of wall damaged by trees/bushes. Replace wall joints. Install erosion protection to bank at outfall from Hungerdown Culverts and repair fencing.	no	yes
	1	E			River Biss - Trowbridge			Tree and vegetation clearance required. Remove general debris, including shopping trolleys. Remove silt deposits at toe of high level sheet piles. Remove debris beneath Town Bridge. Clear vegetation from stone pitched revetments and repair if required.	no	yes
	1	E			Lambrook Stream - Southwick			Tree and vegetation clearance required. Remove debris.	no	yes
	-	E			Byde Mill Brook - Lacock			No works required other than routine maintenance.	no	yes

Region/FDC	Cost £'000	Actual (A) or Est. (E)	Spend to 31.3.2001	Location & Rivers affected	Defence type
	-	E		River Marden - Calne	
		E		South Brook - Melksham	
		E		River Avon - Melksham	
	60	E		Clackers Brook - Melksham	
		E		Berryfield Brook - Melksham	
		E		Sherston & Tetbury Avon - Malmesbury Cowbridge Weir	
		E		Sherston & Tetbury Avon - Malmesbury St John's Bridge	
		E		Sherston & Tetbury Avon - Malmesbury Channel Works at Confluence	
	20	E		Sherston & Tetbury Avon - Malmesbury Wynyard's	
		E		Sherston & Tetbury Avon - Malmesbury Holloway Bridge	
		E		Sherston & Tetbury Avon - Malmesbury Linolite Sluices	
		E		Sherston & Tetbury Avon - Malmesbury 1971 Scheme	
	1	E		River Avon - Kingsmead Mill	
	5	E		Paxcroft Brook - Trowbridge	
	1	E		Hardenhuish Brook - Chippenham	
	1	E		River Avon - Chippenham	
	5	-		River Somer - Midsomer Norton Tunnel	
		E			
	5	-		Wellow Brook - Radstock	
		E			
		E		Wellow Brook - Welton Vale Culvert	
		-			
	10	-		Somerset Frome - Frome	

Length	Nature of work done and why See note 1	Annual reporting purposes only	
		Note 2 yes/no	Note 3 yes/no

	New housing development has replaced existing embankment (scheme) with flood wall and flood gate.	no	yes
	Tree and vegetation clearance, possible channel reprofiling. Confined space survey of culverts (inc. Tree and vegetation clearance, silt removal from toe of sheet piles, removal of large quantity of silt and vegetation from beneath two arches of Town Bridge.	no	yes
	Removal of urban debris including trolleys and other large items. Confined space survey of culverts. Replace unstable retaining wall on left bank at Scout's Hut, general tree and vegetation clearance.	no	yes
	Tree and vegetation clearance, silt removal from channel near Melksham Hospital Estate, urban debris removal.	no	yes
	Tree and vegetation clearance from revetments, repair/reinstate revetments as required.	no	yes
	No reinstatement works required. Routine maintenance.	no	yes
	Topographical survey of bank crest, raising of embankment if required.	no	yes
	Removal/replacement of existing sluice gate in consultation with land owner.	no	yes
	Replace joint material in wall. Clear silt and vegetation from stone pitching. Repoint and repair both over flow weirs and clear vegetation from spillways. Clear debris in bridge culverts and monitor silt/gravel build up.	no	yes
	Clear vegetation obstructing compound and refit faulty lock mechanism on gate. Clear vegetation from spillway.	no	yes
	Tree and vegetation clearance. Carry out hydraulic analysis to determine whether major dredging works are required to remove silt and increase channel capacity. Privately operated weir, owned by Agency. Reinstatement of d/s masonry protection and possible bank regrading required.	no	yes
	Fabricate and install trashscreens for County Way culvert, urban debris removal.	no	yes
	Tree and vegetation clearance. Debris removal. Confined space surveys of numerous culverts. Filling of scour holes d/s of weirs.	no	yes
	Routine tree and vegetation clearance.	no	yes
	General tree & vegetation clearance, silt removal, removal of urban waste, clear revetments and repoint if required, monitoring of cracking in r.c. walls, core samples to analyse cracking in outfall structure, fencing repairs.	no	yes
	Tree and vegetation clearance, urban debris removal (including tanks, tyres, corrugated steel sheets and asbestos sheets. Reinstatement of gabion mattresses at the Wellow/Snailsbrook confluence, repointing of retaining wall. Silt and gravel shoal removal from Somervale Road	no	yes
	Confined space survey required of culvert.	no	yes
	Phase I&II. Tree clearance, repair/reinstate stone revetments, remove shopping trollies, repairs to masonry side weir and overspill weir, treatment of Japanese Knotweed, vegetation clearance. Phase III.		
	Construct a boat launching point at St Leonards Mill Weir, tree and vegetation clearance, major dredging and debris removal to reinstate flood relief channel together with hydraulic analysis to prevent future siltation, repair/replace		

5	E	-	River Boyd - Bitton	Tree and vegetation clearance, silt removal from toe of sheet piles and bed of concrete channel, clear weep holes in piles, repair/reinstate masonry scour protection revetment d/s of weir, remove or repair dangerous access bridge at Golden Valley.	no	yes
1	E	-	Brislington Brook - Bristol	Tree and vegetation clearance. Confined space inspection of bypass culvert.	no	yes
-	E	-	River Avon - Totterdown Tidal Protection Scheme	No works required.	no	yes
1	E	-	Stockwell Watercourse Re-alignment	Tree and vegetation clearance, debris removal from bridge culverts and Armos.	no	yes
1	E	-	Folly Brook	Hole at service crossing through flood wall to be sealed, new seals provided for flood gates, flapvalves to be	no	yes
1	E	-	Bradley Brook	Tree and vegetation clearance, removal of brambles from gabion over spill weir into dry flood relief channel, reprofile (de-silt) dry by-pass channel, debris clearance from reach at Bradley Bridge, topographical survey of crest level of embankment, raise crest level back up to Bank reinstatement works required at St John's Way. Tree and vegetation clearance and debris removal.	no	yes
1	E	-	Bristol Frome - Yate & Chipping Sodbury	Tree and vegetation clearance, infill scour hole caused by road drain,	no	yes
1	E	-	River Chew - Chew Magna	Tree and vegetation clearance required from channel and revetments, repair/reinstate revetments if required.	no	yes
1	E	-	Stoke Brook	Remove debris from bridge culverts.	no	yes
10	E	-	Ashton Vale - Bristol	Silt removal from channel, urban debris clearance, confined space surveys of tunnel and culverts.	no	yes
10	E	1000	Tubbs Bottom Detention Reservoir	Refurbishment of stilling basin, routine monitoring surveys, additional works to seal Jarrett's Pit, bank protection adjacent to trash screen.	no	yes
40	E	40000	Bristol Frome - Culvert System	Works to be undertaken this financial year. Detailed survey has been carried out by Consultants.	no	yes
1	E	-	River Avon - Bath	Escape ladders and safety lines need replacing, tree and vegetation clearance required at escape points from ladders, replace damaged/missing flap valves. Repair damaged flood wall at Cricket Ground.	no	yes
1	E	-	River Avon - Shirehampton	Tree and vegetation clearance required from embankments. Investigation into permanent closure of	no	yes
1	E	-	River Avon / Markham Brook - Pill FAS	Monitoring of erosion to steel bracket supporting cladding required. Monitoring of bank slip on R.Avon, d/s of Pill confluence.	no	yes
Total	193					
GRAND TOTAL	836					

- Note 1** Describe what the repairs are and why needed. Indicate if further work included in capital scheme
Note 2 Indicate (yes or no) whether work was included in current maintenance programme
Note 3 Indicate (yes or no) whether work has been included in revised maintenance programme this year or next year

Jan 24th 2001

As at 23rd January 2001

SOUTH WEST RFDC

**ACCELERATED PROGRAMME FOR RIVER DEFENCES AND TELEMETRY
IMPROVEMENTS**

GEC BIDS FOR 2000-01 AND 2001-02

Scheme	Current planned work start	Revised work start	When could application be with MAFF	£'000	
				Changes sought to GECs(+/-) (a) 2000-01	(b) 2001-02
REPAIRS	-	now		+205	+105

SOUTH WEST RFDC**INDICATION OF POTENTIAL CHANGES
FOR 2002-03 AND 2003-04****TOTALS****+205****+105**

Scheme	Current planned work start	Revised work start	£'000	
			Indication of changes to May 2000 MTP forecasts (+/-)	
			(a) 2002-03	(b) 2003-04
OTTERY ST MARY	3/4	2003	+200	+1165
HARBERTONFORD	-	2002	+560	
POLMORLA	5/6	2003		+300
GALMPTON	-	2003		+160
BRADIFORD WATER	7/8	2002	+340	
SLADESBRIDGE	7/8	2002	+500	
BAMPTON	6/7	2003		+998
UMBERLEIGH		2003		+300

TOTALS**+1400****+3123****AVON & DORSET LFDC****ACCELERATED PROGRAMME FOR RIVER DEFENCES AND TELEMETRY
IMPROVEMENTS****GEC BIDS FOR 2000-01 AND 2001-02**

Scheme	Current planned work start	Revised work start	When could application be with MAFF	£'000	
				Changes sought to GECs(+/-) (a) 2000-01	(b) 2001-02
RINGWOOD	05/06	2001			+ 50
REPAIRS	-	now		+50	+73
			TOTALS	+50	+123

AVON & DORSET LFDC

**INDICATION OF POTENTIAL CHANGES
FOR 2002-03 AND 2003-04**

Scheme	Current planned work start	Revised work start	£'000	
			Indication of changes to May 2000 MTP forecasts (+/-)	
			(a) 2002-03	(b) 2003-04
DOWNTON	05/06	2002	+417	
TOTAL			+417	

ACCELERATED PROGRAMME FOR RIVER DEFENCES AND TELEMETRY
IMPROVEMENTS

GEC BIDS FOR 2000-01 AND 2001-02

Scheme	Current planned work start	Revised work start	When could application be with MAFF	£'000	
				Changes sought to GECs(+/-)	
				(a) 2000-01	(b) 2001-02
MELKSHAM	-	2002	9/01		+150
SHURNOLD	2/3	2002	9/01		+44
REPAIRS	-	now		+52	+141
TOTALS				52	335

BRISTOL AVON LFDC

**ACCELERATED PROGRAMME FOR RIVER DEFENCES AND TELEMETRY
IMPROVEMENTS**

**INDICATION OF POTENTIAL CHANGES
FOR 2002-03 AND 2003-04**

Scheme	Current planned work start	Revised work start	£'000	
			Indication of changes to May 2000 MTP forecasts (+/-)	
			(a)	(b)
			2002-03	2003-04
MELKSHAM	1/2		+50	
SHURNOLD	2/3	2002	-44	
TOTALS			+6	

ACCELERATED PROGRAMME FOR RIVER DEFENCES AND TELEMETRY
IMPROVEMENTS

GEC BIDS FOR 2000-01 AND 2001-02

Scheme	Current planned work start	Revised work start	When could application be with MAFF	£'000	
				Changes sought to GECs(+/-)	
				(a) 2000-01	(b) 2001-02
PARRETT BANKS MANOR FM.		2001	-		+300
REPAIRS		now		+45	+165
			TOTAL	+45	+465

SOMERSET LFDC**ACCELERATED PROGRAMME FOR RIVER DEFENCES AND TELEMETRY
IMPROVEMENTS****INDICATION OF POTENTIAL CHANGES
FOR 2002-03 AND 2003-04**

Scheme	Current planned work start	Revised work start	£'000	
			Indication of changes to May 2000 MTP forecasts (+/-)	
			(a)	(b)
			2002-03	2003-04
HILLFARANCE	4/5	2004		393
WILLITON	4/5	2002	370	
CREECH ST MICHAEL	-	2003	601	
		TOTALS	971	393

TABLE D6

Please note : Best available information as at 05/01/01. (Some future change likely)

New Pre-Feasibility studies identified after Autumn/Winter flooding 2000 05/01/00
(Costed at £5k each)

AREA

Devon	Cornwall	Avon and Dorset	Bristol Avon	Somerset	SUMMARY
Bishops Tawton	Gunnislake	Blandford St Mary Pump	Bathampton	Ashford Mills FAS	Devon 5 @ £5k
Cowley	Polson/St Leonards	Stour Embankments	Bradford on Avon	Bradford Abbas FAS	Cornwall 8@ £5k
Stoke Canon	Tregrehan Stream	Dorchester Improvements	Brislington Square	Bruton	Avon and Dorset 7@ £5k
Yeoford	Newport	Tisbury	Calne FAS	Cam	Bristol Avon 22@ £5k
Weare Giffard	Bridgerule	Gillingham	Charlton Bottom Watercourse, Keynsham	Cannington	Somerset 27@ £5k
	Polmear Stream	Shapwick	Chipping Sodbury	Congresbury	
	Bridges/Luxulyan	Maiden Newton	Chew Magna	Coxley	
	Mawgan Porth		Frampton Cotterell	East Lydford FAS	
			Frome FAS	Gooseum Rhyne FAS, Congresbury	
			Hanham	Hawkcombe Stream	
			Keynsham	Hele Bridge FAS	
			Ladyfield Brook FAS	Mudford FAS	
			Lam Brook	Nether Stowey	
			Nunney	North Bradon FAS	
			Malmesbury Scheme Refurbishment	Norton Fitzwarren	
			Midsomer Norton	Nynehead	
			Saltford	Sherborne FAS	
			South Brook FAS	Silk Mills	
			Staines Bridge, Malmesbury	South Hill Pumping Station	
			Swineford	Stoford FAS	
			Wallbridge	Taunton Town Tributaries	
			West Town Lane, Brislington	Thorney FAS	
				Timberscombe and Wooton Courtenay	
				Tone FAS Firepool Weir to Frieze Hill	
				Tone d/s Taunton	
				Yetminster FAS	
				Yeovilton FAS	
Total cost £25k	Total cost £40k	Total cost: £35k	Total cost: £110k	Total £135k	Grand Total = £345k

Table D7
Oct/Nov Floods:

SUMMARY SHEET FOR OCT/NOV 2000 FLOOD COSTS

	SOUTH WESSEX		NORTH WESSEX				Cornwall		Devon	TOTALS
	Avon & Dorset		Bristol Avon		Somerset					
	2000/01	2001/02	2000/01	2001/02	2000/01	2001/02	2000/01	2001/02	2000/01	
1) Repairs to existing schemes - Grant Aidable	50	73	52	141	45	165	160	105	25	838
2) Collecting/archiving Data	30		15		60		15		15	135
3) Accelerated Feasibility/Design 2000/01	15		10		30		10		80	145
4) Catchment Management Strategies	25		25		50		100		75	275
<i>Reclaimable Total</i>	70		50		140		125		170	555
5) Operational Cost of Running Event	122		26		432		75		28	683
6) Regional Office Costs of Running Event	17		17		17		17		17	85
7) New Pre-feasibility Studies Identified	35		110		135		40		25	345
<i>Revenue Cost Total</i>	174		153		584		132		70	1113
TOTALS	294	73	255	141	769	165	437	105	265	2504

* as at 23rd January 2001

APPENDIX E – HISTORY OF FLOODING

History of flooding in Region since April 1998, estimate of properties flooded and action taken subsequently.

Details as available.

(South Wessex) 60 properties were recorded as having flooded during the December '99 event. Following this event high level flows continued for much of the year causing a number of groundwater flooding issues the full length of the Avon catchment. Unfortunately the number of affected properties was not recorded.

APPENDIX F – VIEWS OF PROFESSIONAL PARTNERS

Correspondence between the EA and organisations such as LAs and Emergency Services in respect to their view on how the event was handled overall.

Overall it is concluded that relationships between the EA and organisations such as the LAs and Emergency services were good during the event. As the event has only recently subsided in the South West no formal response has been received. However, a debrief was held to discuss West Bay and Dorchester with the Dorset police and the Emergency Planning Services. A copy of the minutes of this meeting is available at our Exeter office.

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