Environment Agency North West Region

Autumn 2000 Floods Review Regional Report

ENVIRONMENT AGENCY

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Cover: Flooding in Common Lane Brook area, Leigh (30th October 2000)

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ENVIRONMENT AGENCY NORTH WEST REGION
OCTOBER/NOVEMBER 2000 FLOODS REPORT

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LIST OF ABBREVIATIONS

ABC	Area Base Controller
AFDO	Assistant Forecasting Duty Officer
AFWDO	Assistant Flood Warning Duty Officer
AMDO	Assistant Monitoring Duty Officer
AVM	Automatic Voice Messaging System
BWB	British Waterways Board
DOSEC	District Off Site Emergency Centre
DSM	Duty Strategic Manager
FDOps	Flood Defence Operations
FWA	Flood Warning Area
FWDO	Flood Warning Duty Officer
HELP report	Head Office Liaison Report
LTA	Long Term Average
MFDO	Monitoring and Forecasting Duty Officer
MWC	Manchester Weather Centre
NCPM	National Capital Programme Management
NDO	National Duty Officer
NFWDO	National Flood Warning Duty Officer
NIRS2	National Incident Reporting System
NTS	Northern Telemetry System
ODO	Operations Duty Officer
PA	Public Address
PR	Public Relations
RBC	Regional Base Controller
RCC	Regional Communications Centre
REDO	Regional Emergency Duty Officer
RMS	Recorded Messaging System
RMT	Regional Management Team
SITREP	Situation Report
STFS	Storm Tide Forecasting System
TBR	Tipping Bucket Raingauge
AIR	Area Incident Room
RFR	Regional Forecasting Room

EXECUTIVE SUMMARY

There was an exceptionally high total rainfall during October and November of 2000 across the North West Region of the Environment Agency. This included a sequence of closely separated bands of very heavy rain. These bands caused a number of flooding incidents that followed on closely from one-another and lead to a high level of flood defence activity throughout this period. Record river levels were reached in locations such as the river Weaver in Northwich which reached the highest level since 1946 and the River Douglas at Central Park in Wigan which reached the highest level on record.

It was during the period from 29th October to 8th November that the majority of flooding to property in the region occurred. This report therefore focuses on that period and on central and south areas where the most significant flooding occurred. Although the focus of the reporting is tightly defined, the issues identified from consideration of this flooding are intended to apply to flooding generally throughout the period in the North West Region. The report uses a national standard template to provide a summary of the flooding and to identify key issues and provide recommendations arising out of the experience.

189 properties flooded in a pattern widely dispersed across the region with no one location suffering flooding to more than 25 properties. 76% of the flooding was from main rivers. A total of 11 Flood Warnings were issued as well as 3 Severe Flood Warnings for the River Douglas at Wigan, the River Wyre at Garstang and the River Ribble at Ribchester.

Flood Basins were operated on the Rivers Wyre and Mersey as well at Lilford Park in Leigh. Generally defences such as these were perceived to have performed well and to have prevented considerably more extensive flood damage. However there were some exceptions, notably the collapse of a culvert at Cringle Brook and a breach in the flood defences on the Cheshire Lines Brook which caused flooding to high quality agricultural land.

The overall cost to the North West Region, including support to North East Region, was approximately £400k. This includes around £150k of unbudgeted costs, most of which will be recovered by recharge to North East Region. A total of 385 staff were involved, including EWU.

Key issues and recommendations arising from the flooding are summarised on the tables over the following pages.

Key Issues

Issues arising and lessons learned are given at the end of each chapter in the report. The most significant of these are listed here under the headings used for chapters in the report:

Event Management

Issue	Recommendations	Who
Internal Major Incident Planning	Produce a NW regional plan, including a clear definition of what constitutes a major incident	NW Region
	Each Region to produce major incident plans, including arrangements for inter-regional aid	National Review
	Disaster planning should draw on the lessons learned from the NE regional experience and workshop feedback	NW Region
Providing accurate and timely information during (and immediately after) flooding	Consider how information can be managed during an event more efficiently	NW Region

Flood Forecasting

Issue	Recommendations	Who
Weather Forecasting	Taken overall, the weather forecasts during the event of 28th October – 8th November were considered to be acceptably accurate. However the timing of the heavy rainfall on 30th October was not forecast well, and more frequent forecasts were suggested.	NW Region
	Closer co-operation between the Agency and the Met Office would be valuable, especially as regards forecasting of Flood Watch conditions	NW Region
		National Review
	Consideration should be given to faxing or emailing weather forecasts from Regional Forecasting Room (RFR) to Area Incident Rooms (AIRs) in order to provide a clear, written record of the forecast. This could still be reinforced by a telephone call.	NW Region
Forecasts of flooding are not always sufficiently in advance of flooding to provide others with accurate and timely warnings. This was a particular issue in Wigan	£200k has been earmarked for 2001/02 to improve forecasting models across the Region. An investigation is to be carried out to enable the coast to be divided into tidal zones. This will improve the warning service along the NW coast.	NW Region
	The knowledge of catchments held by various Agency staff needs to be documented for use by all forecasting duty officers.	NW Region
	A detailed and fundamental review of forecasting needs and user requirements is to be commissioned at the start of the new financial year.	NW Region
	A new river gauging station is planned to be built upstream of Wigan flood warning area as part of the work arising from the Easter 1998 Floods, action A1:16.	NW Region

Flood Warning

Issue	Recommendations	Who
Clear and effective dissemination of flood warnings	Bugs in the macro programme used in the Region to produce flood warning faxes should be fixed	NW Region
	Floodline ("RMS") scripts should be shortened	National Review
	Consider expanding use of loudhailers and house calls by flood wardens for flood warning	NW Region & National Review
Application of Flood Watch	Practical issues such as the most appropriate timing of Flood Watch and All Clear to be reviewed in Spring/Summer	NW Region & National code change Review
	A number of Local Authorities have expressed concern over the Flood Watch stage saying that they receive too much information and too often.	NW Region & National code change Review
Staff on flood warning duty rotas were very stretched during the flooding	Possible expansion of the flood warning rotas is being pursued	NW Region
Procedures need to be improved	Various procedures should be improved as detailed in the report. Areas affected include; Northwich, Bedford & Lilford, Woolley Bridge and Railtrack.	NW Region
Severe Flood Warning thresholds were set too low	A review of Severe Flood Warning thresholds should be undertaken. Pre-defined trigger river levels for Severe Flood Warning will only be in place for Lancaster Quay, Walton-le-Dale, Salford and Didsbury and Northenden where the largest number of properties lie in the Flood Warning areas	NW Region

Emergency Response

Issue	Recommendations	Who
Altmouth Pumping Station, inability to operate plant as required.	Responsibilities clarified and action plan agreed. Pump availability had been improved	NW Region
	Catchment strategy to be fast tracked by NCPM to enable capital investment decisions to be made	NW Region
Operation of flood Basins	Review of operating methodology for Mersey & Wyre Flood Basins to maximise benefits	NW Region
	Ensure property on Stenner Lane, Didsbury is not affected by filling of the Mersey flood basins	NW Region
Communications with Flood Warning	Consideration is to be given to providing an Assistant Operations Duty Officer in the Incident Room.	NW Region

Public Relations

Issue	Recommendations	Who
Media coverage	Continue proactive media plan with work such as that carried out at Woolley Bridge which was perceived to have enhanced the Agency's reputation	NW Region
	More Agency staff should be trained to work with the media since demand during a severe event is heavy	NW Region
Post-event advice	Equip relevant staff to respond appropriately to requests for advice on insurance and cleaning up after flooding, even if we direct the public elsewhere for further detail	NW Region
	Prepare staff to answer comments from the public like "we got no warning" and "we want a flood defence scheme"	NW Region

Development in the floodplain

Issue	Recommendations	Who
Objections to development made by the Agency	All of the properties that were flooded were more than 20 years old. It has therefore not been possible to identify any objections made to development by the Agency on the grounds of flood risk.	-
Future development control issues	There is currently no development proposed for the areas affected by flooding, although the risk remains that there will be. Stronger control on development through PPG25 would be valuable.	National Review
	Encourage greater use of Sustainable Urban Drainage Systems and carry out more research into land-use practices and their impact on flooding	National Review
	Adjustments of indicative flood outlines are being made using the experience of the flooding	NW Region

Organisational Issues

Issue	Recommendations	Who
Strategic level management using new RIP guidelines	Clarify arrangements for strategic management of significant events including the role of the Regional Director, Areas Mangers, Duty Strategic Managers and Regional/Area Base Controllers & provide training	NW Region
Operations communications	Communications between FWDO and ODO in incident room worked well	-
	Reconsider liaison arrangements between ODO and REDO	NW Region
Making use of staff outside of Flood Defence function	In order for staff outside of the flood defence function to be fully effective if they are called upon for support during an event, they need to be provided with ongoing training support	National Review
Providing inter-regional aid	Ensure that the Region can supply the correct Noble number of EWU staff	NW Region
	Review the Noble numbers	National Review
	Definition of need, health and safety responsibilities and communication lines are required. It is also important that staff know what decisions they can and can not make	National Review

Flood Alleviation

Issue	Recommendations	Who
Use of £51 million awarded to Agency	Consider recommending a change to the MAFF decision rules to take account of social and environmental factors and to increase standard of flood protection	National Review
Workloads	recognise and manage the significant additional workload on NCPMS	National Review
	recognise and manage the significant additional workload on Areas who need to act as the intelligent customer whilst meeting very quick turnaround times	NW Region
Perceived problems with current schemes	Acceleration of the programmes at Folly Gates, River Mersey, River Alt, Cringle Brook and Sankey Brook	NW Region
	Conduct post project appraisal at Liggard Brook, where the scheme has failed to live up to expectations of land landowners	NW Region
	Work At Barrowford, Pendle is being accelerated as Emergency Works.	NW Region
	Investigate possibilities of schemes at Northwich, Blackbrook at St. Helens, River Dean at Bollington and Common Lane at Leigh.	NW Region

1. INTRODUCTION

1.1 Introduction

Across the UK, the autumn of 2000 was the wettest since records began in 1766, with an average 457mm of rain falling between September and November. Areas such as Sussex (Lewes, Uckfield) and Yorkshire (York, Selby) suffered widespread serious flooding. Nationally, the estimated cost of the flooding was £500 million. 7,406 properties were flooded.

This report summarises the management and impact of the flood event of 29 October to 8 November 2000 in North West Region, within the framework of the National report format.

1.2 Extent of Flooding in North West Region

In the North West Region of the Environment Agency, the three months to the end of November were the second wettest on record (records vary from 64 to 145 years). 321mm of rain fell during October, almost twice the long term average for the month. 175mm of rain fell during November, 170% of the long term monthly average. River flows were well above average across the region with some reaching record levels.

The exceptional monthly average rainfall was overlain by repeated bands of heavy rain passing across the region during October and November. These caused a number of flooding incidents that followed on closely from one-another and lead to a high level of flood defence activity throughout this period. Flood Watches were in force somewhere in the Region for 21 days during the month of November. However, it was during the period from 29th October to 8th November that the majority of flooding to property in the region occurred. This report therefore focuses on that period and on central and south areas where the most significant flooding occurred.

It should be noted that although flooding was widespread with a total of 189 properties flooded in the reporting period in Central and South Areas, it was not unprecedented in recent years. The flooding of October 1998 was of a similar if not slightly greater magnitude.

The extent of flooding is summarised below in Table 1.1. The locations of flooding are labelled on Figure 1.1. Figure 5.1 also shows the extent of flooding using the national map template.

Table 1.1 Locations where > 10 properties were flooded

(October 29th – November 7th, 2000)

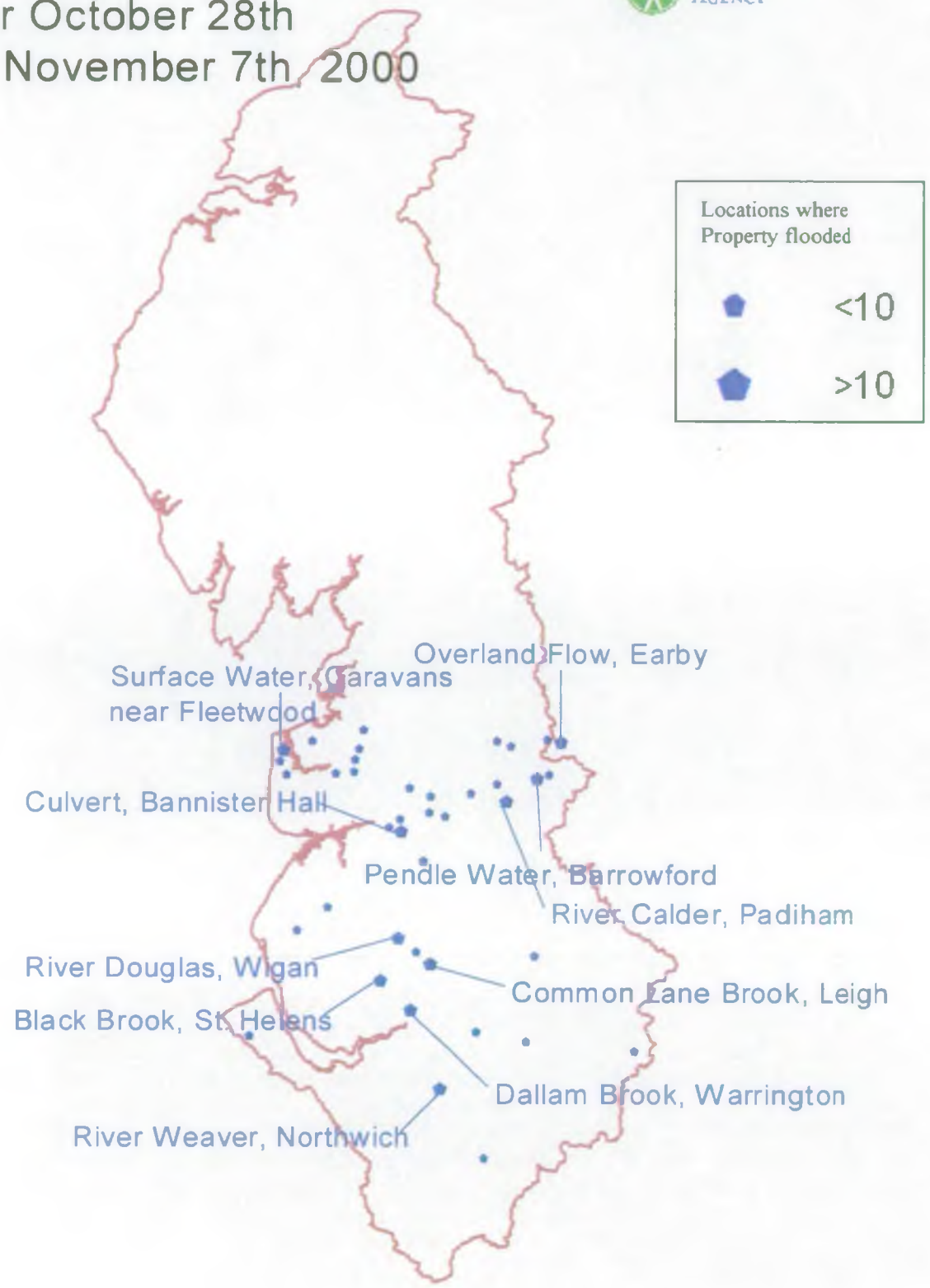
Location	Properties	Cause of Flooding	Main?
Calagran Caravan Park, near Fleetwood	20 caravans affected.	Surface Water. Pumping station was overwhelmed.	Surface water
Bannister Hall, near Higher Walton (Preston)	17 properties	Culvert capacity exceeded.	Non-main
Padiham	13 properties.	River Calder	Main+
Earby*	15 to 20 properties	Overland flow	Non-main
Barrowford	10 properties	Leak in flood defences on Pendle Water	Main
Adams Bridge area of Wigan**	6 properties, 35 evacuated	River Douglas	Main+
Leigh	16 properties (incl. church)	Common Lane Brook plus road drainage	Main
St. Helens	12 properties	Black Brook	Main
Dallam, Warrington	22 properties	Dallam & Sankey Brooks	Main
Northwich (30th October)	14 properties (incl. 1 residential) 2 evacuations	River Weaver	Main
Northwich (6th November)	13 properties (incl. 1 residential) 3 evacuations	River Dane, Weaver Navigation plus drainage	Main
All Other locations	64 properties + 9 caravans		
REGIONAL TOTAL	189 properties + 29 caravans		76% main

* Earby is in NE region, but within NW region's "public face boundary" (Lancashire)

** included even though < 10 properties flooded due to extensive disruption to town centre

+ the cause of flooding in these locations was not clear. Flooding apparently occurred from surface water, possibly due to the drainage systems being surcharged by high river levels.

Flooding locations for October 28th - November 7th 2000



2. EVENT MANAGEMENT

2.1 Procedures

The Flood Warning Service Strategy describes the roles and responsibilities of the Environment Agency and external organisations involved in flood incidents. It outlines the aims of flood defence and the Flood Warning Service and provides background information on aspects such as relevant legislation and other issues.

The Flood Warning Service comprises:

• Detection	Constant monitoring of weather, catchment and coastal conditions.
• Forecasting	Prediction of future river and sea levels.
• Flood Warning and Dissemination	Preparation of warnings for locations at which forecast levels might result in flooding and delivery of warnings to those at risk and to operational organisations.
• Response	Operating flood defences, keeping operating organisations fully appraised of flood threats.

The Flood Warning Service Document describes how the Environment Agency's Flood Warning Service is delivered in the North West Region. It outlines the following systems and procedures:

- The Flood Warning Service (one Regional and three Area Duty teams).
- The Flood Warning System (four stages of Flood Watch, Flood Warning, Severe Flood Warning and All Clear).
- Flood Warning Areas (Flood Watch Catchments; Specific Flood Watch Only Service; Flood Warning Areas and Tidal Flood Warning Areas).
- Roles and responsibilities of the Duty Officers including arrangements for leave, sickness, working hours directive, etc.
- Procedures for opening and closing the Regional Flood Forecasting (RFR) and Area Incident Rooms (AIR).
- Public relations.
- Flood detection, forecasting and warning dissemination.
- Response to flooding incidents.
- After flooding incidents.
- References to other documented procedures and manuals.

Guidance for Flood Warning Codes describes and explains the Flood Warning code system that was introduced across England and Wales from September 2000. It sets out the background behind their introduction and defines the codes, the areas that they cover and their use. It also covers the methods of Flood Warning dissemination and provides templates for messages (including voice, pager, loudhailer and fax messages).

The Flood Monitoring and Forecasting Manual sets out procedures for Regional Monitoring and Forecasting Duty Staff. It includes:

- Quick reference guide to personnel, Flood Warning Areas, Local Authority Boundaries, Rainfall Warning Areas and Flood Watch and Flood Warning Areas.

- Duty checklists for the Monitoring and Forecasting Duty Officer (MFDO), Assistant Forecasting Duty Officer (AFDO) and Assistant Monitoring Duty Officer (AMDO).
- List of alarm and warning stations and related actions and procedures.
- RFR procedures.
- Details of Flood Warning Areas including, for each catchment, a catchment overview and map, a chart showing Flood Warning Actions Summary including Flood Warning levels for each area, maps showing the Flood Warning Areas and plotting charts for the Flood Warning Areas.
- Tidal Flood Warning duties and procedures.
- Guidance notes for the use of equipment including telemetry, radar and satellite
- Appendices including the Business Continuity Plan, Northern Telemetry System (NTS) Equations, Dam Failure Procedures, Forms and Fax Templates.

2.2 Incident/Forecasting Room Times & HELPs/SITREP

Table 2.1 below summarises the key RFR and AIR statistics for the event.

Table 2.1 – Key Statistics for the Event

	RFR	South AIR	Central AIR	North AIR
Dates Agency Incident Rooms Opened*	28 October – 7 November	28 October – 8 November	28 October – 2 November	28 October – 29 October
Staff Number worked	40	68	48	25
Staff time worked	122 hours plus 40 overtime	1514 hours in total	583 hours plus 200 overtime	250 hours plus 200 overtime
Number of calls taken in Incident Rooms directly	324	500 – 1000	463 – 575	Estimated 100 – 500
Number of calls to Floodline	467,239 calls to Floodline in England and Wales			

* RFR and AIRs were opened and closed several times during this incident, see table 2.2 for more detail.

Table 2.2 gives the times that the RFR and AIRs were open during the course of the event, as recorded in the event files.

Table 2.2 – RFR and AIR opening times 28 October to 8 November 2000

RFR	South AIR	Central AIR	North AIR
	Open, 07:30, 28/10		
		Open, 08:05, 28/10	
	Close, 28/10	Close, 11:35, 28/10	
Open, 17:00, 28/10			Open, 17:00, 28/10
			Close, 19:00, 28/10
		Open, 20:30, 28/10	
			Open, 23:15, 28/10
	Open, 20:00, 29/10		Close, 02:15, 29/10
Close, 02:30, 29/10		Close, 02:15, 29/10	
Open, 10:00, 29/10			
		Open, 05:40, 29/10	
			Open, 07:15, 30/10
			Close, 08:30, 30/10
			Open, 07:15, 31/10
			Close 10:10, 31/10
			Open, 14:00, 31/10
Close, 16:00, 31/10		Close, 14:00, 31/10	Close, 17:30, 31/10
Open, 12:45, 1/11	Close 09:15, 1/11	Open, 07:00, 1/11	
Close, 21:45, 1/11		Close, 22:00, 1/11	
		Open, 09:00, 2/11	
		Close, 18:30, 2/11	
Open, 22:50, 2/11			
Close, 02:54, 3/11			
			Open, 07:30, 3/11
			Close, 15:00, 3/11
	Open, 13:00, 5/11		Open, 14:00, 5/11
Open, 20:00, 5/11			
			Close, 00:35, 5/11
			Open, 07:15, 6/11
			Close, 21:50, 6/11
Close, 03:45, 7/11			
Open, 08:45, 7/11			Open, 08:50, 7/11
Close, 20:10, 7/11			Close, 17:00, 7/11
			Open, 08:00, 8/11
	Close, 8/11		Close, 10:00, 8/11

Table 2.3 lists the times of all Regional and Area SITuation REPorts (SITREPs), as recorded in the event files and stated by the Agency. No Head Office Liaison Plans (HELPs) were issued in the North West Region during the reporting period.

2.3 Liaison, Communications

2.3.1 Internal

In general, internal communications during the event were effective. Communications between Area Incident Rooms (AIR) and the Regional Forecasting Room (RFR), and between AIRs and the Emergency Works Unit (EWU) worked well. EWU felt that the Regional Emergency Duty Officer (REDO) role working in conjunction with the Area Operations Duty Officers (ODO) proved very effective and communications between the two parties were good.

Area staff reported that procedures seemed to work well. Liaison went well and there was good communications with local authorities. However, it was felt that this could be improved on site and that better co-ordination could save resources.

Table 2.3 – SITREP times

Regional SITREP	South SITREP	Central SITREP	North SITREP
10:11, 30/10			
15:15, 30/10	15:20, 30/10		
	23:30, 30/10	23:00, 30/10	
	04:45, 31/10		
		08:38, 31/10	
	09:00, 31/10		
10:00, 31/10			
		12:33, 31/10	
15:10, 31/10	14:45, 31/10		
			09:00, 1/11
09:00, 1/11			
15:55, 1/11			
		20:33, 1/11	
22:00, 1/11			
10:00, 2/11			
15:00, 2/11			
	22:30, 2/11		
02:36, 3/11			
10:00, 3/11			
15:00, 3/11			
07:00, 4/11			
15:00, 4/11			
07:00, 5/11			
15:45, 5/11			
10:36, 6/11			
15:50, 6/11			
	22:00, 6/11		
	06:00, 7/11		
10:00, 7/11			
	13:30, 7/11		
15:00, 7/11			
	19:30, 7/11		
11:03, 8/11			

Note: Twice daily regional SITREPs (at approx. 10:00 and 15:00) continued until 16th November (beyond the end of the event in North West Region) due to the flooding elsewhere in the country.

2.3.2 Professional Partners

Professional Partners of the Agency include the Police, the Fire Service, Local Authorities and other organisations that are involved in providing and co-ordinating the response to a flood event. No significant problems with communications between the Agency and Professional Partners were reported.

Further details of issues arising from liaison and communications with Professional Partners are given in Chapter 8 and Appendix F.

2.3.3 Media and the Public

It was reported that communications with the public during the event were generally good. PR handled the event well. Details of issues arising from liaison and communications with the Media and the Public are given in Chapter 7 and Appendix B.

2.4 Numbers Of Staff Deployed, Range Of Functions And Inter Regional Co-Operation (Event Management Only)

Across the Region members of staff were sent out on site to co-ordinate operations and report on flooding problems. Water Resources were out doing high flow gauging.

The South Area AIR was staffed by up to 9 people at any one time. This level of staffing was higher than normally expected in order to handle the number of calls being received. A further 3 ODOs were also on duty during the event.

Central Area reported that during the event Emergency Works Unit, Customer Services, Flood Defence and Water Resources personnel were used. The Central Area AIR was staffed by five people - FWDO, ODO, two AFWDOs and 1 administration support staff. A further two members of Agency staff were enrolled in order to deal with the number of incoming telephone calls. It was felt that this level of staffing was adequate for the AIR. During the event, Central Area had only one Area Base Controller (ABC) available. Since the event a further three ABCs have been appointed and are undergoing training.

Table 2.4 summarises the numbers of different types of staff involved over the period 29th October to 2nd November (Note that this only covers the first part of the event).

Table 2.4 - Flooding of 29th October – 2nd November 2000, North West Region Who was involved?

Area	Who	Numbers
North Area	Flood Warning duty staff	8
	Total North	8
Central Area	Flood Warning duty staff	16
	Operations staff	8
	Flood Warning and hydrometry on site	9
	Support staff	9
	Total Central	42
South Area	Flood defence staff (inc. flood warning and operations duty)	44
	Support staff and Flood Warning duty staff from other functions	20
	Total South	64
Region	Flood Warning duty staff	18
	Other staff inc. RCC, telemetry support, switchboards, PR, etc.	18
	Total Regional	35
EWU		120
TOTAL		270

A similar breakdown for the second part of the event (over the first weekend in November 2000) was not available. However Table 2.5 shows the number of people involved in Regional and Area offices for the whole event (the period of 28th October to 7th November), and includes details of the number of shifts and hours worked.

Table 2.5 - Summary of people involved (Region and Area) for the whole event including numbers of shifts and hours worked

	Region	South	Central	North	Total
Number of people involved	40	68	48	25	181
Number of shifts worked	12	38	20	6	76
Number of office hours	122	Not given	583	250	955+
Number of out of office hours	40	Not given	319	200	559+
Total number of hours worked	162	1514	902	450	3028

The office hours for Regional staff include all hours when the RFR was open. Regional out of office hours include time when MFDOs were monitoring at home.

Further details of the numbers of staff deployed in the field, including EWU, are given in Chapter 6 Emergency Response.

2.5 Scale Of Calls Received

Table 2.6 summarises the number of calls received by the North West Region during the event as far as it has been able to determine this figure.

Table 2.6 – Number of calls received*

	RFR	South AIR	Central AIR	North AIR	Total
No. calls received	324	500 – 1000	463 – 575	Not calculated for this period but 100-500	1350 - 2400

* This number has not been comprehensively recorded to date. However, it is felt that sufficient detail for event planning is available. Calls relating to the flooding incident (and sometimes not relating) come through to the incident rooms by many different channels including Floodline, RCC, Area Office Switchboards and mobile phones.

The Flood Warning Event Log for the flood event of 29th October to 31st October lists 324 telephone calls made and received from the Regional Forecasting Room.

2.5.1 South Area

South Area were not able to provide details of the exact number of calls received during the compilation of this report (a significant amount of work going through event files would be required). However, they reported that they received a 'large' number of calls and required an increase in the number of staff to cope. Eight or nine people staffed the South AIR during this event, with up to a further four operations duty staff active (one ODO and 3 assistant ODOs). All handled calls from the public during this event. Unlike Central Area, South Area did not feel that the number of calls received during this event exceeded all previous events (Autumn 1998 being one example where more calls were received).

2.5.2 Central Area

Central Area reported that during this event the Central AIR received more telephones calls from members of the public than any previous event. During the event several members of the public phoned in asking for river information, some because they had

experienced problems accessing Floodline. This was probably due to the number of calls it was receiving during the national event.

Central Area reported 463 calls recorded as being received by the AIR over the period. As well as the normal five members of staff in the AIR, a further two people were required to handle the telephone calls being received. A number of calls (an estimated further 20%) were also received from members of the public on other telephone lines. These were handled by other Agency members outside the AIR.

2.6 Issues Arising And Recommendations

2.6.1 National Level Issues And Recommendations

- Concerns were expressed that once the National Incident Reporting System (NIRS2) comes into operation the RCC will not be able to handle the volume of calls coming into the Region.
- The Regional Flood Defence Manager (RFDM) felt that there was confusion regarding the identification and communication of requirements for inter-regional aid, particularly at his level of management. There was also a query as to where the response for inter-regional aid requests should be made.
- The demand for timely and accurate information on the flooding across the region was intense. The event highlighted the difficulty of obtaining and co-ordinating such information and consideration must therefore be given to how this task is managed both during and after events.
- Training is needed for staff carrying out the Regional Base Controller (RBC) and Area Base Controller (ABC) roles.
- Areas find it difficult to keep to the Working Hours Directive during a long event due to insufficient numbers of Flood Warning Duty Officers (FWDO).
- A paper listing key points clarifying the role of the Duty Strategic Manager (DSM) is to be presented to Regional Management Team (RMT).

2.6.2 Regional Level Issues and Recommendations

The following Regional level issues and actions were raised at the Regional Flood Event Debrief:

- The concerns expressed over the volume of calls once NIRS2 comes into operation affects RCC. The Regional Flood Warning Team (RFWT) is to raise this issue with the relevant Regional staff.
- There is an action on the RFWT to obtain procedures for inter-regional aid from National.
- The point was raised that the media seem to have a better knowledge of locations of flooding incidents than the Agency. It is understood that the media have hotline numbers into the Police and Fire Service where they can gain up to date information. The Agency is to obtain telephone numbers of all emergency service hotlines and consider using a member of staff during an event to contact the numbers, collate the relevant information and feed into the SITREPs.
- There was an intense demand for timely and accurate information on the flooding across the region. This event highlighted the difficulty of obtaining and co-ordinating such information and RFWT and AFWTs are giving consideration to how this task is managed both during and after events.

- Cumbria Police and Fire have agreed to fax any reports of flooding and road closures to North Area Incident Room. There is an action on Central and South to consider obtaining similar information.
- Areas have requested that SITREPs be put on to Bulletin Board.
- It was sometimes difficult to contact the key players at Area (i.e. Area Base Controller (ABC), REDO) during events. It was felt that these key players should not be reacting to calls but should be sitting back and taking an overview of the event. There is an action on Areas to look at their procedures.

On the issue of staffing, the Regional Flood Event debrief raised the following point, as well as those already raised above (under national issues):

- Issues with Terms and Conditions for duty staff and EWU were raised, particularly as a result of the impact on home and family life. Consideration is to be given to raising this issue at the next RMT.

Individual Areas have also reported the following issues and recommendations, arising from their own debrief sessions.

2.6.3 South Area Issues And Recommendations

South Area reported the following issues from their experiences during this event:

- The Incident Room fax machine ran out of toner. No replacement could be found so the toner was exchanged from the machine upstairs. Toner has been ordered and is to be made available in Incident Room.
- Problems were experienced when diverting the switchboard. Instructions will be created and placed in FWDO manual and this is also to be included in training sessions.
- There was a query as to whether all AFWDO1s could be trained on Surefax systems.
- There was a query over the procedures for issue of warnings to Railtrack based on the Audlem trigger level (Flood Watch update). The procedures are to be included in the next training round.
- A problem with the Flood Warning Macro was found during the generation of a tidal fax. This is to be addressed by Region.
- FWDO commented that contact with FDOps via the ODO worked well in the Incident Room.
- ODO commented that it was difficult to liaise at Regional level. There is a need to keep REDO informed but liaison arrangements may be reconsidered.
- Consideration is to be given to having up to one hour overlap at handover of shifts.
- Consideration is to be given to providing an Assistant Operations Duty Office in the Incident Room (ideally a knowledgeable member of Flood Defence Staff).
- There is an issue with regard to the effect the sluices in Northwich have when they are operated. Liaison with British Waterways is required regarding the operation of the sluices.
- Procedures are to be amended to ensure that residents in Wigan are informed when the basins at Lilford are ¾ full. Wigan was not informed during this event.
- Consideration is to be given to the purchase of radios, as mobile phones do not work well in certain areas. The early despatch of PA operators is required as some got caught in traffic during this event.

2.6.4 Central Area Issues And Recommendations

Central Area reported the following issues and recommendations arising from the event:

- Central Area have appointed three Area Base Controllers, who are undergoing training.
- Central Area had problems distinguishing various external calls coming into the Area Incident Room; these were mainly calls from the public being transferred from the Regional Control Centre (RCC). (Action on Central Area to provide RCC with one extension number for transferring through these calls).

3. FLOOD FORECASTING

3.1 Overview Of Flood Forecasting And Weather Monitoring

Monitoring and Forecasting Duty Officers (MFDO) are responsible for checking the rainfall, river conditions and the weather forecast twice daily. Systems available to the MFDOs include:

- their own portable PC, which links into the Northern Telemetry System (NTS), allowing access to river level, rainfall, weather radar and tidal levels and forecasts;
- CIRRUS, which allows raingauge and river level sites to be dialled up directly and data downloaded;
- MicroRadar software that backs up the NTS radar displays;
- WRIP also provides river level/flow data, raingauge data and radar data as well as being a forecasting tool for rainfall-runoff models.

At Region, weather forecasts are received from the North West Bulletin Board (morning) and from the Manchester Weather Centre (afternoon). Area offices receive twice-weekly bulletin forecasts.

During severe conditions, Severe Weather Warnings may be issued by the Meteorological Office. These are faxed by the Met. Office to the Environment Agency's Thames Barrier Control Room who forward the Warning on to the Agency's Regional offices. The Regional office forwards forecasts and Warnings to Area offices or AIRs as appropriate. Information is also passed on to Area offices by telephone.

A forecast summary is filled out on a daily basis, whether an event is in progress or not. The MFDO also receives Warnings from external agencies and computer generated alarms (for example, from NTS).

The MFDO acts upon the current monitoring conditions and any alarms received according to his judgement. If the situation merits, the Regional Forecasting Room will be opened.

Once the Regional Forecasting Room is open, hand plots are made of river levels/flows in critical catchments (where the levels/flows have reached Agency standby levels). Forecasting models including simple peak-to-peak correlation and rainfall run-off models are available for some locations. The models and hand plots are used to provide best estimate river level forecasts, which are passed to FWDOs in the Area offices to support their decisions to issue Flood Watches and Warnings if necessary.

3.2 Weather forecasting

3.2.1 Availability Of Weather Forecasts

The North West Region of the Environment Agency receives information from the Meteorological Office in various forms:

- Daily written forecasts issued at 10 a.m. and posted on the Agency's bulletin board
- NIMROD radar pictures forecasting rainfall up to 6 hours in advance.

- A series of Warnings issued by the Met. Office in Bracknell (received in the North West via Thames Barrier) and by Met. Office Manchester Weather Centre.
- Direct telephone contact between the MFDO and the Met. Office duty forecaster at Manchester.

Warnings received include:

- Heavy Rainfall Warnings
- Severe Weather Warnings
- Thunderstorm Warnings
- Gale Warnings
- Storm Surge Forecasts

The most specific weather forecasts are provided by telephone, and it is primarily these that the MFDO uses, in combination with other information (such as catchment conditions) to advise FWDOs on the possibility of flooding. However, telephone forecasts can change frequently and are difficult to record quantitatively. The bulletin board forecasts have therefore been used to quantify the accuracy of the weather forecasts received during the period covered by this report.

The other forecasts are generally a lot less specific in terms of predicting an exact amount of rainfall over the forecast period. The Manchester Weather Centre (MWC) produces rainfall warnings covering all of north west England with predictions of the degree of rainfall expected on each major catchment. The Meteorological Office issue Severe weather Warnings that are generally on a national basis. Due to the particular nature of this event the Meteorological Office also issued a daily special service forecast, although this also tended to be on a national level with little specific data about rainfall in the north west.

3.2.2 Accuracy Of Weather Forecasts

The bulletin forecasts break down the North West Region into three areas – Cumbria & Pennines north of Ribble; Remainder of Lancashire; and Greater Manchester, Cheshire, Merseyside. These broadly coincide with the Area divisions of the Environment Agency North West Region (North, Central and South respectively). The Wyre and Lune catchments, however, are under the 'north of Ribble' part of the forecast, whereas they fall into the Agency's Central Area. Generally the North West bulletins give an exact number of millimetres rain expected over the forecasting period. The bulletins cover periods of up to 72 hours from the time of the forecast.

Table 3.1 summarises the weather forecast accuracy for six of the catchments in the North West Region.

Tables 3.2 and 3.3 give a more detailed (gauge station level) comparison of the forecast level of rainfall with the actual rainfall received for the period 28th October to 7th November. Note that the values given in Table 3.3 for Central Area raingauges do not tally exactly with those stated later in Table 5.4. This is because Table 5.4 gives 24-hour values for 9 a.m. to 9 a.m. whereas these values are midnight to midnight. The values from Tables 3.2 and 3.3 are illustrated as bar charts in Figures 3.1 and 3.2, for ease of comparison.

South Area

By comparing the forecast values for South Area (taken to be 'Greater Manchester, Cheshire and Merseyside' from the MWC bulletin board forecast) with the averages of the actual rainfall it can be seen that the general tendency is for the forecast to overestimate the amount of rain, especially towards the end of the event. The average overestimate is 7.5mm, but the forecast was up to 15 mm over at one station on one day. On three days the forecast produced an excellent prediction – being within 2 mm of the actual rainfall for that day.

On one day, 30th October, the forecast grossly underestimated the rainfall. 19.0 mm was forecast and an Area average of 30.2 mm experienced. The underestimate was most pronounced at Holdenwood rainfall station in the Irwell catchment, which received 58.0 mm on this day.

South Area felt that there was room for improvement in forecasting accuracy and frequency. The month prior to this event was exceptionally wet and catchments were saturated. This meant that even a small amount of rainfall on the flashy catchments could trigger a flood incident. It was felt that hourly updates of rainfall forecasts would be helpful in such an instance as the issue of Flood Watches is dependent on accurate rainfall forecasting. Hourly updates would enable Area to handle the issuing of Flood Watches more effectively. It was stated that the current forecasting meant that occasionally Flood Watches were issued when they were not appropriate (leading to the possibility of 'crying wolf') and also vice versa – Flood Watches were not issued when perhaps they should have been.

Central Area

Again, the forecast values for Central Area (taken to be 'Remainder of Lancashire' from the MWC bulletin board forecast – i.e. Lancashire from the Ribble and south) generally overestimate the amount of rainfall, up to an overestimate of approximately 20 mm on a couple of days. The average overestimate was approximately 13mm. Again, on three days the forecast was within 2 mm of the actual rainfall.

Also (as for South Area), on 30th October the forecast grossly underestimated the rainfall, predicting 23 mm when the actual average received was 60.1 mm. On this day Abbeystead, in the Wyre catchment, received 82.8 mm rainfall.

Considering 31st October, however, it can be seen that the MWC forecast overestimated the rainfall by up to 22 mm. At an hourly level the data shows that a significant proportion of the rainfall of 30th October was late on in that day. In other words, over the two days the forecast magnitude of rainfall was closer to the actual rainfall than it initially appears, but the heavy rain was experienced earlier than originally forecast.

Forecast Updates – Telephone & Email

As stated above, the MFDO primarily uses telephone updates of forecasts to advise FWDOs on the possibility of flooding. Telephone notes, copies of emails and rainfall warnings from MWC, recorded in the event files, show that the heavy rainfall on 30th October, while initially forecast for later on (31st), was picked up and a warning issued. For example, a Rainfall Warning was received from MWC at 17.01 on 29th October identifying that up to 18 mm of rainfall was expected in 6 hours or less over catchments 11 – 14 (essentially the South Area of North West Region). Rainfall of approximately this volume was duly recorded at stations in the Irwell, Mersey and Weaver & Gowy catchments.

In conclusion, the MWC weather forecasts are generally to what could be termed an 'acceptable' level of accuracy. On occasion the actual rainfall varies significantly to that originally forecast but a revised forecast is usually issued prior to the event, either by telephone or as a Rainfall Warning. There was a feeling from South Area that more frequent updates to the weather forecasts would assist in issuing Flood Watches and Flood Warnings.

3.3 Agency Telemetry Outstation Availability And Robustness

There were very few problems with telemetry communications availability during the event. Outstations were robust with one exception – Central Park in Wigan. Much of the flooding was on smaller watercourses, which are not gauged. There is therefore no telemetry data for these watercourses.

3.3.1 South Area

In South Area, Hydrometric Staff were called upon to check the operation of a number of telemetry outstations that were thought to be giving incorrect data. These are summarised in Table 3.4.

Table 3.1 – Weather Forecast Accuracy

Date (24 hours starting at 00.00 on...)	Douglas		Irwell		Mersey		Ribble		Weaver & Gowy		Wyre		Daily success rate
	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	Forecast	Actual	
28/10/2000	21.0	13.2	11.0	10.8	11.0	9.0	21.0	23.8	11.0	7.8	28.0	19.0	67%
29/10/2000	13.0	10.6	9.0	12.8	9.0	16.2	13.0	24.8	9.0	11.5	26.0	12.2	50%
30/10/2000	23.0	53.2	19.0	36.6	19.0	29.8	23.0	48.8	19.0	20.8	30.0	82.8	17%
31/10/2000	30.0	5.4	22.0	7.9	22.0	7.4	30.0	10.4	22.0	4.2	35.0	7.6	0%
1/11/2000	30.0	6.4	10.0	8.7	10.0	9.2	30.0	26.0	10.0	1.6	45.0	34.2	50%
2/11/2000	26.0	16.6	22.0	11.1	22.0	11.8	26.0	31.4	22.0	10.6	29.0	18.2	0%
3/11/2000	26.0	21.4	15.0	12.1	15.0	10.3	26.0	9.2	15.0	2.0	26.0	6.0	50%
4/11/2000	20.0	5.0	16.0	8.3	16.0	7.6	20.0	0.2	16.0	10.4	40.0	12.0	0%
5/11/2000	20.0	16.6	10.0	4.9	10.0	21.4	20.0	7.0	10.0	14.8	27.0	6.8	33%
6/11/2000	20.0	3.4	16.0	6.9	16.0	43.0	20.0	28.2	16.0	20.3	18.0	13.0	33%
Catchment success rate	30%		40%		30%		20%		50%		10%		

Notes:

The forecast values above have been taken from the daily bulletin board forecasts from the Manchester Weather Centre. Irwell, Mersey and Weaver & Gowy forecasts were taken from the Greater Manchester, Cheshire and Merseyside part of the forecast; Wyre forecasts from the Cumbria and Pennines North of Ribble part; and Ribble and Douglas from the Remainder of Lancashire part. Actual rainfall was obtained from the gauge stations named above. For the purposes of this table, the forecast is deemed to be 'successful' if it falls within ± 5mm of the actual rainfall. Where the forecast is > 5mm less than the actual, the value is underlined; where the forecast is > 5mm over the actual the cell is shaded.

Table 3.2 - Forecast comparison - South

Date	MWC Forecast	Average South Area	Holden Wood Irwell	Hollingworth Irwell	Mowcop Weaver & Gowy	Ringley Irwell	Woodhead Mersey	Worleston Weaver & Gowy
28/10/2000	11.0	9.5	17.2	8.4	9.4	6.8	9.0	6.2
29/10/2000	9.0	12.9	14.0	13.2	10.8	11.2	16.2	12.2
30/10/2000	19.0	30.2	58.0	20.4	17.8	31.4	29.8	23.8
31/10/2000	22.0	6.6	10.6	5.8	7.0	7.4	7.4	1.4
01/11/2000	10.0	6.4	3.6	11.8	1.0	10.8	9.2	2.2
02/11/2000	22.0	11.1	9.2	9.4	10.8	14.8	11.8	10.4
03/11/2000	15.0	8.4	11.2	8.4	2.6	16.8	10.0	1.4
04/11/2000	16.0	8.9	9.4	10.6	7.4	5.0	7.6	13.4
05/11/2000	10.0	10.9	5.8	4.4	21.0	4.4	21.4	8.6
06/11/2000	16.0	17.4	10.2	7.8	23.6	2.6	43.0	17.0
07/11/2000	5+	9.4	8.2	6.0	8.6	3.4	24.4	5.8
Total	150.0	131.7	157.4	106.2	120.0	114.6	189.8	102.4
Maximum	22.0	30.2	58.0	20.4	23.6	31.4	43.0	23.8
Average	15.0	12.0	14.3	9.7	10.9	10.4	17.3	9.3
Median	15.5	9.5	10.2	8.4	9.4	7.4	11.8	8.6
Standard deviation	4.9	6.8	14.9	4.4	7.2	8.4	11.4	7.0

Figure 3.1 – Forecast Comparison – South Area

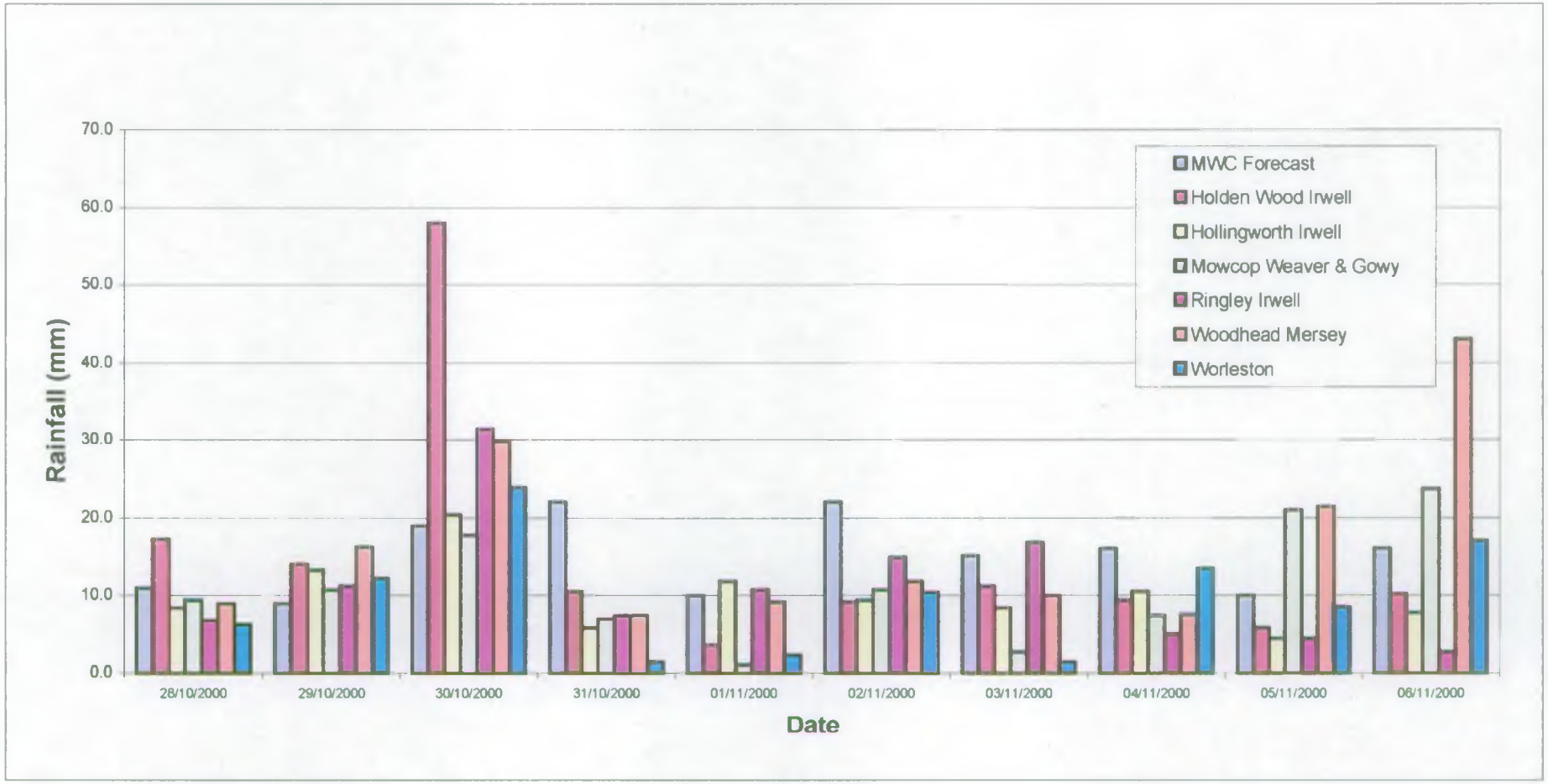


Table 3.3 - Forecast comparison - Central

Date	MWC Forecast	Average Central Area	Abbeystead Wyre	Far Gearstones Ribble	Worthington Douglas
28/10/2000	21.0	22.2	19.0	23.8	13.2
29/10/2000	13.0	20.6	12.2	24.8	10.6
30/10/2000	23.0	60.1	82.8	48.8	53.2
31/10/2000	30.0	9.5	7.6	10.4	5.4
01/11/2000	30.0	28.7	34.2	26.0	6.4
02/11/2000	26.0	27.0	18.2	31.4	16.6
03/11/2000	26.0	8.1	6.0	9.2	21.4
04/11/2000	20.0	4.1	12.0	0.2	5.0
05/11/2000	20.0	6.9	6.8	7.0	16.6
06/11/2000	20.0	23.1	13.0	28.2	3.4
07/11/2000	5+	10.7	3.6	14.2	5.8
Total	229.0	221.1	215.4	224.0	157.6
Maximum	30.0	60.1	82.8	48.8	53.2
Average	22.9	20.1	19.6	20.4	14.3
Median	22.0	20.6	12.2	23.8	10.6
Standard deviation	5.2	15.9	22.6	13.8	14.2

Figure 3.2 – Forecast Comparison – Central Area

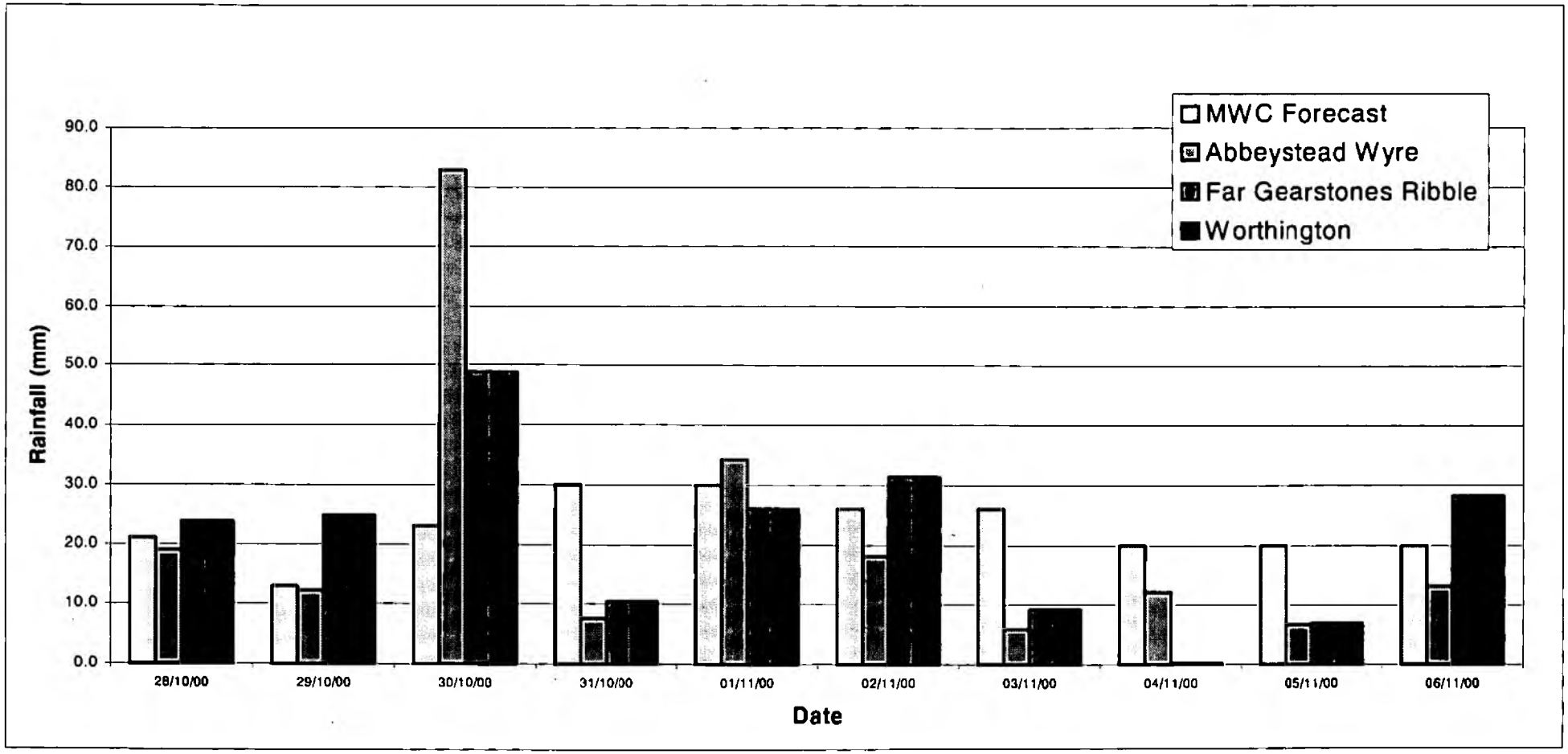


Table 3.4 – Summary of telemetry outstations thought to be giving incorrect data

Site Name	Station Type	Comments
Holden Wood	TBR*	A phone line fault was reported. BT had disconnected the line ahead of proposed work.
Hayfield New Mills	TBR	Incorrect rainfall totals were being reported. This was traced to Telegen problems and passed to NTL. The fault was rectified, although some data lost.
Audlem	River Level	There was a query as to whether the well was blocked. Checks revealed that there was nothing wrong with the well.
Congleton Park	River Level	There was a query as to whether there was anything wrong as the trace had a rapid level change. Checks revealed nothing wrong.

*TBR = Tipping Bucket Raingauge

The telemetry outstation at Lilford Park was unavailable during the event due to equipment being changed over to the North Telemetry System (NTS). However, the Lilford Park level could be obtained via an alternative outstation on the old system and was monitored by Regional and Area staff.

There were no problems reported with South Area outstation robustness during the event.

3.3.2 Central Area

There were no reported problems with Central Area telemetry communications availability during the event.

Central Area reported that outstations were robust with one exception - Central Park at Wigan. In this Area the flood forecast from Region was too late to give Area and residents time to react. Analysis of the event showed that there had been a blockage of the new level recording equipment on site. This meant that during the event the level shown in the forecasting room was actually less than in reality. The low rate of rise was not picked up at the time as the station is new and therefore there was no historical data with which to compare the event.

As flood levels increased, the blockage was blown out and the river level in the gauge rose dramatically to its true level. Central Area staff have investigated the cause of the blockage and are making improvements to the site. The Central Park station is also now regularly checked for blockages. The forecasting model for Wigan is being reviewed, in the light of this event, using recent data. NCPM are waiting for an Area request to enable feasibility work on any possible improvement scheme to be brought forward.

The Central Area report also makes reference to a lack of telemetry in the Ribchester Flood Warning Area. A river-gauging station is now almost complete in Ribchester within the Flood Warning Area.

3.4 Ability Of Agency To Predict The Actual Flood Levels Using Their Current Models (Predicted Vs. Actual Levels)

A detailed appraisal of the North West Region's flood forecasting system is given in the paper Evaluation of forecast accuracy for the floods of October and November 2000, presented by Chris Tomlin of the Agency's North West Region. The following section draws on information and text presented in that report to summarise river level forecasting during this event.

The early forecasting of river levels is a significant problem in many of the catchments of the North West Region. In Central Area the catchments are often of a steep nature and the rivers have a rapid response to rainfall. This causes problems with early warning in places such as Wigan, Reedyford and Ribchester. In South Area, forecasting of Flood Warnings at Woolley Bridge is complicated by the fact that it is at the top end of the catchment and there are reservoirs upstream. Forecasting in Northwich is made more difficult by the operation of British Waterways' sluices that influence the level of the River Weaver.

Forecasting of river levels is carried out at RFR. The level forecasts are monitored by AIRs, who may supply Region with additional information, judgement or experience in order to revise the forecast.

The floods of October and November 2000 were of exceptional severity and were a severe test of North West Region's forecasting models and operational rules. Although the overall performance of both was satisfactory, shortcomings at a number of sites became apparent. Evaluation of forecast accuracy for the floods of October and November 2000 looked at eight sites in Central and South Areas in detail and both site-specific and general recommendations were made, which are reproduced in the Issues and Recommendations section of this Chapter. The sites evaluated were as shown in Table 3.5. For each of the sites hydrographs for the events are contained in Appendix I.

Table 3.5 – Details of sites evaluated

Site name	FW Area	River	Date of floods
Brinksway, Sale Ees, Didsbury	Northenden and Didsbury	Mersey	30/10, 5-6/11
Stubbins	Strongstry and Chatterton	Irwell	30/10
Hayhurst Bridge	Northwich	Weaver	30/10
Garstang Flood Control Scheme	Garstang	Wyre	30/10, 31/10, 1/11
Woolley Bridge	Woolly Bridge	Etherow	30/10, 5-6/11
New Jumbles Rock	Ribchester	Ribble	30/10, 31/10, 2/11
Central Park	Wigan	Douglas	30/10
Croston Mill	Croston	Douglas	30/10, 31/10, 2/11

3.4.1 South Area forecasting

Northenden and Didsbury (Brinksway/Sale Ees/Didsbury)

Water levels in the Sale Ees and Didsbury basins are controlled by manually operated sluice gates in the banks of the Mersey; in turn, the operators at each site use the river levels at the sluices as a guide for gate operations.

Forecast and observed levels at Brinksway are used to manage the Sale Ees and Didsbury basins. Levels at Brinksway are forecast using either the upstream water

levels or by using a radar rainfall-based transfer-function model. For these events it appears that only the upstream water levels method was used.

Chris Tomlin's report considers forecasting and the operation of the gates in detail. During the first event both sets of flood gates remained closed (although the level in Didsbury basin did rise, presumably due to direct run-off into the basin). The first forecast made was very accurate, while the second over-estimated the peak.

During the second, more significant, event both basins were operational. Again, forecasting was generally accurate, and although one forecast over-estimated the level by 619mm this forecast was produced with a lead time of almost 5 hours.

Site specific recommendations were as follows:

- The forecasting technique used is sound, provided that the lead time does not exceed four hours.
- The Didsbury basin fills much quicker than Sale Ees, so perhaps the gate settings for the former are too low. Consideration should be given to reviewing the gate settings for *both* sets of sluices, although it is understood that these settings have been reviewed in detail in the past.

Strongstry and Chatterton (Stubbins)

Chatterton and Strongstry are two small villages beside the River Irwell. A total of 58 properties are considered to be at risk from fluvial flooding. The existing flood defences are about a 1 in 12 year standard. A new flood defence scheme for the villages has been proposed, but construction of it has not yet started. Warnings for the villages are issued from river level forecasts made based on observed and forecast levels at Stubbins gauging station. A maximum forecast lead time of one hour is generally used, due to the often rapid nature of the rise of the Irwell.

A WRIP model exists for Stubbins, but it does not appear to have been used during this event. Of the three hand plot forecasts made, two were very accurate, the third was not (the third predicted a further rise in river level when the rate of rise had already slowed considerably).

Chris Tomlin's report does not make any site specific recommendations for Stubbins, but does conclude that a comparison of the hand plots to the WRIP model would be interesting.

Northwich (Hayhurst Bridge)

Northwich stands at the confluence of the River Weaver and the River Dane. Northwich has historically suffered subsidence, which has exacerbated its flooding problems. Current estimates suggest that 70 properties, mainly commercial, are at risk in Northwich. Overtopping of the existing banks has occurred in events with as low as a 1 in 5 year return period. As the Weaver through Northwich is canalised (the Weaver Navigation), British Waterways Board (BWB) are responsible for keeping the river level at this point at 1.2m above station datum. This is achieved through the use of sluice gates, which are fully opened during flood events. BWB are supposed to inform MFDO when the gates are fully open.

Warnings for Northwich are based on river levels at Hayhurst Bridge. The forecast for Hayhurst Bridge is based on flows observed at Ashbrook, on the Weaver, and Rudheath, on the Dane.

Chris Tomlin's report considers the forecasting in detail, but in general forecasts for the first flood event were acceptably accurate, whereas those for the second event (especially the earlier ones) were less accurate, probably due to the lead times involved. Site specific conclusions are:

- Is the forecasting system too complicated? Consider reviewing and revising.
- The forecast lead time should be limited, as early forecasts are often inaccurate.
- Obtain BWB sluice data for Hayhurst Bridge (if possible) so that exact position of sluice is known in real-time (see below).

South Area commented that there were some issues with late issuing of the Flood Warning for Northwich. However, it was felt that this was more due to issues with timing and accuracy of weather forecasts than level forecasting. A meeting has been set up with BWB in order to clarify the operating regime of the sluices on the Weaver Navigation.

Rochdale

South Area commented that updated data for the Rochdale forecasting model is currently being reviewed. It is hoped that this, along with the adoption of a further gauging station into the forecast, will assist in improving the timeliness and accuracy of level forecasting for Rochdale.

3.4.2 Central Area forecasting

Garstang (Garstang)

The Garstang Flood Control Scheme on the River Wyre consists of two manually operated gates that control the flow into a large flood storage basin, protecting Garstang to a 1 in 50 year standard. Gate operations are controlled by the FWDO at Preston. For the three events listed at Garstang in Table 3.5 the basin was slightly full, nearly full and barely full respectively.

The event hydrographs show that the flood control basin at Garstang is very effective at reducing the flood peaks in the river and that the gates are being operated in accordance with the control rules.

Chris Tomlin's report concludes that the forecasts produced for Garstang are generally conservative, and that the lead time is short (two hours at most). Forecasting at Garstang is complicated by the interaction between the Wyre, the Garstang FCS and the ponds just upstream at Scorton. The Warnings issued at Garstang allow local landowners to move stock to safer areas, which may be one reason why the forecasts are slightly conservative. Specific recommendations for Garstang were made as follows:

- A careful watch should be kept on the basin level at Garstang. As the basin becomes full, spillage from it will cause a flood peak in the Wyre (it should be noted that spillage begins well *before* the basin is full)
- A storage curve for the Garstang basin should be derived in order to improve forecasting.

- Level forecasts would be improved if the gate opening, and its consequent effects, were considered.
- No forecasts appear to have been made for the second event at Garstang, which was the most severe of the three that occurred on 30th October to 1st November.

Woolley Bridge (Woolley Bridge)

Woolley Bridge carries the A57 over the River Etherow in the town of Hadfield. The Etherow catchment is hydrologically complex, most of it draining through the Longendale chain of reservoirs. Although the reservoirs attenuate moderate floods, the overflow channel from the top four reservoirs flows directly into the Etherow, which can give rise to a flood pulse arriving very quickly at Woolley Bridge.

There are two level loggers used for issuing Warnings here: Woolley Bridge and Woolley Bridge Gates. For the events of 30th October and 5th/6th November 2000 the levels at Woolley Bridge Gates were not used. The hydrograph in Appendix I is for Woolley Bridge.

Seventy properties are at high risk of flooding at Woolley Bridge, including an industrial estate, which is protected by a pair of moveable gates at Sterling Bridge. Chris Tomlin's report concludes that the operation of the gates conformed to the control rules and that the on-site operator was able to use his judgement and experience to decide when to close the gates.

Specific conclusions and recommendations for Woolley Bridge include:

- Consideration be given to integrating North West Water's operation of the reservoirs at Longendale, including water releases, and the Agency's flood forecasting and Flood Warning.
- The accuracy of the forecasts at this site depend entirely on the skill of the forecaster. While the experienced forecasters who predict levels at Woolley Bridge are doing as good a job as a well-calibrated model, new operatives would likely perform worse. Consideration should be given to the provision of a mathematical model to assist in forecasting at this site.

Ribchester (New Jumbles)

Ribchester is a small town on the right bank of the River Ribble, about 7km downstream of New Jumbles Rock gauging station. Flood Warnings for Ribchester are based on the 1 hour ahead forecast at the gauging station, which is 1 hour's flow time above Ribchester – i.e. a two hour ahead forecast for the town can be achieved.

The initial forecasts for the first event, 30th/31st October, were quite poor, with significant underestimates of the levels. These forecasts also had short lead times (less than 80 minutes in all cases). The last forecast for that event was more accurate. For the second event, only the first forecast (of three) is accurate, although the second and third forecasts were made with long lead times. Severe Flood Warnings were issued on the basis of the forecasts at Ribchester, but the forecast levels were not reached. An in-zone gauging station is almost complete above Ribchester, which will allow far greater accuracy in forecasting to be achieved.

Chris Tomlin's report makes a detailed appraisal of the forecasting at Ribchester for the events of 30th October to 1st November. Site-specific recommendations are as follows:

- The current forecasting procedure for Ribchester is adequate provided that the forecast lead time is 90 minutes or less and the experienced personnel who know the Ribble catchment are in charge of forecasting and the issuing of warnings.
- For the Ribble, more attention should be paid to the hydrographs at the upstream gauges, particularly Henthorn.
- The range of the level logger at Ribchester should be increased. During this event it reached a maximum level and then appeared to have reset itself.

Wigan (Central Park)

The Central Park Flood Warning Area includes a total of 82 properties at risk from fluvial flooding from the River Douglas in the Scholes District of Wigan and around Adams Bridge. There are no forecast models for the Wigan FW Area. Trend plotting and judgement are used to forecast levels. During the event of 30th October a WRIP forecast was made, although this was disregarded at the time. Site-specific recommendations are as follows:

- There is an urgent need for a suitable flood model for Central Park, Wigan. This could include investigation and development of the WRIP model.
- It seems odd that no forecasts were made for this site. The Warning Log notes that better forecasts are needed here.

It should be noted, however, that it has not been confirmed whether the flooding in Wigan was solely due to overtopping from the main river. It is believed that drainage systems became surcharged due to the high river levels and that this also contributed to the flooding.

Croston

Croston Mill gauge is located on the River Yarrow, at the top end of the Croston Flood Warning Area, which includes a total of 359 properties at risk of flooding. Warnings for Croston are based on levels at Croston gauge. Only one forecasting model is available, which is a rainfall-runoff WRIP model using radar rainfall as an input.

There was very little in the way of flood forecasting at Croston Mill with a single level forecast for each of the two flood events. Both forecasts were accurate, although the lead time for one of the forecasts is short (1 hour 22 minutes in this case, usually it is 3 hours). Chris Tomlin's report concluded that both of the forecasts were good.

3.5 Impact Of Any Inaccurate Flood Forecast

At Central Park in Wigan the blockage of the level recording equipment meant that the rise of the river was not initially recorded. Issue of a Flood Warning was therefore delayed – the poor lead time left no planning time for residents, the council and emergency services.

Further details on the influence of flood forecasting on the issue of Flood Warnings are given in Chapter 4 Flood Warning.

3.6 Issues Arising And Recommendations

Issues arising from weather forecasting include:

- Weather forecasts are generally 'acceptably' accurate.
- On occasion the actual rainfall varied significantly to that originally forecast but a revised forecast is usually issued prior to the event, either by telephone or as a Rainfall Warning.
- More frequent updates to the weather forecasts would assist is issuing Flood Watches and Flood Warnings.

The Regional Flood Event Debrief raised the following issues:

- It was agreed by all those present that, although warnings were largely issued in a timely manner, there is an immediate need for improvement and investment in flood forecasting capabilities (Action RFWT).
- Areas requested that region produce a paper detailing the catchments they can forecast for and the tools they are using to produce these forecasts (Action RFWT).
- The point was raised that it is not only the Agency staff who are affected by bad forecasts. Local Authorities are also using our forecasts to mobilise men to specific locations at specific times.

Key issues identified in the Regional Response to October/November event include:

- A quick review of all Flood Warning Areas was carried out to define what forecasting tools are currently available to forecasting duty offices for each Flood Warning Area.
- £200k has been earmarked for 2001/02 to improve forecasting models across the Region. An investigation is to be carried out to enable the coast to be divided into tidal zones. This will improve the Warning service along the NW coast.
- Forecasting duty offices and Area staff have different levels of knowledge and experience of the response of different catchments depending on background and history. This knowledge needs to be documented for use by all forecasting duty officers.
- A detailed and fundamental review of forecasting needs and user requirements is to be commissioned at the start of the new financial year. This will include consideration of what specific model improvements are required, how future forecasting needs should be managed and, importantly, specify a new unified forecasting system for the Region in line with national guidance. It is possible that this will lead to significant investment in a new forecasting system in the North West from 2002 onwards. A consultancy brief is being prepared this financial year for review.

A new river gauging station is planned to be built upstream of Wigan Flood Warning Area as part of the work arising from the Easter 1998 Floods, action A1:16. Also a river-gauging station is being built in Ribchester within the Flood Warning Area.

Site specific conclusions arising from Chris Tomlin's report, Evaluation of forecast accuracy for the floods of October and November 2000, have been outlined above under the individual sites (section 3.4). General conclusions on forecasting include:

- Better logging of river level forecasts is needed

- Good forecasts are dependent upon skilled operators who know the catchments. Forecasts should be made less dependent on local knowledge.
- The Forecasting Manual needs updating with details of the WRIP models
- Operational rules are good and are being adhered to.
- Forecasting lead time should be limited to the time in the Forecasting Manual. Longer lead times than recommended in the Manual generally lead to very poor forecasts.

It was noted by Binnie Black & Veatch (BB&V) that there is no consistent and accessible written record of weather forecasts given by RFR to AIRs – they tend to be provided by telephone. It is therefore difficult to assess the accuracy and adequacy of the weather forecasts. It is recommended that consideration be given to faxing or emailing weather forecasts from RFR to AIRs in order to provide a clear, written record of the forecast. This could still be reinforced by a telephone call.

4. FLOOD WARNING

4.1 Overview of Flood Warning in the Region

The Flood Monitoring and Forecasting Manual gives an overview of the Flood Warning stages and step-by-step guidance on things to take into account when considering a Flood Watch. It also gives details of the Flood Warning Areas in the North West Region.

4.1.1 Flood Warning Areas in North West Region

The latter part of Section 7 of the Flood Monitoring and Forecasting Manual is divided into subsections, which give an overview of each catchment in North West Region. This includes a description of the major watercourses in the catchment, their typical response and other relevant information such as flooding history. It also lists any Flood Warning Areas in the catchment as well as any locations where a specific Flood Watch service is given. There is a section for each Flood Warning Area (if any) in the catchment. This gives the following information:

- Gauge Board chart, which summarises all actions for the Flood Warning Area (e.g. issue of Flood Warnings for Area 'A', Area 'B', issue of Severe Flood Warnings, etc.).
- Forecasting summary, which lists any models and rules of thumb available.
- Map of the Flood Warning Area.
- Plotting Graph.
- Schematics of operation of sites such as storage basins and pumping stations (if any).

Figure 4.1 shows the Flood Warning Areas in North West Region. It indicates the Flood Watch Catchments; those areas where a Specific Flood Watch Only Service is given; and those areas where a full 4 stage Flood Warning Service is given. Tables 4.1, 4.2 and 4.3 list the Flood Watch and Flood Warning areas in North West Region.

4.1.2 Impact of new 4 stage Warning system

On September 12th 2000, the Environment Agency introduced a 4 stage Warning system to replace the Yellow Amber Red colour codes. Under the new system the duty teams assess the weather conditions at an early stage and consider the need to issue a Flood Watch for all or part of the Area. As expected this has resulted in increased activity in AIRs and the RFR with duty teams being active more frequently and for longer. However, it is hoped that the 4 stage Warning system has improved the service provided. Flood Watches in particular are informative as an early warning to both the public and professional partners. There have also, however, been some comments from professional partners that the volume of Flood Watch faxes was too great (see Appendix F).

4.2 Trigger/Threshold levels for Warnings

Catchment-wide Flood Watches were issued following the receipt of Heavy Rainfall Warnings from the Meteorological Office. Because of the type of rainfall forecast and the prevailing catchment conditions, the possibility of flooding over the whole of the North West Region was forecast by the MFDO and FWDOs. Further Warnings were based on subjective interpretation of actual and forecast weather conditions and river levels.

At Ribchester, Garstang and Wigan Severe Flood Warnings were issued. In Ribchester this caused the police to consider moving to a Silver state of operation (i.e. evacuation mode). The police did not in the end formalise the Silver control as they had officers on the ground who were monitoring the situation. Evacuation of householders was considered but was not, in the event, required. It is understood that the issue of the Severe Flood Warning at Ribchester was more likely due to an inappropriate trigger level than to an inaccurate forecast.

Map 1: Flood Warning Areas

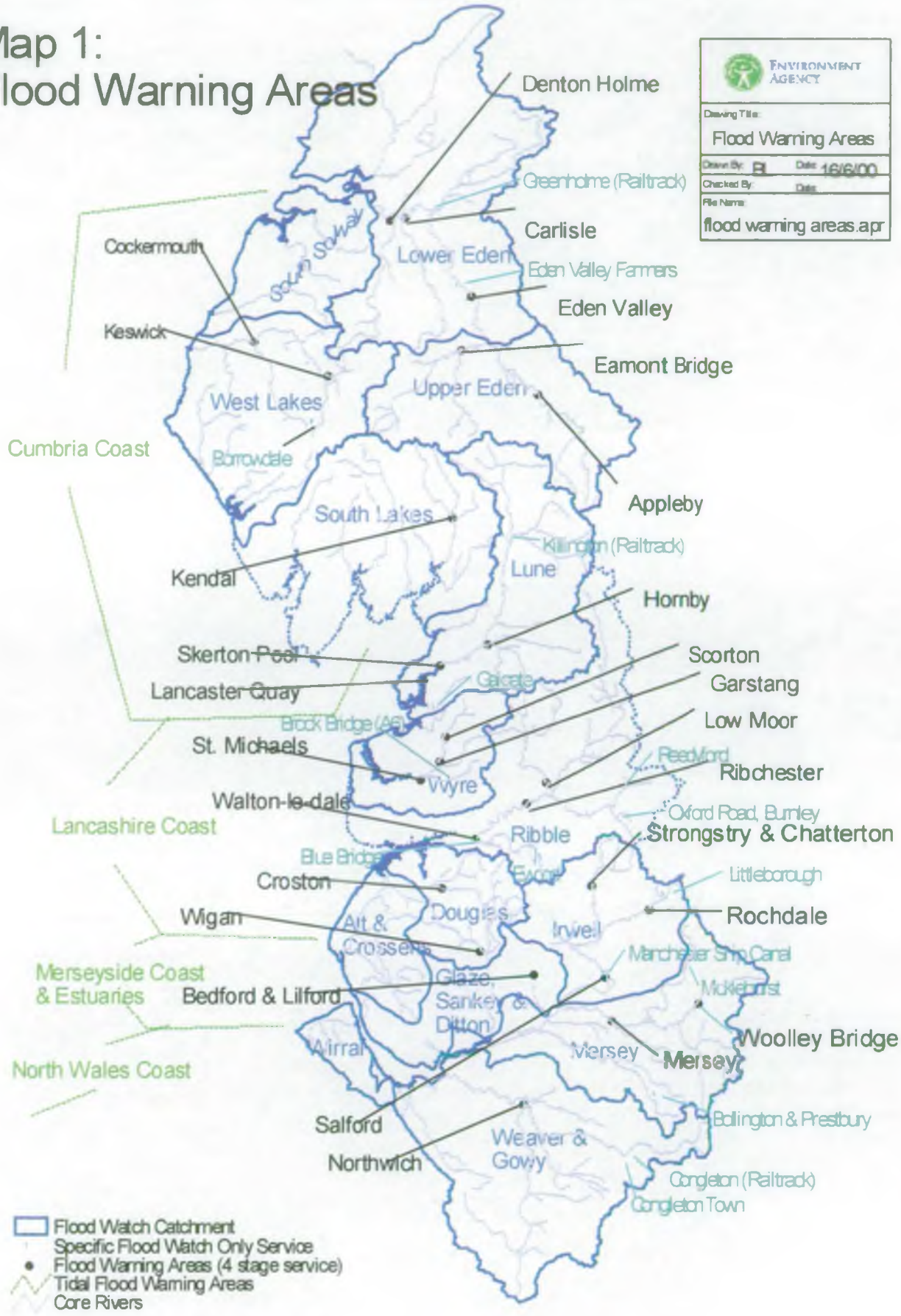


Table 4.1 - List of catchments for Flood Watch

MO no.*	Catch-ment code	Catchment for Flood Watch	Description of Area
1	SS	South Solway catchment	The South Solway area covers the Allerdale district including Longtown ,Wigton, Aspatria & Maryport.
2	LE	Lower Eden catchment	The Lower Eden catchment, covering the Carlisle & Eden districts including Brampton.
3	WL	West Lakes catchment	The West Lakes area covers the Allerdale & Copeland districts including Keswick, Cockermouth, Workington, Whitehaven & Egremont.
4	UE	Upper Eden catchment	The Upper Eden catchment covers the Eden district including Kirkby Stephen, Appleby & Penrith.
5&6	SL	South Lakes catchment	The South Lakes area covers the South Lakeland & Barrow-in-Furness districts including Kendal, Windermere, Ulverston, Barrow-in-Furness & Millom.
7	LU	Lune catchment	The Lune and Wenning catchment from the Tebay area to Lancaster includes Hornby, Galgate and Cockerham.
8	WY	Wyre catchment	The Wyre catchment includes Scorton, Garstang, St Michaels, Pilling and Thornton.
9	RI	Ribble catchment	The Ribble, Darwen, Calder, Hodder and Pendlwater catchments from Settle to Preston include Clitheroe, Longridge, Colne, Nelson, Burnley, Accrington, Blackburn and Darwen.
10	DO	Douglas catchment	The Douglas catchment, from Horwich to Hesketh Bank, includes Wigan, Chorley, Croston, Leyland and Skelmersdale.
11	IR	Irwell catchment	Central and northern areas of Greater Manchester; the Rossendale District Council, Belmont and Edgeworth areas.
12 (i)	AC	Alt & Crossens catchments	The Alt & Crossens catchments from Huyton to banks including Kirkby, Formby, Ormskirk and Southport.
12(ii)	SGD	Sankey, Glaze & Ditton Brook catchment	Central and eastern areas of Merseyside; western areas of Greater Manchester; Widnes; and western parts of Warrington.
13	ME	Mersey catchment	Southern and eastern areas of Greater Manchester; north-eastern areas of Cheshire; eastern parts of Warrington; and areas of Derbyshire bordering Greater Manchester and Cheshire.
14	WE	Weaver catchment	Central, southern and north-western areas of Cheshire; Runcorn; and areas of Shropshire and Staffordshire bordering Cheshire.
15	WI	Wirral catchment	Central, eastern and north-western areas of the Wirral; and western parts of Ellesmere Port.

*MO no. = corresponding Met Office Heavy Rainfall Warning Catchments

Table 4.2 - List of Tidal Flood Warning Areas

Code*	Catchment for Flood Watch	Description of Area
TN	Tides in Cumbria	The Cumbrian coast from the northern Part of Morecambe Bay to the Solway Firth including Whitehaven and Workington.
TC	Tides in Lancashire	The Lancashire coast includes Southport, Lytham, Blackpool, Fleetwood the Pilling coast, Heysham and Morecambe and areas adjacent to the tidal reaches of the Rivers Lune, Wyre & Ribble.
TS	Tides in Merseyside and Cheshire	The Merseyside coast from Crosby to Hoylake including areas adjacent to the River Mersey up to Warrington.
	Tides in North Wales	The North Wales coast from the Dee estuary, Chester to The Llyn Peninsula including Ynys Mon.

*codes are TN (for tidal North), TC (for tidal Central) and TS (for tidal South)

Table 4.3 - Specific Flood Warning Areas (4 Stage Service) and Trigger Sites

Flood Warning Area :-	Catchment - Flood Watch	Trigger Site	Trigger type	Notes
NC1 Appleby	Upper Eden	Appleby	Eden level	
NC2 Eden Valley	Lower Eden	"Eden Valley"	Eden flow	No gauge at Eden Valley[*E]
NC3 Carlisle	Lower Eden	Sheepmount	Eden flow	
NC4 Cockermouth	West Lakes	Southwaite Br.	Cocker flow	
NC5 Denton Holme	Lower Eden	Cummersdale	Caldew level	Also "Cockermouth" flow used. No gauge at Cockermouth[*C],
NC6 Keswick	West Lakes	Low Briery	Greta level	Cummersdale *or* Holme Head (R. Caldew) level used for trigger
NC7 Eamont Bridge	Upper Eden	Pooley Br.	Eamont level	
SC1 Kendal	South Lakes	Victoria Br.	Kent level	
SC2 Lancaster Quay	Lune	Skerton Weir	tidal Lune level	levels forecast from Caton flow & Fleetwood tide level
SC3 Skerton Pool	Lune	Skerton Weir	Lune level	
L1 Scorton	Wyre	Scorton	Wyre level	
L2 Garstang	Wyre	Garstang	river & basin levels	
L3 St.Michaels	Wyre	Catterall Gate	Wyre level	
L4 Hornby	Lune	Hornby	Wenning level	
L5 Ribchester	Ribble	Jumbles Rock	Ribble level	
L6 Walton-Le-Dale	Ribble	Salmesbury	tidal Ribble level	warnings from combination of flow & tide[*W]
L7 Croston	Douglas	Croston Mill	Yarrow level	
L9 Low Moor	Ribble	Low Moor	Ribble level	
GM1 Wigan	Douglas	Central Park	Douglas level	
L8 Strongstry&Chatterton	Irwell	Stubbins	Irwell level	
GM2 Salford	Irwell	Manchester R/C	Irwell level	
GM3 Mersey	Mersey	Brinksway	Mersey level	plot Didsbury & Sale river and basin levels for info.
GM4 Bedford, Lilford	Glaze, Sankey,	Lilford & Bedford	Basin levels	the watercourses are tributaries of Glaze Brook[*BL]
GM5 Rochdale	Irwell	Rochdal ETW	Roch level	
D1 Woolley Bridge	Mersey	Woolley Br.	Etherow level	
CH1 Northwich	Weaver & Gowy	Northwich	Weaver level	

[*E] no gauge at Eden Valley – forecast from Temple Sowerby and Udford
[*C] no gauge at Cockermouth – forecast from Ouse Br. & Southwaite Bridge (Sum of flows form Derwent and Cocker)
[*W] flow at Walton-le-dale forecast from Salmesbury. Penwortham tide level forecast from Liverpool. Warning based on joint Walton-le-dale flow & Penwortham tide level.
[*BL] Pen Leach Brook runs through subarea A. Lilford Park Brook runs through subarea B.

A general review of trigger levels in Central Area is being undertaken, in order to avoid the recurrence of situations such as that experienced in Ribchester. This was not felt necessary in South Area.

4.3 Warnings Issued, Target Lead Times Versus Actual Lead Times

In total 11 fluvial Flood Warnings were issued in North West Region during the period 30 October to 6 November. An additional three fluvial Severe Flood Warnings were issued during the same period. Tidal Flood Warnings for coastal areas were also issued on 28 October.

Tables 4.4, 4.5 and 4.6 show all Flood Watches, Flood Warnings and Severe Flood Warnings issued during the event for South, Central and North Areas respectively. Table 4.7 shows the Flood Warnings and Severe Flood Warnings with their target lead times. It also gives the times when the river levels passed the Flood Warning level, allowing a comparison of target lead times with actual lead times to be made. This information was sourced from event files, NTS and the Monitoring and Forecasting Manual. It should be noted, however, that the time when the river level meets the Flood Warning Trigger level does not necessarily indicate the time when properties began to flood. Therefore the actual length of time between the issue of a Flood Warning and when properties began to flood may be greater than that implied by Table 4.7.

For the purposes of the comparison below the issue time of warnings shall be taken to be the time the warning was issued to Professional Partners.

4.3.1 South Area

In South Area, Flood Warnings were issued for Strongstry and Chatterton, Northwich, Woolley Bridge and Didsbury and Northenden. The following paragraphs comment on the lead times after the issuing of the Flood Warnings in relation to the information presented in Table 4.7.

Strongstry and Chatterton

Only one Flood Warning was issued for Strongstry and Chatterton Flood Warning Area (FWA), covering just Part A of the FWA. The Warning was issued at 8.10 on 30th October 2000. In the event the river peaked at 90mm below the Flood Warning Trigger level, so no lead time comparison is possible.

Northwich

During the first event, Flood Warnings were issued to Northwich at 14.30 (Part A of the FWA) and 16.33 (Part B) on 30th October. The target lead time for Northwich is 2.25 hours. However, Part A of the FWA received only 14 minutes lead time before the trigger level was received; and Part B 52 minutes. In neither case was the target lead time met.

Arising from the first event, South Area reported that more extensive flooding than expected was experienced in Northwich. This meant that flooding was experienced in Northwich FWA Part C before the trigger for this zone had been met. The Flood Warning Areas in Northwich have since been amalgamated into an undivided Flood Warning Area covering all of what were previously parts A, B and C of the Flood Warning Area. For the second event the Warning was issued for all Parts of the Area simultaneously.

During the second event, a Flood Warning was issued to Northwich at 11.15 on 6th November 2000, covering all three Parts of the FWA. This Warning gave more than sufficient lead time to all Parts of the FWA: 4 ½ hours for Part A and almost 7 hours for Part B. The trigger level for Part C was not reached.

Woolley Bridge

A Flood Warning for Woolley Bridge was only given during the second event. The Warning was issued for Part A of the FWA at 04.00 on 6th November 2000. The target lead time for Woolley Bridge is 1 ½ hours, in fact 3 ½ hours lead time was given.

Didsbury and Northenden

Only one Flood Warning was issued to Didsbury and Northenden – at 05.45 on 6th November. The actual lead time for this Warning was less than one hour, whereas the target was 3 ¼ hours. The Warning was issued significantly later than it should have been. However, no property in this FWA was affected by flooding.

4.3.2 Central Area

In Central Area, Flood Warnings were issued for Ribchester, Wigan, Croston, Walton-le-Dale and Garstang. The following paragraphs comment on the lead times after the issuing of the Flood Warnings in relation to the information presented in Table 4.7.

Ribchester

During the first event a Flood Warning for Ribchester FWA Parts A and B was issued at 08.25 on 30th October. The lead time for Part A was only 37 minutes – less than the target lead time of 1 ½ hours. However, once the river level had crossed the trigger for Part A it then receded before rising again. Therefore it did not cross the trigger level for Part B until 21.10 on 30th October, giving a lead time of 12 ¾ hours for FWA Part B.

During the second event a Severe Flood Warning for the whole of Ribchester FWA was issued at 01.05 on 31st October. In the event, the level of the River Ribble did not cross the trigger level for FWA Part A until 14.31 on 1st November, shortly after the Severe Flood Warning had been superseded by a Flood Warning for Part A. Flood Warnings for Parts B and C were also issued during the afternoon of 1st November, but the river did not reach these trigger levels.

In any case, it is understood that only one property was actually flooded directly from the Ribble – the Old Police House. Other properties were flooded due to problems with surface water run-off.

Wigan

A Severe Flood Warning for all Parts of the Wigan FWA was issued at 09.08 on 30th October 2000. This Warning was actually issued shortly *after* the trigger levels had been reached for all Parts of the FWA. The reason for this, as mentioned previously, was the blockage at Central Park gauging station that led to a false reading of the level at this point (see section 3.3.2 for details). It is believed that, although the Warning was issued after the trigger level had been reached it was a further 1 hour before any flooding was experienced (still less than the target lead time of 1 ¼ hours).

No Warnings were issued for Wigan during the second event.

Croston

A Flood Warning for Part A of Croston FWA was issued at 09.08 on 30th October 2000. The trigger level was not reached.

Walton-le-Dale

During the first event a Flood Warning was issued for Part A of the Walton-le-Dale FWA at 12.19 on 30th October. In the event the Flood Warning trigger was not crossed until 0.00 on 31st October, giving a lead time of 11 hours 41 minutes.

During the second event a Flood Warning for Part A of the FWA was issued at 16.01 on 1st November. The trigger was crossed at 17.00 on the same day giving a lead time of 59 minutes – less than the target lead time of 3 hours.

Garstang

During the first event a Flood Warning for Part A of Garstang FWA was issued at 00.45 on 31st October. This was actually *after* the trigger level had been crossed. The fact that this Warning was not issued before the trigger was crossed may be related to the issues raised by Chris Tomlin in Evaluation of forecast accuracy for the floods of October and November 2000, specifically that the Garstang Basin begins to spill before it is full.

East Lancashire

A Flood Watch update was issued to cover Reedyford, Pendlewater in East Lancashire, approximately half an hour before any flooding. However, this area is covered by a Flood Watch only service. Consideration is being given to bringing Barrowford and other locations in this area into the 4 stage Flood Warning service.

4.4 Summary of Warnings and Severe Flood Warning across the Region

The 11 Flood Warnings were issued across the Region during the period from 28th October to 8th November were:

- River Ribble at Ribchester, 3 occasions
- River Ribble at Walton-le-Dale, 2 occasions
- River Weaver at Northwich, 2 occasions
- River Yarrow at Croston
- River Mersey at Didsbury and Northenden
- River Irwell at Strongstry and Chatterton
- River Etherow at Woolley Bridge

Three Severe Flood Warnings were issued across the region during the period from 28th October to 8th November. They were:

- River Ribble at Ribchester
- River Douglas at Wigan
- River Wyre at Garstang

Table 4.4a – South Area Flood Watches and Warnings Issued during the October/November Flood Incident

Date	Time	Warning Level	Area affected by Flood Watch or Flood Warning	In force until
29/10/00	21.15	Flood Watch	All Catchments	Further notice
30/10/00	00.30	Flood Watch Update	All Catchments. River Weaver level at Audlem has reached 2.10m (Railtrack Specific Flood Watch).	
30/10/00	05.45	Flood Watch Update	All Catchments. River Roch level at Littleborough has reached 0.75m. (Specific Flood Watch).	
30/10/00	06.30	Flood Summary	All Catchments. Flood Watches remain in force.	
30/10/00	07.15	Flood Watch Update	All Catchments. River Mersey at Northenden and Didsbury, River Irwell at Strongstry and Chatterton have reached Flood Watch levels (4 stage service Flood Warning Areas)	
30/10/00	08.10	Flood Warning	River Irwell at Strongstry and Chatterton	
30/10/00	09.00	Flood Watch Update	Flood Watch in force across all Catchments. River level at Woolley Bridge has reached 2.3m (Update Flood Watch). Flood Warning in place for River Irwell at Strongstry and Chatterton.	
30/10/00	10.50	Flood Watch Update	Flood Watch in force across all Catchments. River level at Rochdale has reached 1.3m (Update Flood Watch). Flood Warning issued for Rochdale. River levels also high on the River Weaver.	
30/10/00	13.15	Flood Watch Update	Flood Watch in force across all Catchments. River Weaver level at Northwich has reached 1.5m (Update Flood Watch).	
30/10/00	16.33	Flood Warning	Flood Warning issued for Rivers Weaver and Dane in the centre of Northwich.	Further notice
30/10/00	17.30	Flood Summary	Flood Watch remains in force for all catchments. Reports of flooding in Northwich, Nantwich, St. Helens and Warrington.	
31/10/00	08.30	Flood Summary	Flood Warning remains in place for Northwich Town Centre. Flood Watch remains in force for all catchments.	
31/10/00	13.45	Flood Summary	Flood Warning remains in place for Northwich Town Centre. Flood Watch remains in force for all catchments.	
01/11/00	09.00	All Clear	All Catchments	
01/11/00	15.45	Flood Watch	Irwell Catchment	
02/11/00	09.15	Flood Watch	All Catchments	
02/11/00	16.15	Flood Summary	All Catchments. Flood Watch remains in force.	
03/11/00	09.00	All Clear	All Catchments	
05/11/00	14.45	Flood Watch	All Catchments	

Table 4.4b – South Area Flood Watches and Warnings Issued during the October/November Flood Incident

Date	Time	Warning Level	Area affected by Flood Watch or Flood Warning	In force until
05/11/00	23.45	Flood Watch Update	All Catchments, raingauge alarms at Mow Cop, Prestbury, Langley Bottoms and Swineshaw. River Roch has reached 0.75m.	
06/11/00	00.45	Flood Watch Update	All Catchments, River Mersey at Northenden and Didsbury has reached 1.8m, River Weaver at Audlem has reached 2.10m, River Etherow at Woolley Bridge has reached 2.30m	
06/11/00	01.15	Flood Watch Update	All Catchments, River Dane at Congleton Park has reached 0.70m	
06/11/00	04.00	Flood Warning	River Etherow in Woolley Bridge	
06/11/00	05.45	Flood Warning	River Mersey between Didsbury and Flixton	
06/11/00	11.15	Flood Warning	Rivers Weaver and Dane in Northwich	
06/11/00	11.45	Flood Summary	Summary of warnings in place for Weaver, Dane, Mersey. Woolley Bridge downgraded to Flood Watch	
06/11/00	18.00	Flood Summary	Summary of warnings in place for Weaver, Dane, Etherow and Mersey.	
07/11/00	01.30	Flood Summary	Summary of warnings in place for Weaver and Dane. No longer warning on Mersey.	
07/11/00	06.30	Flood Watch Update	All Catchments, River Etherow has reached 2.30m	Until conditions change
07/11/00	13.00	Flood Summary	Weaver and Dane Warning downgraded to a Flood Watch.	
08/11/00	10.00	All Clear	All Catchments	

Table 4.5a – Central Area Flood Watches and Warnings Issued during the October/November Flood Incident

Date	Time	Warning Level	Area affected by Flood Watch or Flood Warning	In force until
26/10/00	20.20	Flood Watch	Ribble and Lune	09.00 – 27/10
27/10/00	09.25	All Clear		
28/10/00	09.15	Flood Watch	Tidal For tide @ 00.47 on 29/10	02.00
28/10/00	20.35	Flood Watch	All catchments	09.00 on 30/10
29/10/00	02.00	Coastal All Clear		
29/10/00	18.32	Flood Watch Update	Alt & Crossens	09.00 on 30/10
30/10/00	06.08	Flood Watch Update	All Catchments	09.00
30/10/00	07.20	Flood Watch	Ribble especially Oxford Road	09.00
30/10/00	08.25	**Flood Warning**	Ribchester A & B	10.00
30/10/00	09.08	**Flood Warning**	Croston A	
30/10/00	09.08	**Severe Flood Warning**	River Douglas at Wigan (parts A, B & C of FWA)	11.00
30/10/10	11.40	Flood Watch update	All catchments	14.00
30/10/00	12.01	**Flood Warning Update**	Croston A	15.00
30/10/00	12.20	**Flood Warning**	Walton-le-Dale A	16.00
30/10/00	16.20	Flood Summary	All Catchments. Previous Warnings for Wigan, Walton-le-Dale and Croston stood down to Flood Watch. Flood Warning for Ribchester still in force.	
30/10/00	19.00	Flood Watch update	All catchments. Levels on the Wyre rising, Garstang basin being operated and the Brock A6 has gone through Flood Watch level.	
30/10/00	19.10	**Flood Warning**	Ribchester Area A.	21.30
30/10/00	19.30	Flood Watch Update	All Catchments. Catterall Basin is Operational as well as Garstang. The Brock has reached Flood level. Low Moor at Standby.	
30/10/00	20.00	**Flood Warning Update**	Ribchester Area B	22.00
30/10/00	20.35	Flood Watch	Hornby	23.00
30/10/00	21.20	**Flood Warning**	Walton-Le-Dale Area A	
30/10/00	23.48	Flood Summary	All Catchments. Flood Warnings in force for Ribchester, Walton-le-Dale and the Wyre catchment. Flood Watches are in force for Wigan, Croston and the whole of Lancashire.	
30/10/00	22.00	Flood Watch Update	Flood Warning in force for: Ribchester and Walton-Le-Dale. Flood Watches for Croston, Wigan and All Catchments.	

Table 4.5b – Central Area Flood Watches and Warnings Issued during the October/November Flood Incident

Date	Time	Warning Level	Area affected by Flood Watch or Flood Warning	In force until
31/10/00	00.05	Flood Summary	Flood Warning in force for: Ribchester and Walton-Le-Dale. Flood Watches for Wigan, Croston and All Catchments.	
31/10/00	00.28	Flood Watch	Wyre	02.00
31/10/00	00.50	**Severe Flood Warning**	River Wyre at Garstang	03.00
31/10/00	01.05	**Severe Flood Warning**	River Ribble at Ribchester (parts A, B & C of FWA)	05.00
31/10/00	06.27	Flood Summary	Flood Warning in force for Walton-le-Dale. All clear for Ribchester, Wigan and Croston. Flood Watch for the whole of Lancashire.	
31/10/00	07.26	Flood Summary	Flood Warning in force for Walton-le-Dale. Flood Watch in Garstang. Flood Watch is in force for all catchments in Lancashire.	
31/10/00	11.45	All Clear	All Catchments	
31/10/00	15.10	All Clear	All Catchments	
31/10/00	17.00	Flood Watch	Lune, Wyre and Ribble Catchments	09.00 on 01/11/00
01/11/00	09.15	Flood Watch update	All catchments	13.00
01/11/00	10.55	Flood Watch	Reedyford	
01/11/00	12.10	Flood Watch	Ribchester	
01/11/00	12.12	Flood Watch	Ribble, Darwen, Calder, Pendlewater, Hodder and Lostock Catchments	
01/11/00	12.54	Flood Watch Update	All Catchments	17.00
01/11/00	13.44	**Flood Warning**	Ribchester A	18.00
01/11/00	14.11	Flood Summary	Flood Warning for Ribchester. Flood Watch for Reedyford and All catchments.	
01/11/00	14.33	**Flood Warning Update**	Ribchester B	18.00
01/11/00	15.26	**Flood Warning Update**	Ribchester C	18.00
01/11/00	16.01	**Flood Warning**	Walton-Le-Dale A	19.00
01/11/00	17.18	Flood Summary	Flood Warnings for: Ribchester and Walton-Le-Dale. Flood Watch in force for all Catchments	
01/11/00	20.45	Flood Summary	No Flood Warnings. Flood Watches in force for All Catchments especially at Ribchester and Walton-Le-Dale.	
02/11/00	10.00	All Clear	All Catchments	
02/11/00	10.20	Flood Watch Update	All Catchments	17.00
02/11/00	17.15	Flood Watch Update	All Catchments	09.00 on 03/11/00
03/11/00	09.15	All Clear	All Catchments	

Table 4.5c – Central Area Flood Watches and Warnings Issued during the October/November Flood Incident

Date	Time	Warning Level	Area affected by Flood Watch or Flood Warning	In force until
06/11/00	11.45	Flood Watch	Flood Watch for all catchments in Lancashire area	17.00 on 06/11/00
06/11/00	17.15	Flood Watch Update	Flood Watch for all catchments in Lancashire area	10.00 on 07/11/00
07/11/00	10.50	Flood Watch Update	Flood Watch for all catchments in Lancashire area	16.00
07/11/00	16.14	All Clear	All clear for all catchments	

Table 4.6 – North Area Flood Watches and Warnings Issued during the October/November Flood Incident

Date	Time	Warning Level	Area affected by Flood Watch or Flood Warning	In force until
30/10/00	11.05	Flood Summary	Flood Watch in place for all catchments in Cumbria	
31/10/00	10.06	All Clear	All Catchments.	
31/10/00	16.50	Flood Watch	Flood Watch for Upper Eden, West and South Lakes catchments.	12.00 on 01/11/00
01/11/00	11.39	All Clear	Upper Eden, West and South Lakes catchments.	
02/11/00	16.37	Flood Watch	Eden and Lakes Catchments	Further notice
02/11/00	20.30	Flood Watch Update	South Lakes Catchments. Levels on the River Kent at Kendal are continuing to rise.	Further notice
02/11/00	22.50	Flood Watch Update	Upper Eden Catchment. Levels on the Eden at Appleby are continuing to rise.	Further notice
03/11/00	00.07	Flood Summary	Flood Watches are in force for Eden and Lakes Catchments. River Kent at Kendal has peaked. Rainfall has ceased but levels remain high.	Further notice
03/11/00	04.10	All Clear	All clear for West and South Lakes catchments. High river levels remain in Upper and Lower Eden.	
03/11/00	04.29	Flood Summary	Flood Watches on Upper and Lower Eden Catchments.	
03/11/00	11.04	All Clear	All clear for Eden Catchments.	
05/11/00	14.15	Flood Watch	All catchments in Cumbria	Further notice
06/11/00	07.29	Flood Summary	Flood Watch still in force for all catchments in Cumbria	Further notice
06/11/00	12.35	Flood Watch	Flood Watch for Upper Eden catchment, level at Appleby has reached 2.5m	Further notice
06/11/00	16.59	Flood Summary	Flood Watch still in force for all catchments in Cumbria	Further notice
07/11/00	09.15	Flood Summary	Flood Watch still in force for all catchments in Cumbria	
07/11/00	16.40	Flood Summary	Flood Watch still in force for all catchments in Cumbria	
08/11/00	08.24	All Clear	All clear for all catchments in Cumbria	

Table 4.7 – Comparison of lead times vs. actual times

As per Quick Ref. Table					Flood Warning Issued (date/time)					Actual Lead Time (hrs)			Difference (hrs)			
Flood Warning Area	Code	Catchment Flood Watch	Trigger Site	Trigger Type	PP	Media	Area	Flood Warning Trigger	Time crossed Flood Warning Trigger	PP	Media	Target Lead Time	PP		Media	
							(A/B/C/...)	either m above station datum (if level); or cumec (if flow)	(Italic indicates approximate time)	= Trigger time - Warning time	= Trigger time - Warning time	(hrs) as per manual	= Actual Lead - Target Lead	OK?	= Actual Lead - Target Lead	OK?
Strongstry & Chatterton	L8	Irwell	Stubbins	Irwell Level	08:10 30/10/2000	08:15 30/10/2000	A	2.00	reached 1.91 at 8:00			0.75				
Ribchester	L5	Ribble	Jumbles Rock	Ribble Level	08:25 30/10/2000		A/B	3.60 (A)	9:02 30/10/2000	0.62	N/A	1.50	-0.88	Not OK	N/A	-
Ribchester	L5	Ribble	Jumbles Rock	Ribble Level	08:25 30/10/2000		A/B	4.10 (B)	21:10 30/10/2000	12.75	N/A	1.50	11.25	OK	N/A	-
Wigan	**GM1**	**Douglas**	**Central Park**	**Douglas Level**	**09:08 30/10/2000**	**09:08 30/10/2000**	**A/B/C**	**1.29 (A)**	**8:20 30/10/2000**	**-0.80**	**-0.80**	**1.25**	**-2.05**	**Not OK**	-2.05	Not OK
Wigan	**GM1**	**Douglas**	**Central Park**	**Douglas Level**	**09:08 30/10/2000**	**09:08 30/10/2000**	**A/B/C**	**1.42 (B)**	**8:24 30/10/2000**	**-0.73**	**-0.73**	**1.25**	**-1.98**	**Not OK**	-1.98	Not OK
Wigan	**GM1**	**Douglas**	**Central Park**	**Douglas Level**	**09:08 30/10/2000**	**09:08 30/10/2000**	**A/B/C**	**1.73 (C)**	**9:02 30/10/2000**	**-0.10**	**-0.10**	**1.25**	**-1.35**	**Not OK**	-1.35	Not OK
Croston	L7	Douglas	Croston Mill	Yarrow Level	09:08 30/10/2000	12:45 30/10/2000	A	2.40		N/A	N/A	2.25	N/A	-	N/A	-
Walton-le-Dale	L6	Ribble	Salmesbury	tidal Ribble Level	12:19 30/10/2000	12:45 30/10/2000	A	5.42	0:00 31/10/2000	11.68	11.25	3.00	8.68	OK	8.25	OK
Northwich	CH1	Weaver & Gowy	Northwich	Weaver Level	14:30 30/10/2000	14:40 30/10/2000	A	1.70	14:44 30/10/2000	0.23	0.07	2.25	-2.02	Not OK	-2.18	Not OK
Northwich	CH1	Weaver & Gowy	Northwich	Weaver Level	16:33 30/10/2000	16:40 30/10/2000	B	1.90	17:25 30/10/2000	0.87	0.75	2.25	-1.38	Not OK	-1.50	Not OK
Garstang	**L2**	**Wyre**	**Garstang**	**river & basin levels**	**00:45 31/10/2000**	**00:55 31/10/2000**	**A**	**2.60**	***0:10 31/10/2000***	-0.58	-0.75	2.50	-3.08	Not OK	-3.25	Not OK
Ribchester	**L5**	**Ribble**	**Jumbles Rock**	**Ribble Level**	**01:05 31/10/2000**	**01:22 31/10/2000**	**A/B/C**	**3.60 (A)**	***14:30 1/11/2000***	37.42	37.13	**1.50**	35.92	OK	35.63	OK
Ribchester	**L5**	**Ribble**	**Jumbles Rock**	**Ribble Level**	**01:05 31/10/2000**	**01:22 31/10/2000**	**A/B/C**	**4.10 (B)**		N/A	N/A	**1.50**	N/A	-	N/A	-
Ribchester	**L5**	**Ribble**	**Jumbles Rock**	**Ribble Level**	**01:05 31/10/2000**	**01:22 31/10/2000**	**A/B/C**	**4.60 (C)**		N/A	N/A	**1.50**	N/A	-	N/A	-
Ribchester	L5	Ribble	Jumbles Rock	Ribble Level	13:44 1/11/2000		A	3.60	14:31 1/11/2000	0.78	N/A	1.50	-0.72	Not OK	N/A	-
Ribchester	L5	Ribble	Jumbles Rock	Ribble Level	14:33 1/11/2000	14:45 1/11/2000	B	4.10		N/A	N/A	1.50	N/A	-	N/A	-
Ribchester	L5	Ribble	Jumbles Rock	Ribble Level	15:26 1/11/2000	15:48 1/11/2000	C	4.60		N/A	N/A	1.50	N/A	-	N/A	-
Walton-le-Dale	L6	Ribble	Salmesbury	tidal Ribble Level	16:01 1/11/2000	16:10 1/11/2000	A	5.42	17:00 1/11/2000	0.98	0.83	3.00	-2.02	Not OK	-2.17	Not OK
Woolley Bridge	D1	Mersey	Woolley Bridge	Etherow Level	04:00 6/11/2000	04:20 6/11/2000	A	3.23	7:30 6/11/2000	3.50	3.17	1.50	2.00	OK	1.67	OK
Woolley Bridge	D1	Mersey	Woolley Bridge Gates		04:00 6/11/2000	04:20 6/11/2000	A	2.80	8:00 6/11/2000	4.00	3.67	1.50	2.50	OK	2.17	OK
Didsbury and Flixton (Mersey)	GM3	Mersey	Brinksway	Mersey Level	05:45 6/11/2000	05:45 6/11/2000	A	2.80	6:39 6/11/2000	0.90	0.90	3.25	-2.35	Not OK	-2.35	Not OK
Northwich	CH1	Weaver & Gowy	Northwich	Weaver Level	11:15 6/11/2000	11:30 6/11/2000	A/B/C	1.70 (A)	15:45 6/11/2000	4.50	4.25	2.25	2.25	OK	2.00	OK
Northwich	CH1	Weaver & Gowy	Northwich	Weaver Level	11:15 6/11/2000	11:30 6/11/2000	A/B/C	1.90 (B)	18:09 6/11/2000	6.90	6.65	2.25	4.65	OK	4.40	OK
Northwich	CH1	Weaver & Gowy	Northwich	Weaver Level	11:15 6/11/2000	11:30 6/11/2000	A/B/C	2.50 (C)	peaked at 2.45m at 01:14			2.25				

Important note:

Flood Warning Trigger levels do not generally correspond to the level at which flooding commences. Therefore the time when the river level meets the Flood Warning Trigger level does not necessarily indicate the time when properties began to flood. The actual length of time between the issue of a Flood Warning and when properties began to flood is often greater than that implied by the table.

Bold indicates Severe Flood Warnings (Severe are only included where there was no Flood Warning first); Flood Watches and Updates not included

4.5 Use And Effectiveness Of Warning Systems

This section comments on availability, reliability, use and effectiveness of the North West Region's warning systems, including AVM, Floodline, flood wardens, local media, sirens and public address systems.

4.5.1 Use of AVM

It should be noted that the number of calls answered is not a good measure of the number of properties warned. One of the main reasons for this is that properties frequently have more than one phone number associated with them (for example, different mobile phone numbers for several members of the household). There are also other reasons such as AVM's response to engaged phone lines, answerphones and call waiting services. This means that there is an issue of AVM statistics not giving a true picture of the effectiveness of AVM.

The general comment from both South and Central Areas was that AVM operated effectively during this event. In South Area some areas were flooded before the AVM warning was issued. However, it is felt that this was a forecasting issue rather than an issue with the operation of AVM.

South Area

Tables 4.8 and 4.9 give summaries of the use of AVM for the two events of 29 October and 6 November 2000 for South Area.

Central Area

This information was unavailable for Central. However, it was reported that no significant problems were experienced with AVM in this Area.

Table 4.8 - Report on AVM use for the event of 29/10/00 (South Area)

Stubbins	
Calls made	78 of which
Calls aborted	12
Calls answered	36 of which
Calls acknowledged	21
Calls unacknowledged	15
Northwich	
Calls made	15 of which
Calls aborted	1
Calls answered	9 of which
Calls acknowledged	6
Calls unacknowledged	3
Rochdale	
Calls made	5 of which
Calls aborted	0
Calls answered	5 of which
Calls acknowledged	2
Calls unacknowledged	3

At Woolley Bridge, 2 successful calls were made to Derbyshire EPU pagers

Table 4.9 - Report on AVM use for the event of 6/11/00 (South Area)

Didsbury	
Calls made	45 of which
Calls aborted	8
Calls answered	19 of which
Calls acknowledged	7
Calls unacknowledged	12
Northwich	
Calls made	104 of which
Calls aborted	13
Calls answered	57 of which
Calls acknowledged	29
Calls unacknowledged	28
Woolley Bridge	
Calls made	31 of which
Calls aborted	0
Calls answered	22 of which
Calls acknowledged	8
Calls unacknowledged	14

4.5.2 Floodline, Flood Wardens, Local Media, Sirens, Public Address

During the event several members of the public phoned in to AIRs asking for information, as they had experienced problems accessing Floodline. This was probably due to the number of calls Floodline received during the national event. Statistics for the use of Floodline were not available for the Region but will feature in the national report on the October/November flooding.

There is only 1 flood warden in the Region, based in Ribchester. Central Area reported that having a flood warden helped, as he was an intermediary between the Agency and the public. He helped to locate sandbags and also to feed back information to the AIR. He also provided information for the post event report.

Central Area also reported a noticeable improvement from the local media in respect to the quantity and quality of warnings issued via radio, due to the new four stage Flood Warning codes. During previous events there had been confusion by the public over the precise meaning of each colour code. The four stage Warning system provided a clear message, which was understood by the public, media and professional partners.

No sirens or loud hailers were used. South Area would normally make use of a vehicle-mounted public address (PA) system. However, it was not possible to use this in the centre of Northwich due to the fact that this area is pedestrianised.

4.6 Extent Of Flooding

The latest available estimate is that 189 properties flooded across South and Central Areas. Table 4.10 shows the number of properties flooded in each Area.

Table 4.10 – Properties warned/flooded

Condition	South Area	Central Area	Regional
No. properties flooded following a Flood Warning	1 residential 13 comm'cial 26 cellars	0	14
No. properties flooded without a Flood Warning	63 residential 16 other 4 cellars	86	165
No. properties not flooded but received a Flood Warning	55 (mainly commercial)	7	62
No. of properties flooded following a Severe Flood Warning	0	10	10
No. of properties that flooded without a Severe Flood Warning	0	0	0
No. properties not flooded but received a Severe Flood Warning	0	139	139

A Flood Watch was in force for all areas where flooding occurred. However, as can be seen from Table 4.10, a considerable number of properties that flooded were not given direct Flood Warnings because they do not lie in 4 stage Flood Warning Areas. For the purposes of Table 4.10 the 'No. of properties flooded without a Flood Warning' is read as those properties that did not receive a formal Flood Warning, although they *were* under a Flood Watch at the time of flooding.

Further details on the properties that were warned and/or flooded are given in Chapter 5.

4.7 Issues Arising And Recommendations

The Regional Flood Event Debrief raised the following issues regarding Flood Warning:

- PR found the new codes much easier to work with and were able to obtain an overview of the current situation much quicker.
- REDO's would like to receive Warning faxes, heavy rainfall warnings, Severe weather Warnings and any other information which could help them prepare and respond to an incident. (Action on RFWT to arrange with RCC for faxes to be passed to REDO).
- A number of Local Authorities have expressed concern over the Flood Watch stage saying that they receive too much information and too often.
- Issues relating to this topic are to be discussed at the next Regional Flood Warning meeting on the 20th November to include: what is the Agency's interpretation of when a Flood Watch should be issued? can the Agency issue an advance warning to professional partners before it notifies the media, if the Agency is aware of Severe weather coming into the region?
- Areas to add note on media faxes to contact PR directly for media enquiries.

The South Area Report raised the following additional issues:

- It was suggested that a meeting be set up between the Agency and Railtrack to discuss trigger levels.
- Woolley Bridge – inconsistency with levels. Gate level and river levels don't tie in. Mike Fraser to look into.

- Interest in the trigger levels at Liverpool, forecast reached criteria of 5m plus high winds. Comment that region are looking at tidal triggers for local areas as well as at Liverpool.
- Consider installing an operational trigger on Causey Bridge.
- Consider combining sub-areas A, B & C in Northwich into one Flood Warning Area with one trigger level.
- Issue of the effect the sluices in Northwich have when they are operated. Liaise with British Waterways regarding operation of the sluices.
- Shrebridge Lodge to be put on AVM with flood level alarm at 2.00m.

Central Area reported that the scale of the event provided valuable data on Flood Warnings. The trigger levels for Severe Flood Warning are to be reviewed in the light of the impact of the floods and high level response by the police when this Warning is issued.

5. EVENT IMPACT

5.1 Overview Of Weather Conditions

The period of 28th October to 8th November 2000 was characterised by a string of Atlantic depressions moving across the south of England and the Midlands. In the time between the depressions there were long periods of heavy showers.

In the North West Region, the showers mostly affected Lancashire and Merseyside, occasionally reaching the Chester and Greater Manchester areas.

Due to the way in which these showers approached Britain over this period, the Pennines tended to shelter north-west England from the bulk of the depression and Yorkshire received far more rainfall than normal. This, coupled with the fact that the rivers in the north-west are much steeper than those in the north-east, allowing quicker run-off of rainfall between showers, meant that flooding in the north-west was far less severe than that experienced in Yorkshire.

The exceptions to this are the flatter areas of Cheshire, which are less protected from the east and have slower run-off.

For the North West, October was the third wettest October on record (since 1936), with 321mm of rainfall. For comparison, the wettest October in the period was in 1967 at 365mm (The second wettest was 1938 at 336mm). In the same period, the wettest month of all was December 1986, with 392mm. Two raingauges measured the wettest October of their record: Lower Rivington (Central Area) with a record from 1900; and Barnacre (Central Area) with 120 years of records (from 1880). Manchester Weather Centre reported that it was the wettest October on their records dating back to around 1940.

Rainfall in November was generally less than for October but it remained impressive at 169.5% of the long term average (LTA). It was the fourth wettest November recorded since records began in 1936. All index gauges recorded in the top four wettest 12 month periods ending in November. For example, Lower Rivington (Central) was the wettest in 100 years, Burnbanks (North) in 78 years and Woodhead (South) in 145 years.

Table 5.1 gives a summary of the rainfall at 9 index gauges across the North West Region.

Table 5.1 – Summary of rainfall in October at 9 regional index gauges

Rainfall	**North** (Ulpha, Dalehead Hall, Burnbanks)	**Central** (Rivington, Stocks, Barnacre)	**South** (Woodhead, Holden Wood, Langley Bottoms)	**Region** (average of 9)
Range (mm)	336.5 – 444.6	261.0 – 379.2	190.6 – 313.9	320.6
Range (%LTA)	171.4 – 181.5	210.5 – 227.1	160.6 – 209.5	195.5

Table 5.2 gives a daily summary of the weather conditions in the Region for the period of the flood event.

The following headline statistics of rainfall during October/November 2000 were reported in the key statistics for media support:

- About 6 inches of rain over and above the LTA for October fell across the North West Region, more than 7 inches in Lancashire.
- Total rainfall for the month of October was almost twice the long term average.
- First week in November had almost half the normal (LTA) rainfall for the whole of November.

Table 5.3 gives a more comprehensive summary of rainfall in the north west during October and November 2000, including a comparison with LTA. Tables 5.4 and 5.5 give further rainfall information for the event period.

Table 5.2 - Daily summary of weather conditions

Date	Summary
28th October	A band of showers covered Cumbria all evening and continued over the South Lake District overnight.
29th October	Showers continued over North Lancs and the South Lake District. A depression over south-east England brought more continuous rain to Central and South areas, not stopping until midnight.
30th October	A depression was moving very slowly over southern and central England. This brought heavy rain to all areas except Cumbria from the early hours until 0900. Up to 60mm fell in a twelve hour period, with over 40mm in many gauges. Curling fronts around the depression containing heavy bands of rain were difficult to track and predict. After the main band of rain finished, heavy bands of showers covered Lancashire through until midnight.
31st October	Light westerly winds brought heavy showers over most of the region all day becoming heavier in the evening.
1st November	Very heavy showers were confined to Lancashire by the westerly wind, which was bringing a lot of moisture from the Irish Sea. This was exacerbated by the Irish Sea being warmer than usual for this time of year. The showers converged to produce a very heavy band of rain stationary over the Ribble Valley and Pendle Water. Intensities gradually reduced after dark.
2nd November	After a dry morning a depression moved slowly over the north-west from mid-Wales and brought curling bands of very heavy rain to various places in the north and the Upper Eden Valley through the afternoon and early evening. Then the movement of the depression lead to the rain coming back down over central and southern areas, not clearing until well after midnight. Intensities reached 8mm per hour in places and over 40mm in 5 hours in North Yorkshire and the Pennines.
3rd November	Light showers on a north-west wind in the morning became concentrated on the southern part of the region in a band from Liverpool to Nantwich through the afternoon and evening. They continued until late the next morning.
4th November	Light showers fell throughout most of the day.
5th November	A widely predicted belt of rain reached our region from the south-west in the late afternoon. Again, the belts of rain curved round the depression and much of the rain reached us from the south-east. The rain continued until 0900.
6th November	The continuing easterly wind around the depression brought some showers over the Southern Pennines into North West Region.
7th November	Belts of rain curling around the depression brought localised very heavy showers from the east into North West Region.
8th November	As the depression moved away into the North Sea, winds moved to the north and produced only light rain all day.

Table 5.3 – Rainfall in the North West Region during the Flood Events of October and November 2000					
Area	**North Area**	**Central Area**	**South Area**	**Regional Average**	**Notes:**
Counties Affected	**Cumbria, Northern Pennines**	**Lancashire**	**Cheshire, Merseyside, Greater Manchester**		
Rivers Affected	**Eden**	**Ribble, Douglas, Wyre**	**Weaver, Mersey, Etherow**		
October 2000					
Additional rainfall in October 2000 above October LTA.	172 mm	184 mm	103 mm	148 mm	About 6" of rain over and above the LTA for October fell across the NW Region, more than 7" in Lancashire.
Total October 2000 rainfall as % October LTA.	177 %	228 %	190 %	195 %	For the month of October, this was almost twice the Long term average.
Additional rainfall in 26-31 October 2000 above expected for 6 days in October.	61 mm	112 mm	54 mm	74 mm	Almost 3" more rain than expected fell across the NW Region in the last 6 days of October, more than 4" extra in Lancs.
Total Rainfall 26-31 October 2000 as % expected in 6 days in October.	241 %	505 %	346 %	345 %	This is almost 3½ times what is normally expected, and 5 times the expected rainfall in Lancashire.
November 2000					
Total rainfall 1-7 November 2000 as % November LTA.	40 %	46 %	72 %	47 %	The first week in November had almost half the normal (LTA) rainfall for the whole of November.
Additional rainfall in 1-7 November 2000 above expected for 7 days in November.	44 mm	37 mm	63 mm	39 mm	Over 1½" more rainfall than expected for a 7 day period in November.
Total Rainfall 1-7 November 2000 as % expected in 7 days in November	205 %	238 %	372 %	228 %	This is over twice what is expected for the Region as a whole and almost 4 times the expected rainfall in the Mersey and Weaver catchments.

Table 5.4 Summary of Rainfall at Raingauge Stations – 29/10/00 to 8/11/00 (South Area)

Rainfall Station	29/10	30/10	31/10	1/11	2/11	3/11	4/11	5/11	6/11	7/11	8/11
Holden Wood	14.0	58.0	10.6	3.6	9.2	11.2	9.4	5.8	10.2	8.2	5.0
Hollingworth	13.2	20.4	5.8	11.8	9.4	8.4	10.6	4.4	7.8	6.0	2.6
Mowcop	10.8	17.8	7.0	1.0	10.8	2.6	7.4	21.0	23.6	8.6	1.6
Ringley	11.2	31.4	7.4	10.8	14.8	16.8	5.0	4.4	2.6	3.4	1.0
Woodhead	16.2	29.8	7.4	9.2	11.8	10.0	7.6	21.4	43.0	24.4	8.8
Worleston	12.2	23.8	1.4	2.2	10.4	1.4	13.4	8.6	17.0	5.8	2.2

NB – units are all millimetres

Table 5.5 Summary of Rainfall at Raingauge Stations – 29/10/00 to 8/11/00 (Central Area)

Rainfall Station	29/10	30/10	31/10	1/11	2/11	3/11	4/11	5/11	6/11	7/11	8/11
Abbeystead	20.6	60.1	9.5	28.7	27.0	8.1	4.1	6.9	23.1	10.7	8.0
Far Gearstones	24.8	48.	10.4	26.0	31.4	92	0.2	7.0	28.2	14.2	2.0
Worthington	24.8	48.8	10.4	26.0	31.4	9.2	0.2	7.0	28.2	14.2	0.0

NB – units are all millimetres

5.2 Overview of flooding in the Country/Region

Across the UK, the autumn of 2000 was the wettest since records began in 1766, with an average 457mm of rain falling between September and November. Areas such as Sussex (Lewes, Uckfield) and Yorkshire (York, Selby) suffered widespread serious flooding. Nationally, the estimated cost of the flooding was £500 million. 7,406 properties were flooded.

Flooding in the North West Region was less widespread than elsewhere in the country. Nevertheless both Central and South Areas were hit by varying degrees of flooding. Flooding experienced in North Area during the reporting period was considerable less significant in magnitude. In North Area, no more than four properties were affected.

All flood basins in the North West Region were operated during the event. It is estimated that £50 million of damage was averted by various flood defence schemes across the Region. The latest available estimate is that 189 properties flooded across South and Central Areas.

5.3 River levels

Table 5.6 shows monthly mean flows for October for three of the region's rivers in comparison to the Long Term Average (LTA) flows of these rivers. It can be seen that the Monthly Mean Flows during October 2000 were significantly above the LTAs. Table 5.7 shows the equivalent information for November 2000.

Table 5.6 – Monthly Mean Flows for Mersey, Lune & Derwent (October 2000)

Site	Monthly Mean Flow for October 2000 (cumecs)	% October Long Term Average
R. Mersey, Ashton	33.3	258
R. Lune, Caton	89.6	194
R. Derwent, Camerton	61.0	170

Table 5.7 – Monthly Mean Flows for Mersey, Lune & Derwent (November 2000)

Site	Monthly Mean Flow for November 2000 (cumecs)	% November Long Term Average
R. Mersey, Ashton	54.5	354
R. Lune, Caton	97.2	182
R. Derwent, Camerton	73.9	174

Other rivers reached record peak flows. The River Douglas at Wigan (Central) recorded its highest peak in 28 years, and the River Weaver at Ashbrook (South) was the second highest in 62 years (highest was in 1946). Some of the stations on the Rivers Wyre and Ribble (Central) recorded third highest levels in their period of records (21 to 39 years). The Lune at Caton recorded its highest mean monthly flow since the start of record.

5.3.1 South Area

South Area reported that, on average, the events were 1 in 45 year events.

- Levels on the River Weaver at Northwich were the highest since 1946 and the 2nd highest in 63 years of record.
- Levels on the River Mersey at Northenden and Didsbury were the highest since 1973 and the 3rd highest in 45 years of record.
- Levels on Sankey Brook at Causey Bridges were the highest since the start of records in 1953.

5.3.2 Central Area

- Levels on the River Etherow at Woolley Bridge were the highest since 1991 and the 2nd highest in 31 years of record.
- Levels on the River Douglas at Wigan were the highest on record; records began in 1973.
- Levels on the River Yarrow at Ribchester were the highest since 1995 and the 3rd highest in 22 years of record.
- Levels on the River Wyre at Garstang were the highest since 1980 and the 2nd highest in 24 years of record.

From 29th October river levels rose and Environment Agency standbys were achieved at Abbeystead, Garstang, St. Michaels, Scorton, Brock A6, Reedyford, Ewood Park, Locks Weir, New Jumbles Rock, Salmesbury, Low Moor, Penwortham, Central Park, Croston, Skerton Weir, Caton, Hornby, Blue Bridge, Wanes Blade Bridge and Kirkby. As the incident progressed Flood Warnings were issued for Walton-le-Dale and Garstang and later Severe Flood Warnings were issued at Ribchester and Wigan.

In the Wyre Catchment the two Flood Storage basins at Garstang and St Michaels were brought into operation. The Garstang basin was full to capacity and the basin at St Michaels was approaching its limit by the time the rain moved out of the area.

Table 5.8 – Summary of river levels (above Station datum) in Central Area

River Gauging Station	River	Maximum Level Recorded during incident	Time elapsed since river last exceeded this level.	Highest Recorded Level
Central Park	Douglas	1.883	Highest Recorded	N.A
Croston	Yarrow	2.318	13 Years	22/8/1987
Henthorn	Ribble	3.625	36 Years	13/12/1964
Hodder Place	Hodder	2.574	5 Years	31/1/1995
Reedyford	Pendlewater	2.47	Highest Recorded	N/A
Whalley Weir	Calder	3.897	5 Years	1/2/1995
Samlesbury	Ribble	5.833	5 Years	1/2/1995
New Jumbles Rock	Ribble	4.393	5 Years	31/1/1995
Penwortham	Ribble	5.806	7 months	8/3/2000
Scorton	Wyre	1.353	20 Years	22/11/1980
Garstang	Wyre	3.816	20 Years	27/10/1980
St Michaels	Wyre	4.843	17 Years	9/12/1983

5.4 Flooding – Source of flooding

With the high rainfall on already saturated catchments, the end of October and beginning of November saw much flood activity. Flood Watches were in force for most of the region. 14 fluvial Flood Warnings were issued, 3 of which were Severe Flood Warnings. A summary of the areas in North West Region affected by flooding is shown below in Figure 5.1. More detailed maps, and photographs, are given in Appendix G. Locations where more than 10 properties were flooded are detailed in Table 5.9, with a summary of the total number of properties affected also given here.

Figure 5.1 – Flooding locations for October 28th to November 7th 2000 (National format map)

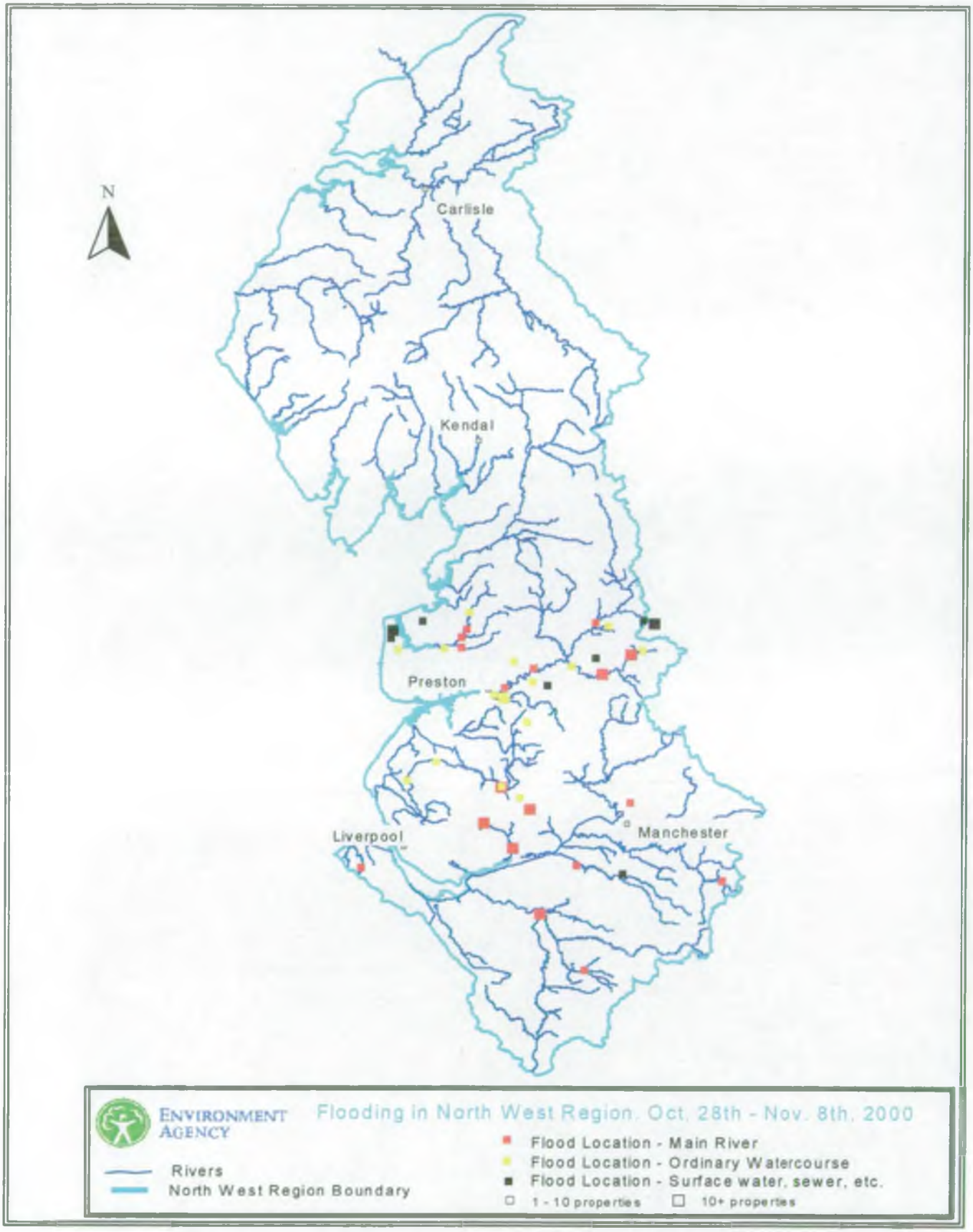


Table 5.9 – Summary of locations flooded October 28th to November 7th 2000

Location	Properties	Cause of flooding	Designation
Calagran Caravan Park, near Fleetwood.	20 caravans affected	Surface water, pumping station was overwhelmed.	Non-main
Bannister Hall, near Higher Walton (Preston)	17 properties	Culvert capacity exceeded.	Non-main
Padiham	10 cellars flooded, 13 properties	River Calder	Main+
Earby	15 to 20 properties	Overland flow.	Non-main
Barrowford	10 properties	Leak in flood defences on Pendle Water	Main
Adams Bridge area of Wigan*	6 properties, 35 evacuated	River Douglas	Main+
Leigh	16 properties (inc. 1 church)	Common Lane Brook, plus road drainage	Main
St. Helens	12 properties	Black Brook	Main
Dallam, Warrington	22 properties	Dallam Brook and Sankey Brook	Main
Northwich (30th October)	14 properties, inc. 1 residential, 2 evacuations	River Weaver	Main
Northwich (6th November)	13 properties, inc. 1 residential, 3 evacuations	River Dane, Weaver Navigation plus drainage	Main
Other properties**	64 properties, also 24 cellars and 9 caravans.		
TOTAL	190 properties 29 caravans 34 cellars		

* included in Table/map even though <10 properties flooded because of extensive disruption to town centre road network.
** see Tables 5.10, 5.11 and 5.12 for breakdown of locations affected.
+ the cause of flooding in these locations was not clear. Flooding apparently occurred from surface water, possibly due to the drainage systems being surcharged by high river levels.

5.4.1 South Area

Two significant flood events occurred in South Area during the reporting period, the first on 30th October and the second a week later on 6th November. Prior to both events a Flood Watch was issued for the whole of South Area.

Flood Warnings were issued on the 29th October for the River Irwell (Strongstry and Chatterton) and the River Weaver (Northwich). The Lilford Park Flood Storage Reservoir on the River Glaze was used on 30th October, as was the Morpeth pumping station on the River Birket.

Flood Warnings were issued on the 5th November for the River Etherow (Woolley Bridge), the River Mersey (Northenden and Didsbury) and the River Weaver (Northwich). The Mersey Flood Storage Reservoirs at Sale and Didsbury were operated on 6th November as well as the River Etherow floodgate at Woolley Bridge. The four worst affected locations in South Area were:

Warrington

In the Dallam and Bewsey areas of Warrington, the Sankey and Dallam Brooks experienced their highest levels since records began in 1953. This caused the banks to overtop at three locations, affecting approximately 22 residential properties. Surface water drainage in this area also surcharged which is thought to have caused flooding to the Eddie Stobart haulage compound and warehousing. Defences in Warrington include some defences and adopted banks but no formal flood defence scheme.

St. Helens

Also in the Sankey catchment, flooding to a depth of up to 0.72m (inside a residential property) from Black Brook was experienced to 10 residential and 3 commercial properties in West End Road.

Leigh

The Common Lane Brook culvert surcharged causing flooding to the adjacent church and roads. 15 residential properties in Johnson Close and Norley Close were affected. Some remedial measures were taken after events on 30th October and these had a beneficial effect on limiting the extent of flooding on 6th November. Investigations and discussions with Wigan MBC are ongoing.

Northwich

The centre of Northwich experienced significant disruption on both 30th October and 6th November with road closures, 3 buildings evacuated, 26 cellars and 14 commercial/residential properties flooded. The flooding arose from the River Dane surcharging Dane Street Bridge and flooding south into London Road. The Weaver overtopped its banks in the Watling Street area and at the marina boatyard (6/11/00 only). The drainage system through the Weaver Way river wall was also surcharged.

Tables 5.9 and 5.10 summarise the flooding that occurred in South Area for the two events (30th October and 6th November respectively).

Table 5.9 – South Area Flood Areas – 30th October 2000

Watercourse	Designation	Location	Properties affected	Details
Barrows Green Brook (Lower Mersey)	Main	Penketh, Warrington	Residential 1	Out of bank flow flooded one property.
Penketh Brook (Lower Mersey)	Main	Penketh, Warrington	Residential 1	Out of bank flow flooded one property.
Black Brook (Sankey, Lower Mersey)	Main	West End Road, St. Helens	Residential 10 Retail 1 Office 1 Garage 1	St. Helens Canal overtopped its banks. In addition Black Brook surcharged its culvert under West End Road
Dallam Brook (Sankey, Lower Mersey)	Main	Hawleys Lane, Warrington	Commercial 3 Haulage Compound	Sewage system surcharged and flooded Eddie Stobart compound and warehouses to maximum depth of 450 mm. Dallam Brook culvert under Hawleys Lane also surcharged but not assessed as causing flooding.
Dallam Brook (Sankey, Lower Mersey)	Main	Charter Ave., Bewsey, Warrington	Residential 4	Dallam Brook overtopped its banks behind No. 71 and flooded the road and surrounding land. Low lying properties 57, 59, 61 and 63 were flooded to a depth of 50mm.
Dallam Brook (Sankey, Lower Mersey)	Main	Southworth Ave., Bewsey, Warrington	Residential 2 (possible)	Street and Gardens from 21 to 61 flooded from rear of properties.
Sankey Brook (Sankey, Lower Mersey)	Main	Higham Ave. & Hodgkinson Ave., Dallam, Warrington	Residential 15	Low length of flood embankment off Higham Ave. overtopped and flooded property (30 to 40 Hodgkinson Ave. and 33 to 47 Higham Ave.) to approximately 300mm.
Common Lane Brook (Glaze)	Main	Plank Lane/ Common Lane, Leigh	Residential 15 Church 1	Abram Cottage Flash upstream of Common Lane Culvert spilled into Plank Lane, Common Lane and Johnson Close. These waters flooded the Church basement completely, the main building to depth of 150mm and the car park to 750mm. 9 properties experienced underfloor flooding in Johnson Close by waters from the same source. 6 properties in Norley Road also experienced underfloor flooding arising from the surcharging of road drainage by the flood waters.
Gale Brook Tributary (Irwell)	Main	Blackburn Road, Dunscar.	Residential 2	Surface water flooding due to blockage of road gullies. Difficulty in cleaning culvert screen at site but this did not contribute to flooding.

Table 5.9 – South Area Flood Areas – 30th October 2000

Watercourse	Designation	Location	Properties affected	Details
River Irk (Irwell)	Main	Hazelbottom Road, Smedley	4 Commercial	River water passed through a fox hole in a flood defence embankment and contributed to surface water flooding of 4 industrial units. There is a long standing surface water drainage problem at the site thought to be associated with the river outfall.
Sutts Hollow Brook (Bollin)	Main	The Dell, Spodegreen, Little Bollington	Residential 1	Water from the Sutts Hollow Brook flooding property (220mm above ground level) and garage (350mm deep).
River Weaver (Weaver)	Main	Shrewbridge Lodge, Nantwich	Residential 1	One property in the flood plain.
Rivers Weaver and Dane (Weaver)	Main	Northwich	Residential 1 Commercial 13 Cellars 26 Evacuations 2	River Dane overtopped its south bank immediately upstream of Dane Street Bridge and flooded London Road. The Weaver Navigation overtopped its banks at the marina boatyard and the Watling Street area. An area near the end of the Weaver Way river wall was flooded caused by the surcharging of drainage into the River Weaver.
River Wheelock (Weaver)	Main	Chapel Street, Wheelock Village	Gardens 2	2 properties on the edge of the flood plain were sandbagged which prevented them being flooded.
Keckwick Brook (Lower Mersey)	Main	Manor Park, Keckwick Brook	Commercial 1	Private flood bank to industrial unit overtopped.
Back Brook / Milton Brook (Gowy)	Main	Great Barrow	Residential 2	Properties on flood plain to Back Brook.
Arrowe Brook (Birket)	Main	Thingwall Road, Wirral	Residential 1	Blockage of trash screen upstream of Thingwall Road.
Brookside Brook Tributary	Non-Main	Bikershaw Lane, Bickershaw	Residential 1	Gardens to Nos. 154-160 Bickershaw Lane and 105-111 Simpkin Street were flooded to a depth of 75mm, this water level against the houses is 75mm below DPC level. Believed No. 160 Bickershaw Lane had minor flooding to property. Water from Hey Brook surcharged the road drainage.
	Non-Main	Styal Methodist Church, Styal	Church 1	Surface water flooding due to blockage of local drainage.

Table 5.10 – South Area Flood Areas – 6th November 2000

Watercourse	Designation	Location	Properties affected	Details
Common Lane Brook (Glaze)	Main	Plank Lane/Common Lane, Leigh	Church 1	Abram Cottage Flash upstream of Common Lane Culvert spilled only into the church basement and car park. This flooding was less extensive than on 30/10/00 partially due to efforts at removing channel obstructions.
River Tame	Main	Saddleworth	Cellars 4	Cellars were flooded. Source of flooding unclear. Probably ground water seepage.
Black Brook (Goyt)	Main	Gregory Row, Chapel-en-le-Frith	Residential 3	Maximum depth of flooding of 250mm
Black Brook (Goyt)	Main	A625 Chapel-en-le-Frith	Non	Culvert under highway surcharged due to partial blockage of the culvert by debris. Low lying properties protected from water spilling from the highway by sandbags.
River Goyt	Main	Water Meetings Cottage, Marple Bridge	Residential 1	Minor flooding, extent reduced by sandbagging.
River Mersey	Main	Stenner Lane, Didsbury	Gardens 3	Properties on the edge of the Didsbury flood storage reservoir were sandbagged. Only the gardens were affected.
River Wheelock (Weaver)	Main	Chapel Street, Wheelock Village	Gardens 2	2 properties on the edge of the flood plain were sandbagged which prevented them from being flooded.
River Weaver	Main	Shrewbridge Lodge, Nantwich	Residential 1	One property on the edge of the flood plain.
River Weaver	Main	Wood Street, Nantwich	Residential 2 Commercial 1	River Weaver overtopped its banks affecting properties. Sandbags were used to prevent flooding.
River Weaver	Main	Northwich	Residential 1 Commercial 14 Cellars 26 Evacuations 3 (4)	River Dane overtopped its south bank immediately upstream of Dane Street Bridge and flooded London Road. The Weaver Navigation overtopped its banks at the marina boatyard and the Watling Street area. An area near the end of the Weaver Way river wall was flooded caused by the surcharging of drainage into the River Weaver.

Table 5.10 – South Area Flood Areas – 6th November 2000

Watercourse	Designation	Location	Properties affected	Details
River Weaver	Main	Audlem Road, Nantwich – Hankelow	Residential 1	Overland flow affected property south of Stapeley Water Gardens.
River Gowy	Main	Beeston Gate Farm Cottage	Residential 1	Either overland flow or surcharge of culvert under farmyard.
Arrowe Brook (Birket)	Main	Thingwall Road, Wirral	Residential 1	Blockage of Wirral MBC maintained trash screen upstream of Thingwall Road.

5.4.2 Central Area

Two significant flood events occurred in Central Area during the reporting period, the first on 30th October/31st October and the second very soon afterwards on the 1st November. Prior to both events a Flood Watch was issued for the whole of Central Area.

The River Wyre Flood Basins at Garstang and Catterall were used as well as a smaller basin at Savick Brook. Throughout the period pumping stations at Altmouth and Crossens in West Lancashire were in operation.

The worst affected locations in Central Area were:

Wigan

Wigan was affected by high water levels and 2 properties were flooded in Eleanor Street. The bus depot and yard were flooded as the retaining wall was overtopped along a length of up to 30 metres. Police had to close the road at Adams Bridge and commercial properties such as Kwik Fit were flooded. Several cars on the car park at Robin Park were also damaged by floodwater. It is believed that the majority of the flooding in Wigan was either from 'blow back' into gullies or from non-main watercourses. Often watercourses were unable to drain into the main rivers due to the high level of those rivers. The depth of flooding was estimated at approximately 50mm.

Croston suffered only road flooding.

Ribchester

In Ribchester only one property was flooded directly from the River Ribble. Other properties were flooded but this flooding was as a result of problems with surface water run-off.

Garstang

Flooded properties in Central Area included Corn Mill Nursing Home, Mill House, and Almond Farm. The EWU responded with sandbags and assisted Wyre Borough Council as resources allowed. Flooding at Almond Farm was estimated to be less than 1m in depth.

East Lancashire

In the East Lancashire catchments widespread flooding was reported at Pendle Water and Barrowford. Three properties were flooded out at Whalley and 2 industrial properties at Nelson. In Padiham, Lune Street was flooded out together with the Town Hall car park and 2 industrial units. Again, this flooding was at least partially due to run-off being unable to get into rivers due to the high level of the receiving watercourse. Flooding in Barrowford was estimated to be around 300mm in the shop that was affected and 150mm in surrounding properties.

Table 5.11 shows a summary of properties flooded in Central Area during the October/November event.

Table 5.11 – Summary of flooding in Central Area

Watercourse	Designation	Location	Properties affected	Details
N/A	N/A	Calagran Caravan Park	20 Caravans affected.	Flooding reported by Wyre Borough Council. Pumping station was overwhelmed causing flooding from surface water.
N/A	N/A	Calder Avenue	1 Property	Surface water flooding reported by Wyre Borough Council
?	Non-main	Springfield Farm, Little Poulton	Estate flooded, but no properties.	Trash screen blocked causing flooding of estate, reported by Wyre Borough Council
N/A	N/A	New Lane, Poulton	3 properties	Surface water flooding reported by Wyre Borough Council
N/A	N/A	St. Michaels	1 property	Reported by Wyre Borough Council. Investigation pending on cause of flooding.
?	Non-main	Scorton	1 property	Blockage on non-main river, reported by member of the public
River Wyre	Main	Corn Mill Nursing Home	1 property	Reported by Wyre Borough Council and EA Officer
Ainspool	Main	Churchtown	2 properties flooded. 20 Surrounded	Reported by Wyre Borough Council and EA Officer
Old Brock	Main	Myerscough Microlight centre	9 caravans and 2 out buildings	Reported by member of the public and EA Officer.
N/A	N/A	Victoria Road, Walton-Le-Dale	20 cellars flooded	Treatment works failure reported by South Ribble Borough Council.
?	Main	Bannister Hall Area	17 properties	Culvert capacity exceeded, reported by South Ribble Borough Council and EA Officer
River Ribble	Main	Tickle Trout, Hotel. Walton-Le-Dale.	1 property	River burst its banks, reported by member of the public.
?	Non-main	Stonebridge Mill	1 property	Reported by Ribble Valley Borough Council. Cause unknown.
Boyces Brook	Main	Ribchester	1 property.	Reported by Flood Warden. Sandbagging prevented more flooding.
?	Non-main	Higher Commons Lane, Mellor Brook	4 properties	Culvert capacity exceeded. Reported by Ribble Valley Borough Council
N/A	N/A	Long Row, Mellor	1 property	Reported by Ribble Valley Borough Council. Overland flow
?	Non-main	Billington	3 properties	Railway culvert exceeded capacity. Reported by Ribble Valley Borough Council.
N/A	N/A	Sabden School	1 property	Highway drainage exceeded. Reported by Ribble Valley Borough Council
River Calder	Main	Station Rd/Park Rd, Lowerhouse Lane	10 cellars flooded. 13 props.	Reported by Burnley Borough Council

Table 5.11 – Summary of flooding in Central Area

Watercourse	Designation	Location	Properties affected	Details
River Ribble	Main	Sawley	2 properties	Reported by Ribble Valley Borough Council
N/A	N/A	Rimington	2 properties	Cause unknown. Reported by Ribble Valley Borough Council
N/A	N/A	Barnoldswick	1 property	Reported by member of the public. Surface water flooding.
N/A	N/A	Earby	15 to 20 properties	Overland flow, reported by Pendle Borough Council
Pendle Water	Main	Barrowford	10 properties	Leak in defences on Pendle Water, reported by Pendle Borough Council
N/A	N/A	Ormerod Street, Colne.	6 properties	Surface water flooding reported by Burnley Borough Council
N/A	N/A	Scarisbrick Arms, Black-a-Moor Lane, Haskayne.	1 property	Cause unknown, reported by member of the public
?	Non-main	Martin Lane, Burscough	1 property	Overtopping of non-main river, reported by member of the public
?	?	Bispham Avenue, Farrington	Nil.	The local authority sandbagged. Reported by South Ribble District Council
River Lostock	Main	Western Drive, Leyland	Nil.	The local authority sandbagged. Reported by South Ribble District Council
River Lostock	Main	Cuerden Way/Holme Road, Bamber Bridge	Nil	River came out of bank. Reported by South Ribble District Council
N/A	N/A	School Lane, Brinscall	1 property	Surface water flooding, report by member of the public
Smith Brook	Main	Martland Mill, Wigan	Nil	Road flooded, reported by Wigan Metropolitan Council. It should be noted that flooding was thought to be at least partially due to surcharging of the surface water drainage systems due to the high river levels.
River Douglas	Main	Adams Bridge area of Wigan	6 properties 35 evacuated	Reported by Wigan Metropolitan Council and EA Officers. It should be noted that flooding was thought to be at least partially due to surcharging of the surface water drainage systems due to the high river levels.

5.5 Number Of Properties Not Flooded Due To Agency And Third Party Defences.

Throughout the region thousands of properties were prevented from flooding due to defences already in place. The current estimate is that around £50 million of damage was averted throughout the region.

On an area by area basis the following properties were not flooded due to existing defences (Agency and third party). A full breakdown of the estimate of the value of damage averted is given in Appendix D Economic Impacts.

5.5.1 South Area

The number of properties successfully defended due to existing Agency defences in South Area was as follows:

- In the Warrington area various schemes defended around 270 properties downstream of Dallam.
- The Mersey Flood Defence basins at Didsbury and Northenden defended around 60 properties.
- Bedford Pumping Station and Lilford Park Flood Bank defended around 900 properties.
- River Gowy defences protected a large oil refinery.
- Timperley Brook defences protected 50 - 60 properties.
- Debris screen telemetry systems in North Manchester protected 40 properties.
- 135 properties in Glossop were successfully defended.
- 50 properties in St. Helens were successfully defended.
- Flooding to an estimated 50 properties in Northwich was prevented by Development Control Measures.

Recently built defences/schemes prevented flooding in the following previously badly hit areas:

- The River Etherow Flood Alleviation Scheme averted around £3m of damage to 65 properties.
- The River Irwell scheme at Ramsbottom defended 32 houses and 19 industrial units (note that this scheme is not yet fully completed).

5.5.2 Central Area

The Central Area Report states that the exact figure for properties not flooded due to Agency defences is unknown. However, due to the basins on the Wyre at Garstang and Catterall approximately 600 residential properties and 90 other buildings were protected saving £26 million. These basins were in operation simultaneously for only the second time during their existence.

The number of properties not flooded due to third party defences is unknown.

5.6 Number of Properties Flooded due to Failure (Not Exceedance) of Agency and Third Party Defences.

5.6.1 South Area

There were no major failures of defences in South Area.

The only minor failure reported were small foxholes in a flood embankment on the River Irk, which possibly meant that the embankment was not tight. This embankment has since been repaired. However, there are other issues in this area that could also have contributed to the flooding.

5.6.2 Central Area

Although it was reported that no properties were flooded due to failure of Agency defences, the following flooding did occur as a result of failures of defences:

- There were two large breaches on the Cheshire Line Watercourse within the River Alt Catchment resulting in over 250 acres of high quality agricultural land being flooded.
- The River Douglas overtopped a floodwall in the vicinity of the Bus Depot near Eleanor Street, Wigan. The wall was also reported to be leaking. Some 30 families in Eleanor Street were evacuated by Wigan MBC.
- A large breach in the River Brock floodbanks resulted in a considerable area of agricultural land being flooded.
- The debris screen on Clough Springs, which was only recently mained, was found to be choked with debris and floodwater was overflowing into Wilkinson Street.
- A steel sheet piled retaining wall upstream of Reedyford Bridge failed completely placing industrial property at considerable risk of collapse into the river.

5.7 Number Of Properties Flooded Due To Exceedence Of Agency Defence Standards

5.7.1 South Area

None reported.

5.7.2 Central Area

Flooding in Central Area due to the exceedance of Agency standards included the following:

- Almonds Farm earth bank defence was overtopped.
- In Wigan flood defences were at their capacity, with slight overtopping occurring in some places.
- In Churchtown, 2 properties were flooded and 20 surrounded by water.
- Corn Mill Nursing Home, Garstang.
- Flooding was reported in Croston Village from the River Yarrow and sandbag teams were engaged in attempts to staunch the overspill.
- Eight Acre Lane Watercourse in the River Alt Catchment surcharged into adjacent property. Considerable resources were deployed in an effort to bolster the defences.

- A 100 metre length of Drummersdale Drain was overtopped. Sandbag teams were deployed but could do little in the circumstances.
- Sandbags were deployed in both Padiham and Whalley when the River Calder threatened to overtop the local defences.

5.8 Towns Without Adequate Defences

In South Area there are several areas where defences may be required in the future. For the present, however, strategies will be prepared for the watercourses, including the identification of areas where flood defences should be considered. Areas where flood defences are likely to be required include Dallam in Warrington, a small area of Northwich and also Common Lane Brook in Leigh (which is part of a bigger strategy). Also in Northwich there is ongoing work to raise the floors of properties above the flood level.

In Central Area the only inadequacy identified was that flap valves may need to be installed on some drains to prevent back surges causing flooding.

5.9 Incidence Of Repeat Flooding

Repeat flooding in South Area occurred at Northwich and also Common Lane Brook, Leigh (church basement).

No repeat flooding was reported in Central Area.

5.10 Issues Arising And Recommendations

Key issues identified in Regional Response include:

- Altmouth Pumping Station, inability to operate plant as required. Meeting taken place, responsibilities clarified and action plan agreed. Pump availability improved Catchment strategy to be managed by NCPM and fast tracked to enable capital investment decisions to be made.
- Liggard Brook, recently completed scheme failed to live up to expectations of landowners. Post Project Appraisal to be carried out. Area has written to local MP explaining situation.
- Barrowford, Pendle, Flooding occurred 10 years on since previous event without work commencing, going to NRG on Friday 8th December and applying for planning permission the following week. Tender period during Jan 2001. If works are classified as Emergency Works, MAFF approval is not necessary before work commences.
- Capital Programme. Need to review the capital programme in the light of the recent event and respond to HO regarding the £51 million Government windfall. Folly Gates Tidal Control Scheme to be accelerated from 2005-06 to 2001-02. River Mersey Scheme to be accelerated from 2004-05 to 2002-03. River Alt Scheme to be accelerated from 2008-09 to 2003-04. Cringle Brook Scheme, possible emergency works could start in June 2001 if programme is accelerated. Sankey Brook scheme, planning issues currently being reviewed, bid to be made to Agency HQ to accelerate scheme from 2008-09 to 2003-04. Areas are currently investigating schemes at Northwich, Blackbrook at St. Helens, River Dean at Bollington and Common Lane at Leigh.

6. EMERGENCY RESPONSE

6.1 Major Incident Plans Activated

In South Area, Silver Control was implemented during both incidents at Northwich. This was based at Northwich police station. For the second event it was reported that the local authority set up an emergency centre at their own site. The implementation of a Silver Control should include the setting up of a *single* centre, co-ordinated by the police.

In Central Area police moved towards a Silver Control on receipt of a Severe Flood Warning for Ribchester. However, this was not formalised as the police had personnel on the ground who were able to deal with situation.

No other major incident plans were activated.

6.2 Agency Staffing, Plant, Adequacy Of Resource, Range Of Functions, Inter Regional Co-Operation

Regionwide, the total number of staff involved in the event, including EWU, was 385. A total of 16,000 sandbags were used in North West Region and an additional 700 pre-filled sandbags were sent to Wales.

37 staff assisted North East Region in sandbagging, inspecting defences, liaising with the public and emergency services, of which 5 were provided by EWU.

It was reported that if the incident had continued EWU personnel would have been hard pushed to keep up the level of staffing required under health and safety regulations, as bed rest was needed following the number of shifts worked.

Table 6.1 summarises the number of people involved in the event:

Table 6.1 – Summary of EWU personnel involved in the event (from 28th October to 7th November)

Emergency Works Unit	
Number of people involved	184 manual and 20 staff
Number of shifts worked	642
Number of hours worked	7700
Emergency Works Unit (assistance to North East Region)	
Number of people involved	32
Number of shifts worked	66
Number of hours worked	800
Total	
Total people involved	236
Total number of shifts worked	708
Total number of hours worked	8500

6.2.1 South Area

South Area Emergency Works Unit responded to the event by providing 24-hour cover, cleaning grids, issuing 3500 sandbags, operating major pumping stations and generally supporting Local Authorities through the Area. A total of 68 staff were involved in Flood Warning and response operations, working in excess of 1500 man-hours.

Three staff from South Area worked in North East Region. There were 15 people on the South Area volunteer list. A total of 68 staff were involved in the effort, including 16 Operations, 17 Flood Warning, 12 other FD staff and 16 other functions support staff. Many support staff were placed on standby to man flood basins and public address systems if needed, but not all were used.

Flood Warning staff worked a total of 16 shifts, amounting to 552 hours worked. Flood Defence Operations worked a total of 21 shifts, amounting to 962 hours worked.

6.2.2 Central Area

October 2000 was an unprecedented month in terms of the volume of emergency effort expended by the Area's Emergency Works Unit. At its height, towards the end of the month, every single available employee was engaged on emergency flood relief work. Heavy and persistent rainfall was a feature of the early and latter parts of the month and both Crossens Pumping Station and Altmouth Pumping Station were pumping around the clock at maximum output. During the period 9th to 10th October and again between 29th October and 2nd November every single available unit within the Area's 22 pumping stations was continuously in operation.

Exceptional heavy rain during Monday 30th October triggered a spate of emergency actions. A further period of heavy rainfall affected the River Ribble catchment and in particular East Lancashire during Wednesday 1st November 2000. Once again EWU were engaged in a series of emergency actions.

The following responses were undertaken by Agency staff during the course of the event:

- The Agency sealed the two breaches on the Cheshire Line Watercourse within the River Alt catchment with sandbags and imported clay.
- Sandbags were deployed in Wigan following reports that the River Douglas had almost overtopped a floodwall in the vicinity of the Bus Depot near Eleanor Street.
- Sandbag teams were engaged in attempts to staunch overspill from the River Yarrow in Croston Village.
- Considerable resources were deployed in an effort to bolster the defences along Eight Acre Lane Watercourse in the River Alt catchment, which was surcharging into adjacent property.
- Sandbag teams were deployed at Drummersdale Drain where the drain was overtopped for 100m, but they could do little in the circumstances.
- Flooding at Hall Lane, Simonswood was alleviated by the installation of sandbag barriers on Simonswood Brook.
- Action was taken to alleviate flooding from Dovers Brook at Sefton Meadows.
- The Agency provided around the clock attendance at Main Drain pumping station, Lytham in order to keep the debris screens clear and optimise pumping effort.
- The breach in the River Brock floodbanks was repaired to a high standard within a period of only a few days, despite poor access to the site.
- Attempts were made to remove a large tree from St. Michaels Bridge over the River Wyre at the height of the flood. In the event the tree split in two and was washed clear of the bridge opening.
- The cleansing of debris screens and the removal of miscellaneous blockages continued around the clock and well into the following day.

- Pendlewater attained its highest level for 33 years and threatened to flood large areas of Barrowford. Response teams from both Central and South Areas were deployed in an effort to plug any gaps in the defences and strengthen walls and embankments as necessary. The debris screen on Clough Springs was overflowing into Wilkinson Street. This was rapidly cleared.
- The banks upstream of Reedyford Bridge were stabilised by incorporating over 120 tonnes of blockstone into the eroded area following the failure of a steel sheet piled retaining wall.
- Sandbags were deployed in both Padiham and Whalley when the River Calder threatened to overtop the local defences.
- A response team visited Ribchester, which had been placed on Severe Flood alert. In the event, only the deployment of sandbags was required.
- Resources were diverted to Samlesbury and Walton-le-Dale in order to deal with isolated incidences of flooding.

Resources were also diverted to Salmesbury and Walton-le-Dale in order to deal with isolated incidences of flooding.

Towards the end of the event in the North West, the emergency effort was transferred across the Pennines to North East Region, where a number of staff and EWU operatives were deployed to assist in flood relief activities.

In Central Area staff worked a total of 583 hours in office time, 319 hours out of office time and 220 hours post-event.

6.2.3 North Area

Three members of staff from North Area assisted North East Region at Selby from 7 November on. 25 people were involved in total in North Area, working 6 shifts and a total of 450 hours (200 hours of which were out of office hours).

6.3 Emergency Services, Local Authority, Other Response Organisations

As well as the usual Police deployment, the Police helicopter was also utilised in the Ribble Valley. Records show that all but Lancaster City Council, Fylde Borough Council and Blackpool Unitary Authority were active during the incident. This was because those areas did not receive heavy rainfall.

6.4 Property Evacuated

It is estimated that 50 – 100 people were evacuated from the Floatel and the sheltered housing in the centre of Northwich.

In Central Area, 30 families were evacuated from houses in Eleanor Street, Wigan. Consideration was given to evacuating a further 30 households in Ribchester, but in the event this was not required.

6.5 Issues Arising And Recommendations

The South Area Debrief raised comments on issuing of sandbags. Agency policy is clear that the priorities are ensuring that watercourses are free of blockages, ensuring that FD assets are operating effectively and also using sandbags to reinforce flood defences. The Agency will only consider providing/placing sandbags to individual properties after this. Some Local Authorities had directed the public to the Agency for obtaining sandbags. Agency policy must be communicated to Local Authorities.

A need to review the operation of Agency installations was identified. The operating methodology of the Mersey and Wyre flood basins needs to be reviewed in order to maximise the benefits of these operational assets. There is also a need to look at the reliability of other assets such as pumping stations.

It was felt that lessons could be learnt from other regions regarding the issue of what the Local Authorities are doing during an event, for example, have they set up District Off Site Emergency Centres (DOSEC), control centres etc. (action RFWT and Area FWTs)

Debriefs took place with the local authorities affected by the flood event. Their responses are given in Appendix F.

7. PUBLIC RELATIONS

7.1 Links To The Media, Coverage By The Media (Except For Flood Warning Dissemination)

The North West Region Public Relations department handled well over 300 complete media enquiries during the 11 day period of this event. This is about as many as they would usually handle during an average quarter. Over 60 radio and TV interviews were given, more than would normally be done in an average quarter.

Across the Region, media coverage was 24 hour, with Agency staff doing interviews for breakfast, morning, afternoon, early and late evening news bulletins. The coverage was generally accurate and positive, with journalists appreciating the 24 hour service and the quality of information from Flood Warning faxes and the Agency's public relations department.

A regional document called "Flood Warning Nutshell" was updated regularly by PR and circulated to key FW staff likely to do media interviews. This carries the main regional and national messages, summaries of national policies on, for example, flood plain development, and key facts and figures.

Staff also used the regional Flood Warning fact sheets which list flood area details such as Flood Defence schemes, last dates of flooding etc.

A document called "Current Flooding – Key Stats. for Media Support" was also produced, which provided supporting information (rainfall, heights of rivers, level of Agency activity and operation of flood defences) about the flood event for the media.

Up to 6 November, public relations concentrated on accurate communication of the various Flood-Warning stages and ensuring that the key message of "you can't prevent it, you can prepare for it" was conveyed. In the later stages of the event, the effort was concentrated on ensuring positive proactive coverage of flood defence schemes in action, to demonstrate the work the Agency does behind the scenes to protect people and property.

The media interest regarding flood defence continued after the event. Granada TV ran a programme on climate change involving the Regional Water Manager, Annette Pinner. Radio Lancashire ran a live two-hour call-in programme from the Incident Room at Lutra House on 29th November 2000. An hour long radio programme for Radio Lancashire was recorded in the Central Area Incident Room in November, following the flooding. Three Agency staff participated in the programme, as well as a Flood Warden and university academics with expertise in flooding and climate change. The programme provided a positive platform to raise the profile of the Agency and to promote awareness of risk from flooding.

Significant items of media coverage included:

A four-page BBC NW Ceefax special on flooding.

A whole edition of Good Morning with Richard and Judy dedicated to flooding, featuring our Flood House and Fred the weatherman demonstrating how to make sandbags out of tights (something he learned when he launched the NW Flood Action Week last year for us).

An item in the main Lancashire paper the Lancashire Evening Telegraph on the Agency's flood defence maintenance workers headed "Unsung Heroes".

A page two article in the main Manchester paper the Manchester Evening News on the success of the Didsbury Flood Defence scheme.

A Granada TV NW news item on the Didsbury Flood Defence scheme in operation.

A BBC TV NW news item on the success of the Etherow Flood Defence scheme.

Radio interviews were given to the majority of the local radio stations. Television interviews with both BBC and Granada TV were given by South Area and Regional staff.

7.2 Number Of Interviews By Media Type

A summary of interviews over the period 29 October to 8 November is given in Table 7.1.

Table 7.1 - Summary Of Interviews
Flooding Interviews 29 Oct – 8 Nov 2000

N.B. These interviews are often repeated, so the total number of broadcasts will be higher than given here			
Monday 30 October 2000			
Century 105 (NW Region) (x2)	Steve Broughton	PR	a.m./early p.m.
Wish FM (Wigan)	Steve Broughton	PR	a.m./early p.m.
BBC GMR (Greater Manchester)	Steve Broughton	PR	a.m./early p.m.
Imagine FM (Cheshire) (x2)	Steve Broughton	PR	a.m./early p.m.
Piccadilly/Key 103 (Manchester) (x2)	Steve Broughton	PR	a.m./early p.m.
Granada TV (x2)	Jeff Lawrenson	FD RFH	Live 1730-1830 news
BBC Radio Lancashire	Jeff Lawrenson	FD RFH	Drive time
Big AM (Manchester)	Anne Goodier	PR	Drive time
Imagine FM (Cheshire)	Simon Heckle	FD S	Evening
Tuesday 31 October 2000			
BBC GMR (Greater Manchester)	Peter Lewis	FD S	Breakfast
Century 105 (NW Region)	Liz Anspoks	FD RFH	Breakfast
BBC Radio Lancashire	Dave Ranson	FD C	Breakfast
Signal (Stoke)	Peter Lewis	FD S	a.m.
Imagine FM (Cheshire)	Peter Lewis	FD S	a.m.
Piccadilly/Key 103 (Manchester)	Peter Lewis	FD S	a.m.
BBC GMR (Greater Manchester)	Peter Lewis	FD S	a.m.
BBC TV North West Today	Phil Younge	FD S	Lunch
Century 105 (NW Region)	Anne Goodier	PR	Drivetime
BBC GMR (Greater Manchester)	Anne Goodier	PR	Drivetime
Imagine FM (Cheshire)	Sue Fox	PR	Evening
Wednesday 1 November 2000			
Signal (Stoke)	Anne Goodier	PR	a.m.
BBC GMR (Greater Manchester)	Anne Goodier	PR	a.m.
Big AM (Manchester)	Anne Goodier	PR	a.m.
BBC Radio Lancashire	Steve Coupe	FS C	Lunch
BBC Radio Lancashire	Steve Coupe	FD C	Drivetime
BBC GMR (Greater Manchester)	Anne Goodier	PR	Drivetime

Thursday 2 November 2000			
BBC GMR (Greater Manchester)	Jeff Lawrenson	FD RFH	Breakfast
Century 105 (NW Region)	Sue Fox	PR	Breakfast
Imagine FM (Cheshire)	Simon Heckle	FD S	a.m.
Century FM (NW Region)	Anne Goodier	PR	a.m.
Piccadilly/Key 103 (Manchester)	Simon Heckle	FD S	a.m.
Big AM (Manchester)	Anne Goodier	PR	p.m.
Granada TV news	Jeff Lawrenson	FD RFH	Live evening news
BBC GMR (Greater Manchester)	Steve Broughton	PR	Drivetime
Imagine FM (Cheshire)	Steve Broughton	PR	Drivetime
Friday 3 November 2000			
Century 105 (NW Region)	Sue Fox	PR	Breakfast
Monday 6 November 2000			
Imagine FM (Cheshire)	Fiona Williams	PR	Breakfast
Century FM (Region)	Fiona Williams	PR	Breakfast
Big AM (Manchester)	Phil Younge	FD S	Breakfast
Century FM (Region)	Phil Younge	FD S	Breakfast
Signal FM (Cheshire)	Steve Broughton	PR	a.m.
BBC GMR (Greater Manchester)	Steve Broughton	PR	a.m.
Granada TV (Region)	Phil Younge	FD S	a.m.
BBC GMR (Greater Manchester)	Anne Goodier	PR	Lunch
Century 105 (NW Region)	Annette Pinner	FD RFH	p.m.
Imagine FM (Cheshire)	Annette Pinner	FD RFH	p.m.
Revolution FM (North Manchester)	Anne Goodier	PR	p.m.
Piccadilly (Manchester)	Annette Pinner	FD RFH	p.m.
Border TV (Cumbria)	Glyn Vaughan	FD N	p.m.
Big AM (Manchester)	John Lymer	FD S	p.m.
Imagine FM (Cheshire)	Anne Goodier	PR	p.m.
BBC GMR (Manchester)	George Ager	Area mgr S	Drivetime
Granada reports	Justin McCracken	RD	live 1730-1830 news
CFM (Cumbria)	Glyn Vaughan	FD N	Drivetime
Border TV (Cumbria)	Glyn Vaughan	FD N	Evening
Tuesday 7 November 2000			
BBC GMR (Greater Manchester)	George Ager	Area mgr S	Breakfast
Signal (Cheshire/Staffs)	Anne Goodier	PR	a.m.
Imagine FM (Cheshire)	Steve Broughton	PR	p.m.
Piccadilly (Manchester)	Anne Goodier	PR	p.m.
BBC NW Tonight (Region)	Kieran Morris	FD RFH	Evening news

Note that PR = member of public relations team, FD = member of Flood Defence Function, RFH = Regional Office, S, C = South, Central area office

7.3 Issues Arising and Recommendations

The media round up for the period 29 October to 8 November states that the main locations of concern for the Agency's external reputation, with respect to potential complaints from members of the public who were flooded, are likely to come from Ribchester, Northwich and Stenner Lane, Didsbury. The media round recommends that the next step is for Flood staff in Agency Areas to work with PR to ensure that the Agency counters any criticism or negative coverage, for example complaints from people whose properties have been flooded.

Issues arising from the Regional Flood Event Debrief held on 10 November 2000 are outlined below in section 7.3.1. These are internal Agency comments (i.e. not specific comments received from the public or external bodies).

The document "Current Flooding – Key Stats. for Media Support" praised the positive, proactive media coverage provided at both Regional and National level. The recommendation is that in the future a similar proactive stance should be adopted.

The region's FW procedures manual and the FW PR plan have been updated to include more specific guidelines on handling calls in the media

7.3.1 Agency Reputation

The management and response to the events in the Region generally went well and internal feedback commended Agency staff for their dedication and performance. The feeling was that the Agency's external reputation was enhanced. This was assisted by good proactive media coverage, especially at Woolley Bridge and at the flood basins at Sale and Didsbury.

Arising from the Regional Event Debrief, there was felt to be a need to look at potential external reputation issues at Altmouth Pumping Station, Liggard Brook, and Barrowford. At Altmouth PS one pump was out of service. A revised maintenance programme has now been instigated to ensure that the pumps operate reliably. At Liggard Brook there are potential issues with regard to local residents' expectations of the pumping station.

The internal reputation of flood defence and event management was largely enhanced by the event. This was helped by, for example, the visit of the Regional Director to staff on the ground during the event. This type of action was seen as a positive step, which can be taken up by RMT during events.

Other potential issues include insurance, advice on clean up after the event and preparing answers to comments such as "We got no warning" and "We want a flood defence scheme". The programme of introducing new flood warning areas in line with the MAFF high level target 2 will begin to address the concerns of many people who did not get warnings. In Northwich people in the flood warning area will receive a warning as soon as the first trigger is reached – which should meet some of the concerns there.

In November the Regional Director was contact by the Cabinet Office and asked to give some comments about why the flooding in the North West was less extreme than in other parts of the country. The response was as below:

- Although the North West received a very high level of rainfall, other parts of the country experienced even more. If the North West Region had received the same intensity of rainfall as the southern part of the country, major conurbations such as Salford would have been inundated.
- The North West has benefited from the level of investment in past schemes. It has also benefited from the use of flood basins and operational work in keeping rivers within their banks (e.g. cleaning of screens). This resulted in an estimated £50m of damage and flooding of thousands of homes being avoided.
- There is more main river (i.e. direct Agency responsibility) in the North West than in many parts of the country and hence the Agency has the ability to carry out a higher level of maintenance.
- The Agency has worked with Local Authorities to ensure that there is effective development control. This includes ensuring that development and flood risk policies are an integral part of Development Plans and Regional Planning Guidance, to avoid inappropriate development in flood risk areas. The Agency has taken a strong approach on consenting of structures close to main rivers.
- Given a high enough level of rainfall, flooding can happen anywhere. There is a need to take a strategic approach to the assessment of future needs and planning and a reassessment of programmes incorporating the social as well as the economic effects of flooding.

8. INCIDENT SPECIFIC

8.1 Major Industry/Infrastructure, Legal Recommendations – Issue/Action/ Ownership/Review Date.

Compared with other parts of the country, the North West Region was not severely affected during the Autumn of 2000. It was therefore felt inappropriate to send out letters to all professional partners. Feedback from professional partners was instead received at debrief sessions with councils, Flood Warning and emergency response planning group meetings, informal communication and public meetings. A summary of the feedback from professional partners is given in Appendix F.

Major roads affected included:

- Roads through the centre of Northwich were affected.
- In central Wigan, Adams Bridge was closed and diversions set up by the police.
- Ribchester Road, Ribchester was cut off for a short while.

APPENDICES

APPENDIX A

Development in the Floodplain

A DEVELOPMENT IN THE FLOODPLAIN

A1 South Area

South Area reported the following information about the four main locations that were affected by flooding:

St. Helens

All properties affected by flooding in St. Helens were more than 20 years old, dating from pre-war, 1940s and 1950s. The properties are too old to determine whether any issues relating to floodplain development requiring consent from local authorities (or equivalent planning authority) were considered.

There are no development control issues currently affecting this area.

Common Lane, Leigh

All properties affected by flooding in Common Lane, Leigh were more than 20 years old, mostly dating from around 1975. It is not thought that any property/development advice was sought at the time of construction of these properties.

15 houses and one church were not on the indicative flood plain. This is now being updated to included these properties.

There are no development control issues currently affecting this area.

Northwich

All properties affected by flooding in Northwich were more than 20 years old. They are all too old to determine whether there were any planning issues relating to floodplain development at the time of construction.

No land currently allocated for development was flooded during this event.

Dallam

All properties affected by flooding in Dallam were more than 20 years old, dating from the 1950s/1960s. They are all too old to determine whether there were any planning issues relating to floodplain development at the time of construction.

No land currently allocated for development was flooded during this event.

A2 Central Area

In Central Area, all properties flooded were over 20 years old.

There are currently no development control issues in the areas affected by flooding in Central Area.

Central Area are in the process of transferring information arising from this event onto the Flood Plain database for the updating of the indicative flood plain maps.

A3 General

The following general points were noted by Agency staff and members of the Regional Flood Defence Committee:

- There is currently no development proposed for the areas affected by flooding, although the risk remains that there will be. Stronger control on development through PPG25 would be valuable.
- It would be valuable to encourage greater use of Sustainable Urban Drainage Systems and to carry out more research into land use practices and their impact on flooding.

APPENDIX B
Public Response

B PUBLIC RESPONSE

In general, the locations in Central Area that were affected by flooding during the October/November 2000 event are areas that have either flooded or been threatened with flooding in the past. There was therefore a high level of awareness amongst the members of the public affected by this event.

The recent launch of the 4 stage Flood Warning system also meant that the issues of flood defence and Flood Warning had had a high profile in the media. Additionally, there had been a build up to this event as the whole of October had been exceptionally wet.

The perception of Agency staff is that the public did, in general, respond to the event and take action such as moving personal effects. However, real information will not be available without public surveys, which are not planned in the North West.

B1 South Area

The general comments from above apply to South Area, although it is difficult to gauge the number or proportion of members of the public who took effective action. It is known that some businesses in Northwich are still using their basements for storage of filing, despite the flooding of these basements that occurs.

B2 Central Area

Central Area reported that the public response to the event was good. Warnings were heeded and actions such as moving personal effects were taken. Without detailed questionnaires it is difficult to gauge the number of owners of flooded properties who took effective action but one estimate put the proportion as probably being around 60%.

APPENDIX C
Organisational Issues

C ORGANISATIONAL ISSUES

Points relating to organisation issues are scattered throughout this report. Some of the most important issues are compiled below.

The changes to the management of flood events undertaken under the "Changing Needs in Flood Defence" project were generally considered successful, particularly with regard to incident management roles. Specific issues were:

- EWU felt that the Regional Emergency Duty Officer (REDO) role working in conjunction with the Area Operations Duty Officers (ODO) proved very effective and communications between the two parties were good.
- The issuing of Flood Warnings from Area Incident Rooms (AIRs) worked well, although staffing AIRs during the long events of October and November was felt to have stretched the Agency's resources to the limit.
- The relationship between and function of Duty Strategic Manager (DSM), Regional Base Controller (RBC) and Area Base Controllers (ABCs) was not always clear and will be clarified in North West Region.
- It is important to have all Flood Defence staff available for duty in emergencies. In the North West we also successfully used staff from other functions for flood duty roles. Staff from development control and the National Capital Programme Management (NCPM) team are among those who play a vital role.
- In order for staff outside of the flood defence function to be fully effective if they are called upon for support during an event, they need to be provided with ongoing training support
- Dealing with public inquiries in the aftermath of the event was made more difficult by the fact that the task is now split between the flood defence and customer services functions.

The management of inter-regional aid could be improved. Specifically, it was difficult to identify the needs in other parts of the country so that resources could be deployed accordingly.

APPENDIX D
Economic Impacts

D ECONOMIC IMPACTS

D1 General

The overall cost to the North West Region, including support to North East Region, was approximately £400,000. This cost includes:

- around £150,000 of unbudgeted costs, most of which will be recovered by recharge to North East Region;
- around £75,000 of additional pumping costs and £83,000 of additional pumping repair costs;
- costs which the Region is committed to pay, although they have not yet been paid.

The gross cost of emergency repairs was £210,000 (excepting the pumping costs listed above). The net costs were around £50,000, taking into account repair work that was being undertaken anyway. It was therefore largely about reprioritising.

Table D.1 was compiled by Peter Lewis from the North West Region, summarising damage averted by flood defences for the event. It should be noted that the above figures relate to the larger autumn flood events only, lesser events and smaller schemes would add to these numbers. The second and third columns of the table indicate what would have been avoided if the event had been of design standard – i.e. it is an overestimate of the number of properties that were actually protected in this event. The fourth column represents the best estimate of damage that was avoided during October and November.

It can be seen from the table that approximately £50 million of damage was averted (using design standard figures).

It is understood that some claims for damages have recently been received arising out of flood events. There have been a total of 29 public liability claims arising. Four claims for flood damaged crops, with a total value £170,000. Twenty-five claims are for damage to microlight aircraft and caravans totalling £87,000. These claims are being progressed by flood defence, estates, finance, legal, loss adjusters and consultants as appropriate.

D2 Businesses affected

In South Area, business affected included the Eddie Stobart haulage compound and warehousing in Warrington. Also flooded were 3 commercial properties at West End Road in St. Helens. The centre of Northwich was badly affected with 14 properties, mainly commercial, flooded on both 30th October and 6th November. Other miscellaneous commercial properties flooded included four on Hazelbottom Road, Smedley, one at Manor Park, Keckwick Brook and one on Wood Street in Nantwich.

In Central Area, the centre of Wigan was affected by high water levels and flooded roads. Some commercial properties, including Kwik Save and the bus depot yard were flooded. Also affected by flooding were Corn Mill Nursing Home in Garstang and two industrial units on Lune Street in Padiham. A shop in Barrowford was flooded to a depth of around 300mm.

Table D.1 - Flood Events October and November 2000
Summary of Damage Averted

Location / Scheme	No. of Properties Protected at full protection		Damage Averted (£k) for this event	Comments
	Residential	Other		
River Mersey Flood Basins	50	10	1,400	Basins used on 6/11/00 Estimated numbers for this event not design level
River Etherow FAS	30	35	3,000	Gate operated 30 October 2000
Lilford Park Flood Basins	900		800	Basins filled on 30 October 2000
Warrington d/s Dallam	250	20	1,250	
Windle Brook St Helens	90		250	
Timperley Brook	50	2	620	
Glossop Brook FAS	105	30	2,500	
River Irwell Ramsbottom	32	19	2,500	
River Wyre Flood Basins	600	90	26,000	Basins used on 29 & 31 October 2000
River Douglas, Wigan	30		150	
Banister Brook	130	31	1,600	
R Eden Appleby FAS	170	20	50	
R Eden Carlisle	700	50	1,400	
Little Caldew	100	20	50	
River Kent Kendal	700	50	1,000	
River Cocker Cockermouth	100	30	50	
River Greta Keswick	150	30	300	
Extensive Screen Clearance throughout the period	740		7,400	Numbers used are minimum estimates
Totals	4,927	437	50,320	

APPENDIX E
History of Flooding

E HISTORY OF FLOODING

The following paragraphs are extracts from the Annual Reports to Flood Defence Committees for the past two years, giving a summary of flooding in the North West Region April 1998 and March 2000. There is also a brief summary of flooding that occurred between April 2000 and the October/November 2000 event.

E1 Flooding Incidents across the Region 1998/99

The North West was fortunate in being unaffected by the severe flooding that affected the Midlands and parts of South Wales during the Easter 1998 week-end. The year was, however, wet across the region and there were significantly more incidents of flooding in the North West than in an average year. Some of these incidents were caused by local thunderstorms, emphasising the difficulty in issuing Flood Warnings under such circumstances. Other events affected larger areas and the events of late October 1998 affected the whole region. The following paragraphs summarise the twelve main flood events of the year April 1998 to March 1999.

Although North West was unaffected by the flood event over the Easter week-end, the weather was wet over the week prior to Easter and the Agency's Garstang flood storage basin on the River Wyre was brought into use for a time on 6 April to prevent flooding of property in the Garstang flood zone. The Rivers Irwell, Mersey and Etherow were affected by heavy rainfall on 9 April and a yellow Flood Warning was issued for the River Etherow at Woolley Bridge although only roads and fields were affected by flooding.

Localised heavy rainfall occurred in the Macclesfield area on 15 June. The upstream River Bollin catchment was already saturated and responded quickly to the intense rainfall. Serious flooding problems occurred, not only from the River Bollin, but also from a culverted watercourse which had been unable to carry the flow and the pressure of water had burst its top. Surface water drains, sewers and road drains were also unable to discharge due to high river levels and nearly 80 properties were affected by the flooding. Flooding also occurred to five garages and commercial property in the downstream village of Prestbury. The Agency attended the event to sandbag properties and, later, removed tree branches and other debris that had been swept downstream. The greatest flood damage was due to a surface water problem rather than from main river and a surface water drain was renewed by the local authority.

An area of persistent, heavy rainfall affected much of Cumbria on 3 August. A total of 14 properties were affected by flooding in parts of south and west Cumbria. The Agency provided sandbags, but our response was hampered by flooded roads. Flood Warnings were provided to Borrowdale and camp sites at Keswick and Southwaite Mill.

An intense, but localised thunderstorm resulted in torrential rain over the Bannister Brook catchment in Leyland on 1 September. A third of the monthly average rainfall occurred in the space of 45 minutes and a total of 37 properties were affected by flooding. The main cause of the flooding was the storm exceeding the capacity and design standard of the local surface water drainage network. The Agency's predecessor had carried out a £1.5 million flood relief scheme at this location in 1993 and flooding did not occur from the river. Had the new flood relief culvert not been in place it is likely that the extent and depth of flooding would have been much worse.

The period 14-15 October was very wet across much of the region. The River Mersey, Etherow , Tame and Roch were all at very high levels as they flowed through the Greater Manchester conurbation. Yellow Flood Warnings were issued for the River Etherow at Woolley Bridge and the River Mersey at Didsbury. River level alarms on the River Roch catchment at Littleborough were passed to Rochdale MBC. Flood Warnings were also issued to Derbyshire County Council and the Waterside Hotel at Didsbury using the Automatic Voice Messaging system (AVM). The Rivers Eden, Irthing, Greta and Kent were also affected by high river levels. Five Agency standby levels were reached and all local authorities in Cumbria were issued with heavy rainfall warnings. Flood Warnings were also issued for the Borrowdale Valley and Keswick camp site. The Agency's flood gates were brought into use on the River Eden at Appleby. There were reports of some flooding at Mossley (east of Manchester) and one property was flooded in Kendal due to a blocked screen.

The whole region was affected by very wet weather throughout much of the period 22 to 31 October 1998. Although individual daily totals were not exceptional, there occurred an unusually large cluster of high rainfall days over this period. Catchments quickly became saturated and rivers then responded rapidly to successive bands of rain. River levels, especially in the south of the region, were very high throughout the ten days and over 90 sites exceeded the Agency's standby. This includes a number of sites when standby levels were exceeded twice or, in some cases, three times as river levels fluctuated in response to successive bands of heavy rain.

The Agency received reports of a total of 285 properties affected by flooding across the region, excluding gardens and garages. Of these, only nine properties were in formal Flood Warning zones and all of these received a Flood Warning. Flooding from non-main river affected 114 properties. The remaining 171 properties affected, although on main river, resulted from culvert blockage or surface water run off. No flooding resulted from pumping station or defensive structure failure. The main areas affected by flooding were Hellifield, Galgate (near Lancaster), Bollington (Macclesfield), Congleton and Mossley (near Oldham)

Over the period 22 to 31 October 20 yellow, 8 amber and 3 red Warnings were issued across the region. The Automatic Voice Messaging system (AVM) worked well. A total of 300 AVM calls were issued in North Area and some smaller zones (e.g. Carlisle and Eden) had 100% success rates. A further 150 AVM calls were issued from South Area giving a total of 450 AVM calls across the region.

The Emergency Works Unit was dispatched to clear debris from watercourses and screens throughout the Region over the period and flood defences became operational in many areas. Pro-active pumping at several pumping stations was instigated in anticipation of further high water levels. Where necessary, stoplogs were placed in defensive walls and flood basins became operational. In Appleby, Cumbria the town's flood gates were again activated. Staff assisted with sandbagging in many areas of the region. Most notably, the deployment of sandbags in a joint operation with the Local Authority prevented flooding of about 30 houses at the village of Stubbins, near Ramsbottom, Lancashire.

On 12/13 November heavy rainfall again resulted in high river levels on the Rivers Mersey, Roch, Irwell and Bollin. A yellow Warning was issued for the River Mersey at Didsbury and an AVM warning was issued to the Waterside Hotel, also at Didsbury. A river level alarm at Littleborough was passes to Rochdale MBC and Macclesfield BC were advised of the heavy rainfall warning. There were no reports of flooding to property.

A combination of strong winds and high tides on 2 January 1999 resulted in an Operation Neptune yellow Flood Warning being issued for the midday tide. With the predicted tide level at Liverpool reaching the Neptune trigger level, and a forecast of a 5.0 metre tide and force 8 westerly winds at Workington, the yellow Warning was upgraded to an amber Warning. The tidal gates at Skinburness, Flimby, Ravenglass and Arnside were closed and farmers on Skinburness Marsh were notified of the high tides. The actual tide reached 5.2 metres at Workington, but the event passed without incident and no reports of flooding of property were received.

The cycle of high tides in early January coincided with further strong winds on 4 January 1999. With a predicted tide level of 5,3 metres at midday at Workington a yellow Warning was again upgraded to an amber Warning. The Agency flood gates, that had been closed for the event two days earlier, were checked and conditions were monitored from various locations along the coastline. The tide actually peaked at 5.6 metres at Workington. At Skinburness, seven low lying properties were affected and at Ravenglass one property was affected by wave action overtopping defences. Some flooding of roads occurred in the Skinburness and Kirkbride area on the Solway Firth.

Heavy rainfall occurred over Cumbria and North Lancashire on 5/6 January 1999. River levels rose rapidly as the sustained heavy rain fell on already saturated catchments. Up to 100mm of rain caused widespread flooding of the River Kent and River Lune floodplains. The amount of rainfall decreased rapidly further southwards. Over 100 properties were affected by flooding during this event. The area most affected was at Kendal where 50 properties were flooded as a result of surface water drainage problems in the Lowther Estate area. Seven yellow, two amber and five red Warnings were issued by the Agency.

All flood structures were put in place including the Appleby floodgates, Keswick stop logs, Durranhill sluices and Little Caldew sluices. Many defences were inspected prior to and during the event and all grills and grids were inspected and cleaned. The Agency also assisted with sandbagging and at least ten properties were prevented from flooding by this action.

Farmers in the Garstang flood storage basin fringe areas were contacted and advised to move livestock. The basin was not operated since levels peaked some 400mm below the basin trigger level. All non-main river problems and sandbagging requests to the local authorities were acted upon.

Further heavy rain affected much of the region on 15/16 January 1999. In Cumbria, the Rivers Eden, Kent and Greta were all affected. Four yellow, two amber and one red Flood Warnings were issued along with two additional Warnings for Borrowdale Valley and Keswick camp site. Three properties were reported as affected by flooding from non-main river and surface water drainage problems. The Appleby floodgates on the River Eden were operated and The Sands at Appleby were sandbagged. Further south, the Rivers Mersey, Irwell, Roch and Birket were also affected by heavy rainfall. A river alarm at Littleborough was passed to Rochdale MBC and Greater Manchester Police were notified of potential problems at Ford Lane, Didsbury.

Much of Cheshire was affected by heavy rain on 28 January. Rivers affected included the Weaver (Audlem, Shrewbridge and Ashbrook), the Dane (at Congleton) and the Birket (on the Wirral). An amber Warning for Audlem was passed to Railtrack. There were no reports of flooding of property.

In the Ribble catchment flooding was experienced on 18/19 February from Mearley Brook in Clitheroe. The flooding was caused by contractor's temporary works for a bridge widening to the watercourse. The method of shuttering for the parapet walls severely impeded passage of flood water, which retarded flow causing water to back up. The problem was compounded as the contractor had taken down a flood defence retaining wall to gain access to the river. Seventeen properties were flooded. The Agency is considering instituting legal proceedings against the contractor.

E2 Flooding Incidents Across The Region 1999/2000

The 1999/2000 year was, thankfully, less eventful than 1998/99 when widespread flooding affected the region in October. A total of 21 incidents were recorded affecting 561 properties during the year. Again, the impact of local thunderstorms during the summer months is very evident. These are very difficult to predict and move quickly and often unpredictably and it is virtually impossible to give timely warnings to those properties affected. The following paragraphs summarise the most significant of the flood events affecting the region during the year.

On 5 July 1999 bursts of heavy rainfall affected the upper reaches of the Irwell catchment. Reports of flooding were received and the South Area Incident Room was opened to monitor conditions and co-ordinate an operational response. At Ringley 21.4mm of rainfall was recorded within an hour but no Agency river level standbys were exceeded. Flooding affected up to 50 houses, cellars and commercial properties on Limy Water at Crawshawbooth caused by a tarpaulin blocking a debris screen and, at Rawtenstall, approximately 7-8 properties were affected. A small number of other properties in the area were also affected mainly from ordinary (non-main) watercourses.

On the 1st August 1999, a band of intense thunderstorms passed across Central Lancashire. In just over one and a half hours 56mm was recorded at Whittle le Woods and 37.1mm at Lancaster Lane, Leyland. The intensity of the rain overwhelmed the surface water drainage systems in several locations the worst affected being Ashby Street, Brindle Street and Cranbourne Street in Chorley where a total of more than 60 properties were inundated some to a depth of 1 metre. Also in Chorley, Botany Bay Antiques, the Railway Hotel and Canal Mill were flooded.

In Whittle le Woods an undersized non-main river culvert could not cope with the volume of water and 25 properties were affected in addition to a number of parked vehicles.

None of the flooding of property during this event was connected with problems on Main river and, in general, the river system in the area coped well with the run off generated by the storm. Post event surveys picked up wrack marks that confirmed the rivers had remained in bank and that the flooding was primarily caused by surface water drains being unable to cope with the deluge.

Due to the sudden and unexpected nature of the event the Agency's Emergency Works Unit (EWU) was unable to respond in time to be effective at all sites although significant blockages were removed from Bannister Brook in Leyland which could have caused flooding if left unattended. The EWU also carried out an operational response at Whittle le Woods and assisted in Chorley on a priority basis.

On 29th September heavy rainfall affected southern parts of the region and parts of south and east Lancashire. At Darwen, 13 houses, 8 shops and a factory were flooded from a blocked culvert on the non-main Buryford Brook. The riparian owners agreed to fund an inspection by the Agency's specialist Culvert Inspection Team who subsequently removed a considerable amount of debris. A factory and several terraced houses were also flooded in Clitheroe, adjacent to Mearley Brook. River levels were also high on the River Irwell at Strongstry and Chatterton and, on 1st October, a further band of heavy rain resulted in yellow Warnings being issued for the River Mersey at Didsbury and the River Irwell at Salford. Warnings were also issued to Railtrack and the Manchester Ship Canal Company. Three properties were flooded at Chapel-en-le-Frith.

Heavy rainfall affected much of Cumbria on 5th November and was particularly intense over the western coastal districts of Allerdale and Copeland. A yellow Flood Warning was issued for Cockermouth and informal warnings were issued for the Borrowdale Valley and Keswick Campsite. A total of 291 properties were flooded – 154 in the Whitehaven area alone. The majority of this flooding occurred from ordinary (non-main) watercourses, sewers, blocked drains and road gulleys although 53 properties did flood from main river. The Agency worked closely with Copeland and Allerdale Councils although their operations to clear blockages and provide sandbags were hampered by flooded roads.

Following further heavy rain over Cumbria on 28th November a yellow and an amber Flood Warning were issued for Keswick and informal warnings for the Borrowdale Valley and Keswick Campsite. A total of 22 properties were flooded in the Lakeland Park and Windybrow areas of Keswick from Cuddy Beck, an ordinary (non-main) watercourse, due to a bridge opening and screened culvert entrance becoming blocked. Again, the Agency monitored conditions and worked closely with the local authority and emergency services.

Heavy rainfall was widespread over Cumbria on 11th January and six yellow Warnings were issued for the River Kent at Kendal and Burneside, the River Greta at Keswick, the River Eden at Appleby and Eden Valley, the River Caldew at Dentonholme (Carlisle) and the Rivers Derwent/Cocker at Cockermouth. An amber Warning was subsequently issued for Carlisle and Farmers Eden Valley. A total of 15 properties were flooded – six from main river at West Newton and four from ordinary (non-main) watercourses as a result of blockages. The other five properties affected were at Brampton and due to a blocked culvert on an ordinary (non-main) watercourse.

The heavy rain also extended into north Lancashire where yellow Warnings were issued for the River Lune at Skerton and the River Wyre at Garstang. Reports of flooding were received from Halton where a garage became partly submerged and at Great Eccleston where a property was surrounded by flood water. The Emergency Works Unit was drafted in to provide sandbag protection to properties at Halton and the property at Great Eccleston. They also provided a sandbag facing to the flood embankments downstream of St Michaels on the Right Bank of the River Wyre which were showing signs of seepage. In addition the flood storage basin at Garstang was brought into use.

E3 Flooding between April 2000 and October/November 2000

3rd and 4th June 2000

At 16.00 hours a heavy rainfall warning was issued by the Met. Office and rain gauge alarms were triggered. During the course of the incident EA Standbys were achieved at Reedyford, Oxford Road, New Jumbles Rock, Central Park, Croston, Skerton Weir, Garstang, Low Moor, Caton, Blue Bridge and Wanes Blade Bridge. A yellow Warning was issued at Croston and an amber was also issued at Ribchester.

The worst affected area was the Pendle Water Catchment where rainfall totals exceeded 34 mm in 6 hours. In Barrowford 4 properties and one shop were flooded with a further 6 properties having their cellars flooded out. An engineering works was affected from Walverdon Water and at Trawden 3 commercial properties were affected by high water levels in Trawden Brook.

There were reports of property being flooded in Cleveleys due to the failure of a surface water pumping station and isolated reports of surface water affecting roads and gardens. At Buckow Brook Pipeline was flooded out together with the road and car park outside the White Crow Worthington.

The EWU responded across the Area clearing grids and assisted local Authorities and Emergency Services at Borrowford and Ribchester where sandbagging of properties was undertaken.

26th September 2000

Operating under the new 4 stage Warning system the duty staff issued a Flood Watch for the Area to cover a period of bad weather starting over the weekend. The value of this warning to the professional partners and the public at large was evident when thunderstorms caused isolated flooding and hazardous conditions in Blackpool on Tuesday 26th October. None of the Flood Warning Areas were affected and the rivers in the area did not reach Flood Warning levels.

5th October 2000

A Flood Watch was issued for all catchments on Thursday 5th October. Although the water levels in the river systems remained below Flood Warning levels there were reports of local flooding of roads and gardens in Maghull and Ormskirk. The ongoing period of unsettled weather was to contribute to deteriorating conditions in the pumped catchments in particular the Alt and Crossens Catchments. Rainfall totals of 31.4 mm were recorded over 24 hours at Liverpool and 23.2 mm at Fine Jane. With heavy bands of rain continuing to affect the Area the pumped catchments were becoming waterlogged and the next band of heavy rain was to prove significant.

9th – 10th October 2000

Over a period of 24 hours a band of persistent rain moved across the south Lancashire catchments of Alt Crossens and Douglas. A Flood Watch was issued and the incident room was operational throughout the day. During the course of the incident EA Standbys were achieved at Central Park, Croston, Kirkby and Wanes Blade Bridge.

The heavy rain on already wet catchments caused great strain in the pumped catchments and all of the Environment Agency's Pumping Stations were working to full capacity. Even so drainage systems were overwhelmed and standing water began to affect large areas of agricultural land in the Alt Crossens and Douglas Catchments.

High river levels in Wigan exposed some weakness in the defences u/s of Adams Bridge to the rear of the bus station. The bus station yard was flooded by a combination of ponding surface water, seepage and drains backing up due to the high level of the river. At Robin Park and Adams Bridge roads became impassable for a while the car park was flooded by surface water.

On the Old River Brock temporary defences were overtopped and flood water spilled out onto a field damaging some 16 microlight aeroplanes and 13 caravans.

APPENDIX F
Views of Professional Partners

F VIEWS OF PROFESSIONAL PARTNERS

F1 General Views Of Professional Partners

In general, the views from professional partners on how the Agency handled this event have been positive.

As the scale of flooding in the North West Region was far less than in other places, it was felt inappropriate to send out letters to all professional partners. Feedback from professional partners was instead received at debrief sessions with councils, Flood Warning and emergency response planning group meetings, informal communication and public meetings. A summary of the feedback from professional partners received at debrief events is given below.

F2 Views From Cheshire & Vale Royal Debriefs

Debriefs in South Area took place at Cheshire County Council on the 19th December 2000 and Vale Royal Borough Council, the local council for Northwich.

F2.1 Cheshire County Council Debrief

There was no representative of the Environment Agency's North West Region at the Cheshire County Council debrief. However, a representative from Environment Agency Wales attended (Cheshire County Council includes areas in the River Dee catchment, which falls under the remit of Environment Agency Wales). Key issues raised at the debrief, relating to the actions and communications of the Environment Agency North West during the event included:

- Environment Agency's cascade warnings were excellent. People in affected areas were well informed and aware of the situation.
- The Northwich Flood Warning Areas (A., B and C) have now been amalgamated into one FWA.
- A message was issued to the media indicating that the centre of Northwich was closed, which was not the case. Local traders were unhappy at this. This message would not appear to have been issued by the Agency but the Agency should note this nevertheless.
- A number of issues were raised by Cheshire County Council Engineering Service relating to highway drainage and culvert capacity. They have set actions on themselves of improving the knowledge of highway drainage and its interaction with land drainage, increasing the frequency of gully and manhole cleansing in vulnerable areas, increasing storage capacity of highway drainage and educating the public and landowners about responsibilities for land drainage. Some of these issues (particularly land drainage) may benefit from input from the Agency.
- A general point was made over the issuing of sandbags to the public. Agency policy is clear that the priorities are ensuring that watercourses are free of blockages, ensuring that Flood Defence assets are operating effectively and also using sandbags to reinforce flood defences. The Agency will only consider providing and/or placing sandbags to individual properties after these priorities have been met. Some Local Authorities had directed the public to the Agency for obtaining sandbags. Agency policy must be clearly communicated to local authorities.

A number of other issues were discussed but these related to County or Borough Council, emergency service or Environment Agency Wales actions and are not detailed here.

F2.2 Northwich Flood Committee (Vale Royal) Debrief

The minutes of the debrief meeting of the Northwich Flood Committee were not available when compiling this report. However, South Area reported that there were no adverse comments on the Agency's performance arising from this meeting. The main action was the amalgamation of the Flood Warning Areas in Northwich into one single area, an action which was supported by the professional partners concerned.

F3 Views From Lancashire Debriefs

Debriefs in Lancashire included an area wide debrief with Lancashire County Council on 22nd November and local Parish Council debriefs as outlined below.

F3.1 Lancashire County Council Debrief

The Lancashire County Council debrief included attendance from representatives of Lancashire Emergency Planning, Borough Councils from the Lancashire area, Lancashire Constabulary, Lancashire Fire & Rescue Service and the Environment Agency. Issues raised at the Lancashire County Council debrief that concern the Environment Agency included:

- The Severe Flood Warning issued for Ribchester was discussed, in particular the response of the police in considering a potential evacuation of residents in the Ribbleton area. The police stated that their primary duty in such an incident is to protect people's lives and that, on receipt of a Severe Flood Warning they will mobilise all resources and, if necessary, arrange for evacuation. An issue arising from this has been mentioned previously – specifically Central Area's review of all Flood Warning trigger levels. It was felt that the issue of a Severe Flood Warning may have been inappropriate due to the trigger level being too low.
- Comments were made on the information that was being received from the Environment Agency:
  - They felt that they were receiving too many faxes and the Agency was giving information that was not relevant to their District. The Agency explained that it was difficult to sift information and extract it for each District. However, they will look into the possibility of formatting faxes to make the information more user-friendly.
  - There was a request for the faxes to be numbered and time of issue clearly indicated in order to assist in indexing the information.
  - Faxed information should be simple plain English for all to understand rather than technical jargon.
  - There was a general feeling that faxes received from the Environment Agency are sometimes of poor quality and are sometimes difficult to read. This was also a comment regarding Severe Weather Warnings received from the Met. Office. Consideration is being given to these being emailed.
  - Districts generally find the weather warnings issued by the Environment Agency very helpful.
  - The Agency welcomes phone calls from Districts regarding clarification of information contained in warnings.

- The Agency is looking into the practicalities of emailing warnings and also setting up a website.

- Comments were made regarding pumping stations in the Crossens area, which were answered by the Agency.
- The Environment Agency is considering holding individual meetings with the 14 Districts.
- The Agency is reviewing trigger levels for Severe Flood Warnings.
- Floodline was felt to be useful but sometimes out of date. During the peak of the floods some 6500 calls per day were being received from the public.

F3.2 Parish Council Debriefs

In Central Area, Flood Warning Parish Council Meetings were held as follows:

- Bilsborrow and Myerscough 3/8/00;
- Settle 21/8/00;
- Sawley 24/11/00;
- Ribchester 27/11/00;
- Barrowford 6/12/00;
- Whalley 18/1/00.

The following were the main points raised at these meetings:

- Surface water is main cause of flooding due to poor highway drainage maintenance. Parishes realise that surface drainage is not an Agency responsibility.
- Parishes are grateful for the maintenance work and warnings that Agency do. In general they believe in a self-help approach.
- There was only one request for a flood defence scheme.
- There was only one comment of dissatisfaction with the Agency with regards to river maintenance.
- A comment was made wondering whether the sandbags were going to be removed.
- Clarified EA responsibilities are for main rivers.

F4 Other Issues

Flood Watch and Flood Warning faxes

As outlined above for Central Area, Local Authorities in Manchester also expressed concern about the volume of Flood Watch faxes. This comment was echoed by Norweb who reported that the volume of Flood Watches contributed to a failure to see a Severe Flood Warning quickly (See enclosed copy of letter from Norweb)

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