Defra/Environment Agency

Flood and Coastal Defence R&D Programme

Flood Warning Management System Phase I

R&D Technical Report
W5C-021/TR

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ENVIRONMENT AGENCY

Defra/Environment Agency

Flood and Coastal Defence R&D Programme

Flood Warning Management System Phase 1

R&D Technical Report W5C-021/TR

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Statement of Use
This document presents a generic description of how the Environment Agency manages flood warning incidents, compares this system with international best practice and presents a business case for development of a Flood Warning Management System.

Keywords
Research; floods; warning; forecasting; incident management; system.

Research Contractor
This document was produced under R&D Project W5C-021 by the Environment Agency CIS Section. Section 4 – International Good Practice, was prepared by Mott MacDonald, Demeter House, Station Road, Cambridge CB1 2RS

Defra/Environment Agency Project Manager
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EXECUTIVE SUMMARY

1. Background

In response to DEFRA High Level Target 1 **"encourage the provision of adequate and cost effective flood warning systems",** a thorough analysis of the Agency's current Flood Warning business was recently commissioned. This identified a number of serious issues, including:

- Flood Warning Targets set by DEFRA are not being met – nationally the Agency is 30% below target.
- Inadequate communications were a recurring theme during the analysis, and contain the potential for tragic consequences during an incident.
- There is overload in incident rooms during flood events, with attendant stress for Flood Warning staff and the prospect of serious mistakes being made.
- Flood events are managed using paper-based systems and procedures. This creates inherent difficulties for decision support, provision of information, performance measurement, resource deployment and tracking.

2. Business Drivers

A number of key drivers make the current position untenable:

- The need to manage big flood events more effectively – recent experiences underline this, against a background of flooding becoming more frequent and more intensive.
- The need to use staff resources more effectively.
- The rising demand for greater coverage of Flood Warning services by politicians, DEFRA and the public, coupled with the Agency's own target of providing coverage to 75% of properties in flood plains by 2007.
- The rising public expectation of the Agency.
- The Agency's reputation is at stake. There is a need to show that events can be managed well and professionally.

3. The Flood Warning Management System (FWMS) Project

Against this background, the FWMS Project was charged with defining the scope of a Flood Warning Management system that would meet the operational needs of the Agency, and address current issues:

FWMS components include:

- Capture and dissemination of field and Incident Room information both within the Agency and to the wider public (via MMDS).
- Summarised current and forecast conditions.
- Intelligent decision support for the issuing of Flood Warnings.
- A workflow capability, linking into Operational Procedures.
- Resource scheduling and tracking support.
- Upgraded communications.
- Interfaces into call handling and incident logging systems.

The project comprised 3 elements:

i) Identification and documentation of current flood warning business processes;
ii) A survey of international good practice in this field; and
iii) A business case for development of a flood warning management system.

4. Current Business Uses

During May 2002, the Midlands Regional office at Solihull, the Midlands Upper Severn Area office at Shrewsbury, the North East Regional office in Leeds and the Dales Area office in York were all visited to discuss their current 'Flood Warning Management Systems'. Based on these interviews, the report presents a generic description of how the Agency manages Flood Warning Incidents.

The description of current Agency Flood Warning Incident Management has been presented using a modern IT industry standard graphic, Unified Modeling Language (UML). This presents a set of Business Use Cases (processes), issues and opportunities.

5. International Good Practice

This section of the report provides a description of Flood Incident Management systems and practices of organisations with a responsibility for flood management and/or warning from Australia, Netherlands, France, Germany, Poland and the USA. It also provides a description of the functionality and relevance of incident command and control systems used by other relevant organisations in the UK, specifically the Cheshire Fire and Rescue Service, the Maritime and Coastguard Agency and the Police.

Comparisons are made with Agency current practice and the report concludes that the Agency would benefit from the use of an Agency wide standard Incident Management System.

6. Business Case

Drawing on the Business Objectives produced by analysis of existing Agency practices set out in 4 above, the report presents a Business Case for the development of an Agency-wide Flood Warning Management System (FWMS). The document also considers the merits of a number of possible solutions and provides a cost-benefit analysis of those options incorporated in the recommendations.

7. Conclusions and Recommendations

The recommended option is Option 6 Develop a Bespoke National System – High Integration to be implemented in conjunction with Option 3 Develop and Implement National Business Processes. Although the capital cost is higher than other options considered, this option will deliver key business benefits, and costs are recovered from operational cost savings more rapidly.

The proposed solution is a National Application that links several existing and proposed systems (for example Multi Media Dissemination, Flow Forecasting Modelling Systems etc). Whilst some system components will be nationally hosted, other modules will be processed locally to minimise dependence upon the Wide Area Network.

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LIST OF FIGURES

1. INTRODUCTION

The National Flood Warning Investment Strategy (2000-2010) identified a number of areas where performance improvements are necessary across the Flood Warning business. In this document the term "Flood Warning" includes all aspects of the process covering detection, forecasting, warning, dissemination, response and post-event analysis. Although some areas are now being addressed (for example Telemetry and Forecasting, Multi-Media Dissemination), a lack of investment in the Warning and Incident Management processes and supporting systems is apparent.

This project sets out the results of an extensive Business Analysis which was performed on Flood Warning Processes between April and July 2002, a review of international good practice in this area and consideration of possible solutions with associated costs and benefits.

2. ISSUES

2.1 Current Issues

Flood Warning and Incident Management are largely reliant upon manual processes at present; there is a dearth of application support for these processes. Although during "routine" events this arrangement is relatively manageable, large events stretch resources, and technology is likely to have a role in addressing the issues identified during analysis, viz:

- Paper based systems that cause difficulties in tracking information, and produce inevitable paper chases both during and after flooding incidents.
- Overloaded phone and fax lines into Incident Rooms during incidents causing delays in receiving and passing critical information. This also creates difficulties for public access to the Agency, and consequential damage to the Agency's reputation.
- Problems in the creation and maintenance of emergency Rosters, with resultant difficulties in identifying and deploying resources.
- Restricted communications:

  With staff in the field, and with the receipt and dissemination of field intelligence.

  Internally, there is the potential for ambiguity concerning the recording of key decisions surrounding the issuing of flood warnings.

  Between Regional Forecast and Area Flood Warning staff.

  Externally, resulting in inconsistent and/or mixed messages. Whilst the dissemination of messages will be addressed by the Multi-Media Dissemination Project, their creation remains with the Flood Warning teams.

  With Professional Partners and Control Centres.

  Between staff operating from different locations during an incident.
- Difficulties in identifying and tracking assets during emergencies.
- Problems tracking staff once they are deployed in the field. This also raises important Health and Safety issues.
- Inefficiencies in report production, further hampered by paper based systems.
- The need for improvements to the collection and collation of key operational data such as properties that have flooded during an incident.
- Freestyle recording and describing of incidents, exacerbated by inconsistent business processes between Regions.
- General overload in incident rooms and resultant stress for Flood Warning staff.
- Cumbersome paper trails that must be followed for post-event analysis and performance measurement.

2.2 Future Trends

The Agency's high level reports to DEFRA already shows failure to deliver warnings within targets in nearly 32% of cases. A number of factors will conspire to further increase pressure upon Flood Warning staff in the short to medium term:

- The Agency's target of extending Flood Warning coverage to 75% of the population living in flood plains (coupled with planned better targeting of Flood Warning Areas), will increase the number of Flood Warning Areas by a factor of between 3 and 5 by 2007.
- The number of points where forecasts are made is set to treble by 2005 and quadruple by 2012.
- Improved telemetry systems alone will increase the number of alarms to be dealt with by 20% before the end of 2005, however the factors mentioned above will raise this further by a factor of between 3 and 5 by 2010.

Without improved support to staff during incidents, it seems likely that increased pressure upon staff caused by improvements to the infrastructure will outstrip the ability of current ad-hoc incident management systems to issue warnings in a timely fashion.

3. REGIONAL AND AREA CURRENT BUSINESS USE

3.1 Introduction

During May 2002, the Midlands Regional office at Solihull, the Midlands Upper Severn Area office at Shrewsbury, the North East Regional office in Leeds and the Dales Area office in York were all visited to discuss their current 'Flood Warning Management Systems'.

This section presents a generic description of how the Environment Agency (EA) manages Flood Warning Incidents. It is based largely on the information gathered from interviews with Agency staff during May 2002.

The description of current Agency Flood Warning Incident Management has been presented using a modern IT industry standard graphic, Unified Modeling Language (UML). This presents a set of Business Use Cases (processes), issues and opportunities. The UML graphic is described in more detail in Section 3.3.3 below.

3.2 Scope

The scope of this section covers;

- Initial documentation of current core business use cases and use case descriptions with reference to existing agreed procedures and rules relating to the management of flood warning and flood events in the Midlands Region, Upper Severn Area, North East Region and Dales Area.

- Documentation of recognised issues and opportunities relating to current business processes.

It is not the intention to make this report a 100% accurate description of the business processes in every Region. Flood Defence will move to 100% consistency with the Target Business Process, over a period of time.

3.3 The Current Flood Warning Management System

3.3.1 Background

Since the Easter 1998 floods and the resultant implementation of many of the recommendations of the Bye Report, the Environment Agency has improved its effectiveness in the provision of accurate forecasts and the dissemination of reliable and timely flood warnings. These improvements were demonstrated during the Autumn 2000 floods. However, it is recognised that further improvements can be made.

To that end, this document is a deliverable of the W5C-021 Flood Warning Management System project. This project forms part of the joint EA/DEFRA Flood and Coastal Defence R&D program, specifically the 'Reducing Flood Risk Theme'.

The document covers the main generic business use cases (processes) that deliver the current EA Flood Warning Management System.

By documenting general business processes and their related issues and opportunities will aid the identification, prioritisation and agreement of possible future software support for the EA Flood Warning Management System.

The current Environment Agency Flood Warning Management System relates to a 'full range of activities involved with the collection of data, production of forecasts, compilation and dissemination of warnings and all related activities'.[1] With such a broad scope, this document intends to begin the process of business use case identification and description. As such it is intended as an initial catalogue, for reference purposes. Currently existing projects and future projects may advance and expand on the use cases described below.

3.3.2 Modeling Approach

The approach taken in this document is to begin to capture business requirements relating to managing a flood event by building a business use case model.

The essence of this model is to identify and begin to detail what the business currently deems it necessary to do to get the job done, broken into sensible chunks of business process description called 'business use cases'.

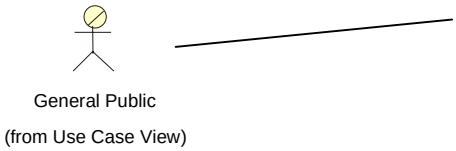
The use cases given in this document are business process (or analysis-level) use cases. They represent behavior that will be common to a number of business scenarios.

These business use cases *are not* intended necessarily to indicate the behavior of a possible IT system. System design requires concrete (analysis-level) use cases, the creation of which is a separate exercise.

3.3.3 Use Case Diagram Graphic

Each use case in this document use the Unified Modeling Language standard graphic to draw a picture that describes what is going on. That basic graphic uses various symbols that can be described as:

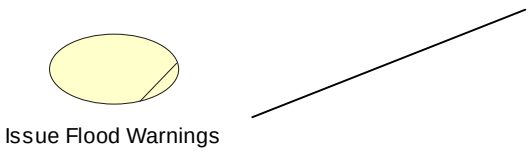
[1] Flood Forecasting and Warning Good Practice Baseline Review, R&D Technical Report W5C-013/2/TR, Mott MacDonald Ltd. March 2002, page 3.



Business Actor – The idealization of an external (to the business) person, process or thing interacting with a business use case that is considered to derive an observable benefit from the successful completion of a use case.

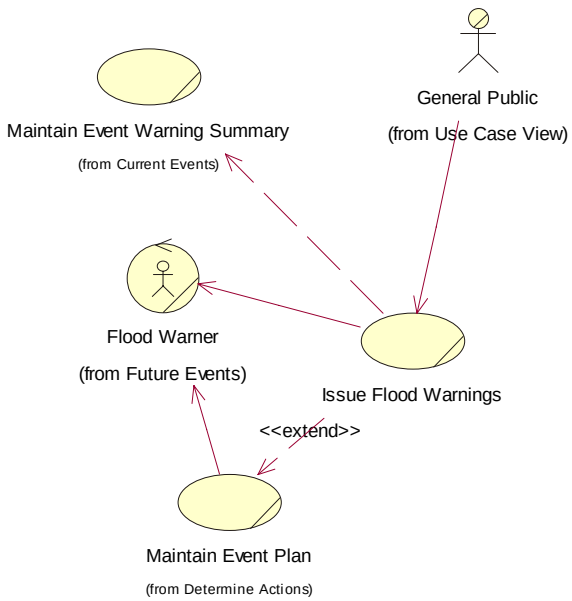
Business System Actor – The idealization of an internal (to the business) person, process or thing interacting with a business use case that is considered to be valuable to model so as to add clarity and understanding to the description of the use case and its delivery of observable benefits.

Actors, both Business and System, define a role. Roles may be human, they may be another system, and they may be the passage of time.



Business Use Case – The specification of a sequence of actions that a business system can perform by interacting with actors. A set of all use cases identified for a system describes all the known, externally visible behavior.

Actors communicate with use cases. This is usually shown by a solid connecting line. The line is bi-directional in terms of communication. If the communication line connecting an actor to a use case originates from the actor to the use case, this can be interpreted as an indication of an actor whose needs 'drives' the use case, that is they derive the main observable benefits.



The UML graphic provides a way of denoting relationships between use cases and clarifying activities. Two useful relationships to sometimes model are when a business use case can, under certain circumstances, extend to another business use case or when it 'includes' another business use case. Extend relationships are optional and do not always occur. Include relationships always occur and should not be optional. In each case, the relationship will be shown with a dashed line. Where the line originates is important. For an <<extend>> relationship, the line will originate from the optional use case to the 'base' use case. For an <<include>> relationship the line will originate from the 'base' use case to the use case that will be included every time in the successful completion of the base use case.

3.3.4 Use Case Description

Use cases were written based on the input of users during user interviews and from the associated documents they referred to. However, business users were encouraged to describe how they worked to manage Flood Warning Incidents, describing how it was in real-life, not necessarily simply how their procedures should work.

Each Use Case has the following components:-

References – references (if we can find them) to existing policy, procedures targets or standards that relate in some way to the use case

Pre-Conditions – what has to be in place before the work described in the use case could start

Trigger – what causes the work described in the use case to start.

Description – a description of the work undertaken by the user to perform the use case.

Post-Conditions – what should be in place so that the use case can finish.

Performance Goals – references (if we found them) to any performance goals for the use case.

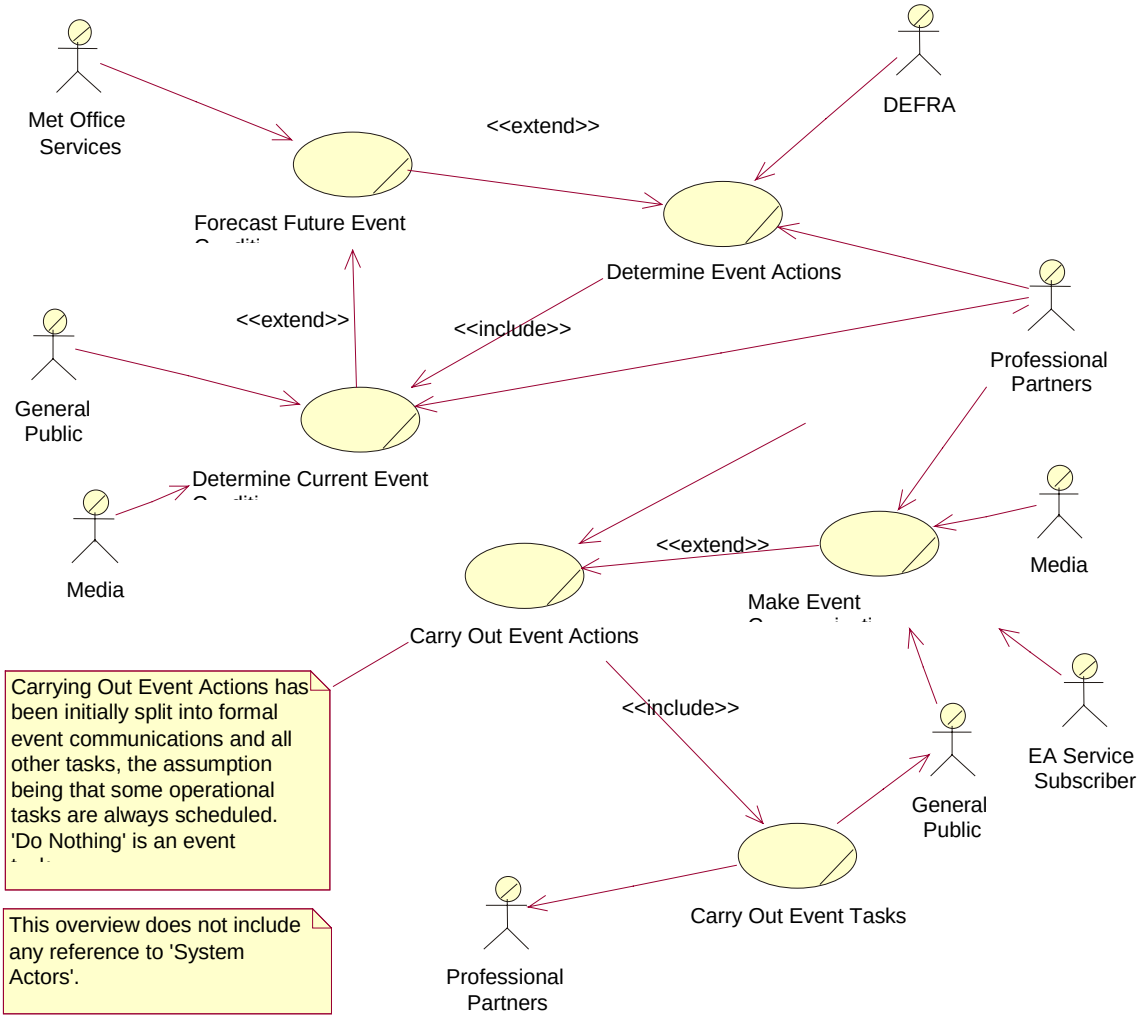
Category and Risk – category describes how important this work is to the Agency, risk describes the impact of the use case failing, if the outputs are not produced.

Issues and Opportunities – Where users identified problems in their work, and how they believed IT might usefully support them in the future.

3.3.5 Current Flood Incident/Event Management System Overview

The current Environment Agency Flood Incident/Event Management System relates to a 'full range of activities involved with the collection of data, production of forecasts, compilation and dissemination of warnings and all related activities'[2], of which specific Flood Warning Management activities are an integral part.

[2] Ibid.,



The above broad definition of the current business system can be given more structure by considering the activities of the current EA Flood Warning Incident/Event Management System as a set of abstract 'business use cases' (processes). These business use cases are designed to ensure that the public and other stakeholders derive the visible benefits of the Agency's efforts to warn them of, protect them from and aid them during flood events.

The following abstract business use cases have been identified.

1. FORECAST FUTURE EVENT CONDITIONS. The Environment Agency (EA), aided by services supplied by the Met. Office, attempts to accurately forecast what the conditions may be in any particularly defined flood event. This process includes forecasting future event conditions on the ground that will require both EA Flood Defence operational activities and the participation of our Professional Partners.

2. DETERMINE CURRENT EVENT CONDITIONS. The EA will carry out activities that ensure it is aware of current event conditions and those of any developing flood event so that it can take the necessary required action.

3. DETERMINE EVENT ACTIONS. With knowledge of current event conditions and accurate forecasts of the expected future conditions (aided by a growing accumulation of historical data), the Environment Agency determines the specific actions it will take in relation to a developing flood event. Many of these activities will have been agreed with direct reference to DEFRA policy, our Professional Partners needs, Emergency Plans and Flood Warning procedures.

4. CARRY OUT EVENT ACTIONS. Having determined what needs to be done, the EA takes action to ensure that those directly effected have accurate and timely information relating to the event and that all tasks that are the direct responsibility of the EA are discharged. This use case can cover many activities. These have been initially divided into two possible abstract use cases.

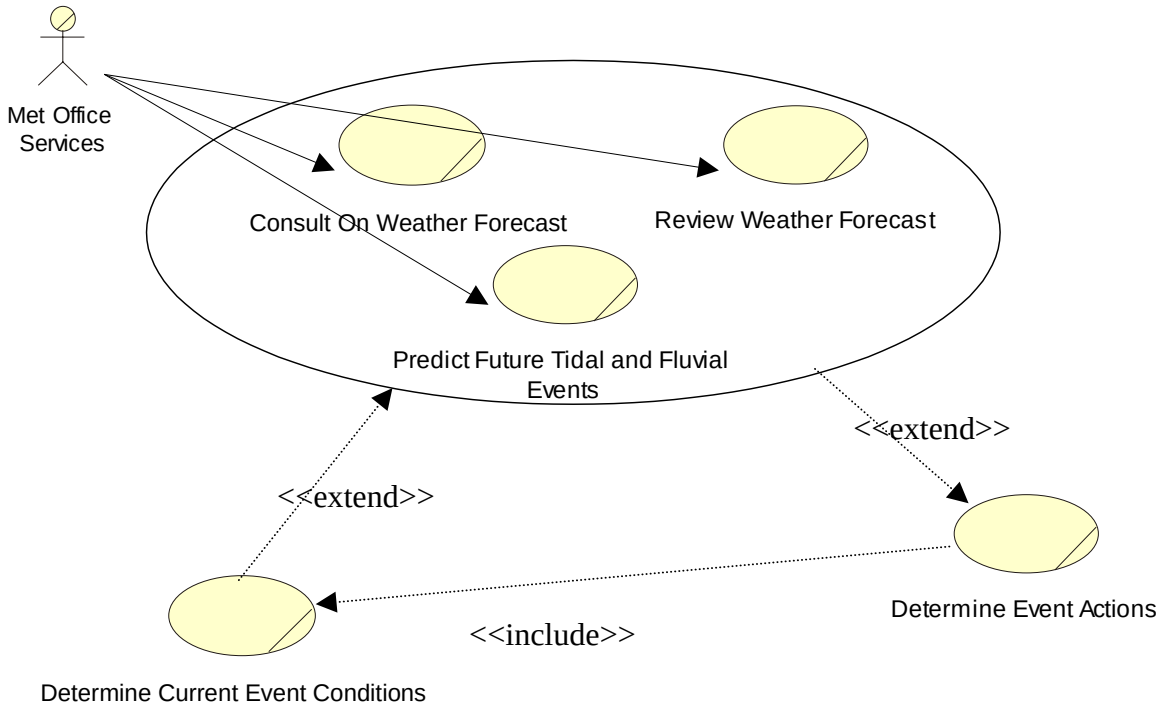
4A. MAKE EVENT COMMUNICATION. (Optional). The EA determines if a formal Flood Watch, Flood Warning, Severe Flood Warning or All Clear announcement needs to be made for a specific flood event. These announcements and the relevant event details are delivered in a number of ways, both generally and to specific service groups. Communications are also made to the various news media, both as formal press releases and in interview form.

4B. CARRY OUT TASKS. The EA have a number of tasks that arise from the actions it deems necessary to respond to any developing flood event. These cover the opening and staffing of specific Incident Rooms, carrying out field operations and data gathering, regular event status reporting and post-event analysis.

The following sections of this document review these abstract use cases in more detail.

3.3.6 Current Business Process (Use Case) Descriptions

3.3.6.1 Forecast Future Event Conditions

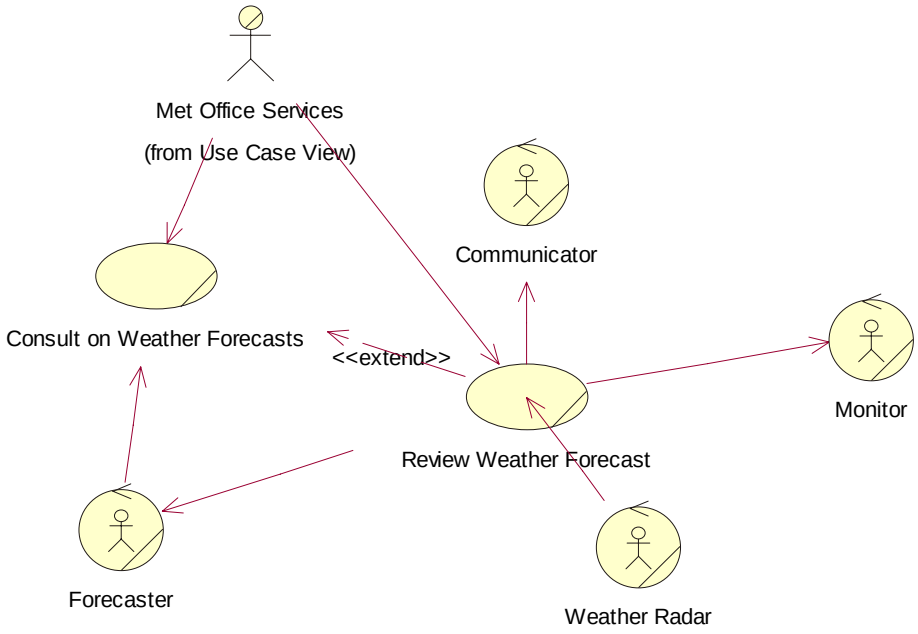


This section will consider the business use cases that currently make up the processes associated with the abstract 'Forecast Future Event Conditions', as described on page 8 above. To aid clarification, the business use case diagrams below show 'business system actors'. The business use cases covered in this section are:

Review Weather Forecast, including Consult on Weather Forecast.

Predict Future Tidal and Fluvial Events.

Review Weather Forecast



Review Weather Forecast – References. National Agreement for Weather Services.

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

EA Midlands Region Flood Emergency Service, Detailed Procedures to Issue a Flood Warning, V4.0, October 2001.

EA North East Region Flood Warning Manual Volume A, Monitoring and Forecasting Procedures, Edition 1, September 2000.

Review Weather Forecast – Pre-Conditions. In any Region, the Regional Forecasters and Monitors and in any Area, the Area Flood Warning Duty Officer, will have been scheduled to cover both office and out-of-office hours. (Met Office weather forecasts are made available generally, and from interviews it is apparent that AFWDO's monitor all weather forecasts, both Met Office and general media as a matter of good practice.)

Review Weather Forecast – Trigger. On a daily basis the Environment Agency Regional Forecasters will have access to the latest Met Office weather forecast in telex and email form. The forecast, depending on format will cover 3-5 days forecast and 6-10 days outlook.[3] Where appropriate, the Met Office Storm Tide Forecast Service will also be available.

[3] Email forecasts received in the North East Region from Met Office Manchester will have 5 day forecasts as one line descriptions and a 6-10 day outlook section. The North East also have access to the Met Office Storm Tide Forecasting Service (STFS) surge tide residual forecasts twice daily.

Exceptional Triggers. Outside the normal Met Office Weather Forecast, the Met Office may issue a Severe Weather Warning or a Heavy Rainfall Warning or a Thunderstorm Warning. These exceptional forecasts, if they occur both within and outside normal office hours, will normally be communicated by fax to the appropriate Regional Communication Centre, followed by a call from the Met Office to the RCC to check receipt. The RCC will take responsibility to distribute the exceptional warning during office hours or raise the alarm to designated staff out-of-hours. Raising the alarm is a separate business use case and needs to have been completed for an exceptionally triggered Review Weather use case to begin.

Business Rule – North East – If predicted rainfall totals for any of the 7 hydrometric areas exceed 15mm in 12 hours or 25mm in 24 hours within the next 36 hours, a faxed Heavy Rainfall Warning will be issued from the Met Office with a follow-up call made to the RCC.

Business Rule – North East – If predicted rainfall totals for any of the 7 hydrometric areas exceed 10mm in 1 hour, a faxed Thunderstorm Warning will be issued from the Met Office with a follow-up call made to the RCC.

Review Weather Forecast – Description. Regional Forecasters, Monitors[4] and others on the email distribution will review the Met Office forecast in relation to rainfall estimates and possible thunderstorm activity.

Extension Point. Where an agreement exists, Regional Forecasters may consult with the Met Office directly to discuss their understanding and interpretation of the Met Office weather forecast.[5]

Business Rule – North East - On receipt of a Severe Weather Warning[6] that relates to the North East or adjacent regions, the Forecasting Duty Officer should contact the Met Office Manchester to discuss the implications for the NE Region.

Where formal models exist, rainfall estimates may be transferred for analysis.[7]

Following the review of any Met Office weather forecast, Forecasters and Monitors may also review other sources of information to gain a view on the possible estimates of rainfall/river levels/tide levels to be expected in the future. These might include weather radar, snow conditions, ground observations/data collections, media weather forecasts, information submitted from Local Government, utilities and Emergency Services.

[4] In the Midlands Region these roles are held simultaneously by one person, in the North East Region they are usually split between two people. To some extent the Area Flood Warning Duty Officer can also be considered a 'Monitor' in this use case as they review Met Office weather forecasts and other media weather information independently.

[5] This arrangement was pointed out during an interview in the North East Region.

[6] Severe Weather Warnings are generalised warnings which can cover a wide range of expected weather conditions.

[7] In the Midlands Region a Flood Watch spreadsheet exists, into which rainfall estimates are entered.

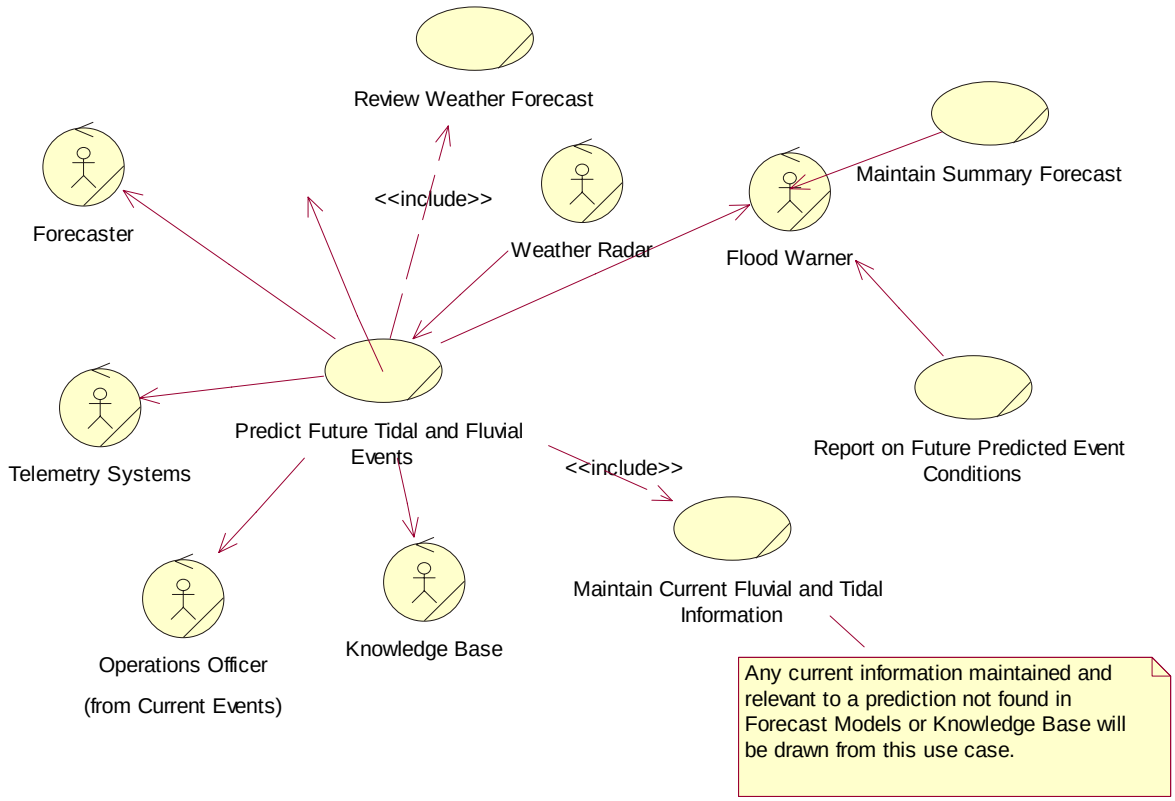
Review Weather Forecast - Post-Condition. Following the review of the weather forecast, the Regional Forecaster should have a view on the expected rainfall, thunderstorm activity, severe weather or storm tides in relation to a specific Region and its Areas. This view will assist in the prediction of future tidal and fluvial events.

Review Weather Forecast – Performance Goals. Daily Met Office weather forecasts and exceptional weather forecasts should all be reviewed by the Regional Forecast team and/or Regional Forecasting Duty Officer and Regional Monitoring Duty Officer depending on when the forecasts are issued. Area Flood Warning Duty Officers are expected to be aware of weather forecasts for their area. In a flood event, AFWDO's will discuss weather forecasts on a regular basis with the RFDO.

Review Weather Forecast – Category and Risk. The business use case Review Weather Forecast is an integral part of the Flood Warning Event Management System. Failure to review at a time when the forecast first becomes available compromises an early opportunity to begin active monitoring of a potential flood event.

Review Weather Forecast – FWMS Issues and Opportunities. The communication links between the Met Office and the Environment Agency depend, especially out-of-hours, on fax messages and manual RCC procedures. This is an area that could be reviewed to investigate alternate means of direct communication between the Met Office and required EA recipients.

Predict Future Tidal and Fluvial Events



Predict Future Tidal and Fluvial Events – References. EA North East Region Flood Warning Manual Volume A Monitoring & Forecasting Procedures.

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Common Incident Classification Scheme (CICS), Incident Classification Methodology, EAS/04_01, Version 2.0, July 2001

Predict Future Tidal and Fluvial Events – Pre-Conditions.
Current conditions will be known, via telemetry, rain gauge data, antecedent conditions, tidal stations, Tide Tables and at times directly observed information from data gatherers, the public, professional partners and the media.

Other required information relating to predicting future tidal and fluvial events will need to be available. Relevant to a particular event these could include; currently available and reviewed weather forecasts, weather radar and other forecast parameters. In some regions, predicting future tidal and fluvial events will be supported by a number of models.

Predict Future Tidal and Fluvial Events – Trigger.
A particular weather forecast indicates conditions are possible in which a flood warning might need to be issued in the future and/or telemetry based alarms will trigger the process of creating a future event prediction. The initial triggers are usually accompanied by a period of monitoring in which a decision is often made on the need to open the Regional Forecasting Room.[8]

Predict Future Tidal and Fluvial Events – Description.
The Regional Forecasting team will take into account the nature of the triggers. The Forecaster will decide or agree with FWDO's that the triggers require a forecast and schedule forecast discussions. The Forecaster will poll all available data and run any applicable forecast model. The resultant forecast prediction is quality checked prior to a discussion with related Flood Warning Duty Officers.

The discussion will cover all the main elements of the forecast. The discussion may concentrate on specific Warning Areas that have been identified as a priority concern. The discussion will cover predicted water levels and timings for the forecast and will include 'levels of confidence' issues, especially for the identified priority Warning Areas. The outcome of the discussion will be an agreed understanding of the current forecast prediction, its timescale and the current level of confidence that the forecast is accurate. Both the Forecaster and the FWDO should ideally log the forecast and its understanding.

Predict Future Tidal and Fluvial Events – Post-Conditions.
The agreed understanding of the forecast relating to a future tidal or fluvial event is known and taken into account when deciding what event actions need to take place. These actions

[8] In the Midlands Region current practice is to combine the Regional Monitoring and Forecasting role in one individual. In the North East, Monitoring of event conditions and telemetry alarms is done by a separate person, who will be working with a Regional Forecaster. In the advanced stages of an event, current condition monitoring can be supported by information from direct observation, the public, professional partners and the media.

will include deciding to issue a flood warning and also the decisions to carry out other event activities.

The prediction will also be used to inform internal EA functions, professional partners, media and public of the current EA position on the likely future event conditions.

Predict Future Tidal and Fluvial Events – Performance Goals.
The forecast of predicted future tidal and fluvial events is an integral part of being able to give those affected the maximum time in which to take appropriate action, whilst giving out warnings that are as accurate as possible. The target minimum lead time currently acceptable for any warning issued is 2 hours ahead of the event in England, and 1 hour in Wales.

Predict Future Tidal and Fluvial Events – Category and Risk.
The predict future tidal and fluvial events business use case is a core process for the Flood Warning Management System. It also has implications for the overall management of any flood incident or event.

If the process completely fails, EA flood warnings would be driven by current levels and weather forecasts alone, and warnings could be issued when not needed or without sufficient lead times to help manage a potentially serious event.

If the process of logging and disseminating the agreed understanding of any forecast fails, incorrect information could be passed to internal EA functions, professional partners, media and the public.

The process of Regional Forecasting and its related systems and issues are outside the scope of this work. However, the logging of the agreed understanding of the forecast and its wider dissemination are relevant to this project.

Predict Future Tidal and Fluvial Events – FWMS Issues and Opportunities.
Paper logs and white boards are the current method of recording the agreed understanding of event forecasts. The issues relating to this current practice are:

Agreed understanding of forecasts are not always logged.

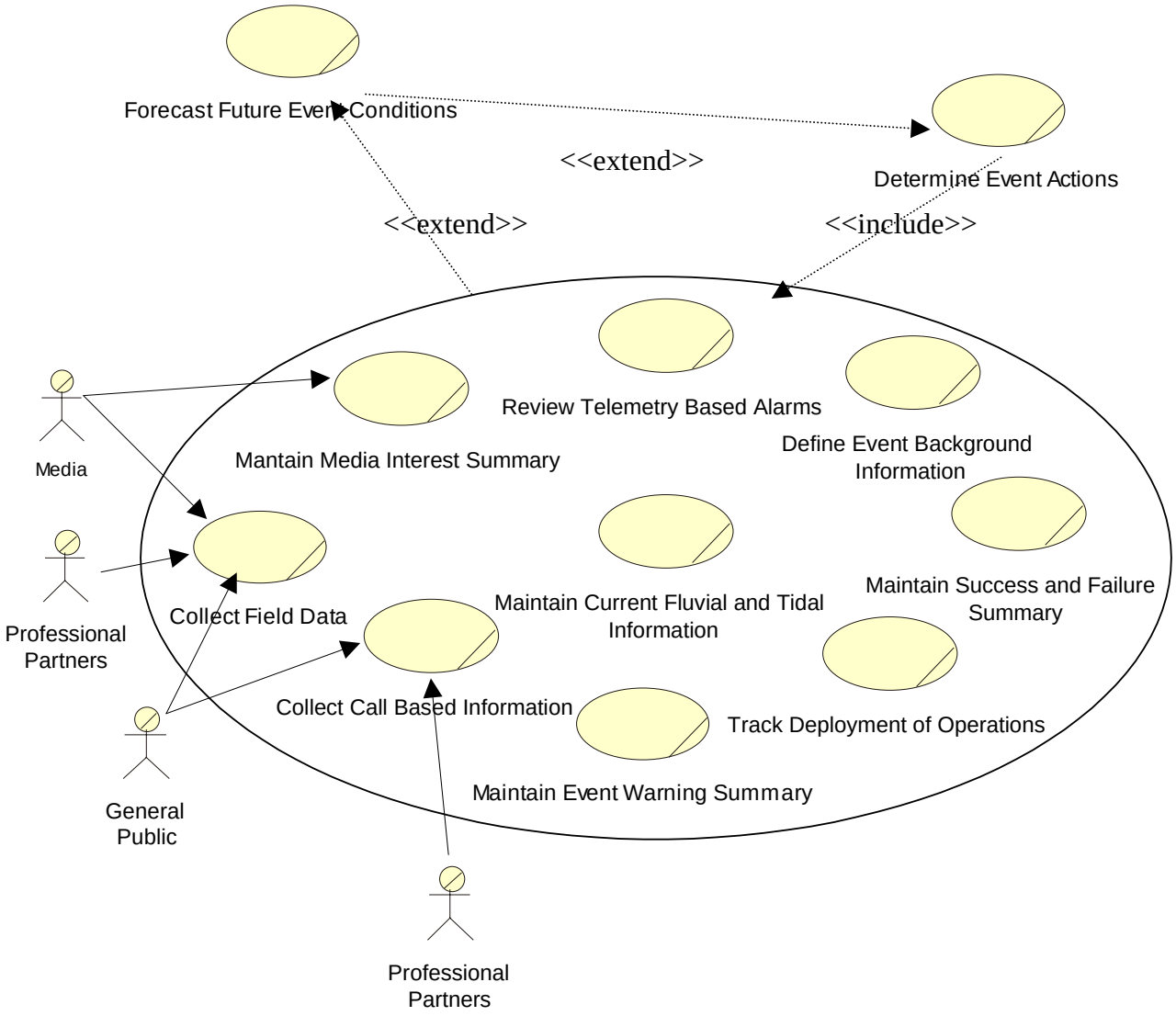
When they are logged, they are not always maintained.

Disseminating the forecast is usually done by fax or phone and is resource intensive at a time when resources may be scarce.

Disseminating the forecast to others runs the risks of the information being out-of-date, or not arriving at the most appropriate time.

There are a number of opportunities to address these issues by using technology to both record agreed forecast statements and disseminate this data to others who need to be kept informed and possibly take event actions.

3.3.6.2 Determine Current Event Conditions



This section will consider the business use cases that currently make up the processes associated with the abstract ‘Determine Current Event Conditions’, as described on page 11 above. To aid clarification, the business use case diagrams below show ‘business system actors’. The business use cases covered in this section are:

Review Telemetry Based Alarms

Define Event Background Information

Maintain Event Warning Summary

Maintain Current Fluvial and Tidal Information

Collect Field Data

Collect Call Based Information

Track Deployment of Operations

Maintain Media Interest Summary

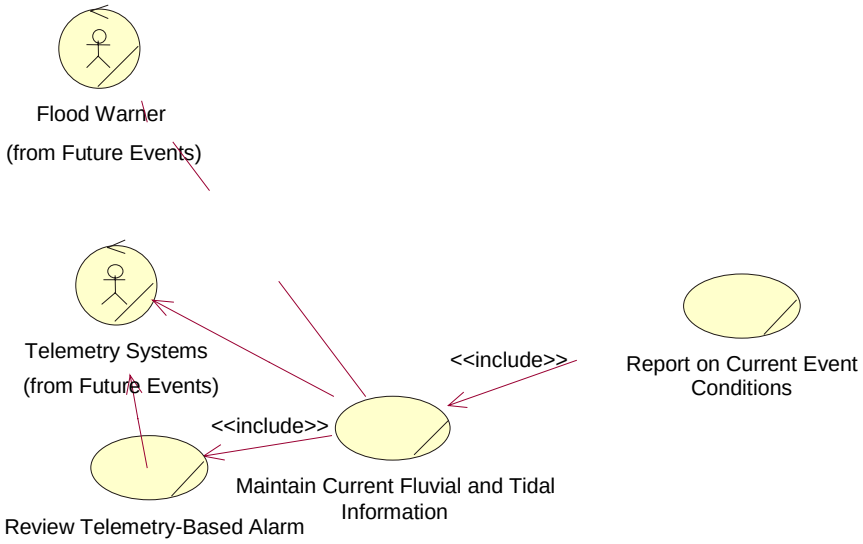
Report on Current Event Conditions

This use case relates to the process by which the Base Controller (either at Area or Regional or National level) can report at any moment on what they believe to be the current event conditions. (This knowledge must periodically form part of the flood event Situation Report).

The Base Controller will be requested to state the current event conditions by both the Media and various levels of EA management and staff. For the Base Controller to be able to report adequately the current event conditions, they must have to hand a number of key segments of information. They must have current knowledge of; event background information, current warnings, current fluvial and tidal information relating to the defined event, the current status of field operations, the success or failure of warning and associated forms of communication and the current interest in the event that has been demonstrated by the media.

The following sections describe how these processes currently work.

Review Telemetry-Based Alarms



Review Telemetry-Based Alarms – References. EA North East Region Flood Warning Manual Volume I Regional Arrangements for Flooding Incidents. EA North East Region Flood Warning Manual Volume A Monitoring & Forecasting Procedures.

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Review Telemetry-Based Alarms – Pre-Conditions. Telemetered rainfall, river level and tidal level outstations will have been configured with alarm conditions.

Review Telemetry-Based Alarms – Trigger. An alarm condition will have been met.

Review Telemetry-Based Alarms – Description. The first step, once an alarm condition has been met, is to transmit the alarm to the appropriate Duty Officers for acceptance. Some alarms are currently passed from the telemetry system directly to an appropriate pager, which will be held by the current Duty Officer. Some alarms will be received by the Regional Communications Centre for the transmission of a pager or phone message.[9]

Once the alarm has been received and acknowledged, the Duty Officer will have to review the alarm and form an opinion of the current conditions that may have caused the alarm. This process may involve monitoring telemetry systems, alerting and conferring with other Duty Officers and reviewing local weather conditions and forecasts.[10]

Review Telemetry-Based Alarms – Post-Conditions. A telemetry alarm would have been raised, transmitted, acknowledged and reviewed. The alarm's conditions would have been noted in relation to a specifically required action or, in the context of a developing event, knowledge of the current fluvial and/or tidal conditions would have been noted for further dissemination by the FWDO.

Review Telemetry-Based Alarms – Performance Goals. Particular systems would have specific goals related to performance and transmission. Both the North East and the Midlands Regions have set procedures for the delivery and acknowledgement of specified telemetry alarms.

Review Telemetry-Based Alarms – Category and Risk. Reviewing Telemetry based alarms are a core Flood Warning Management System business use case. (They can also on occasion be the initial trigger for the deployment of operational resources and thus relate to the overall management of a possible flood incident or event.)

Failure to deliver, acknowledge and review initial telemetry alarms risks losing the opportunity to begin effective monitoring at an early stage of a developing event. As the event escalates and catchments are subject to constant active monitoring by Duty staff, alarms become of less importance. As levels rise, fall and possibly rise again, telemetry alarms may even be selectively switched off.

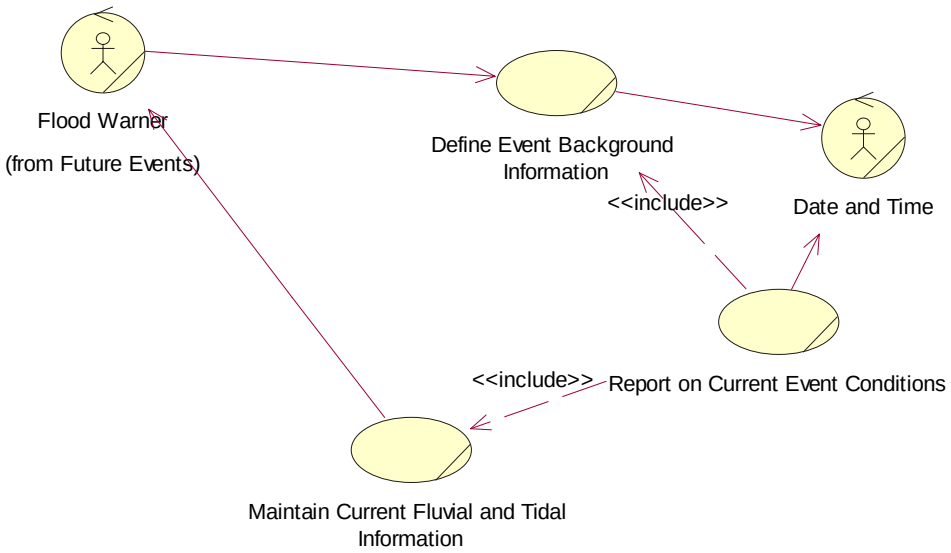
Review Telemetry-Based Alarms – FWMS - Issues and Opportunities.
As an event develops, where a MDO is charged with contacting a FWDO to alert them to a new alarm, direct contact between MDO and FWDO is sometimes difficult. This is especially true if the FWDO is home based at the time and is using limited phone lines to run Agency systems remotely. Even when the FWDO is at an opened AIR, MDO/FWDO contact is difficult if the FWDO is calling for assistance or talking to the FDO.

[9] The North East Region Northern Telemetry System calls pagers direct. Failure to acknowledge an alarm within a specified time will mean the alarm being sent to the RCC. The RCC will try and contact the appropriate Duty Officer directly.

[10] In the North East Region, the Monitoring Duty Officer currently keeps a paper log of river levels under review and notes changes over time. The Monitoring Duty Officer is also responsible for contacting the FWDO if certain alarm levels are reached.

Telemetry systems differ across the Agency regions. Integration into possible flood warning and incident/event support systems across several telemetry products would add to costs and risks.

Define Event Background Information



Define Event Background Information – References. Common Incident Classification Scheme (CICS) Incident Classification Methodology, EAS/04_01, Version 2.0 July 2001.

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Various Area and Regional historical Situation Reports:
Midlands Region 01/02/02 – 15:00
North East Region 12/11/00 – 08:00
North East Dales Area 12/11/00 – 18:00
North East Don & Aire Area 1/11/00 – 16:00

Define Event Background Information – Pre-Conditions. The event has developed to such a degree that an Area Incident Room has been opened. Currently this relates to the assessment made by the FWDO that their role and responsibilities would be best discharged with the support and facilities available in an AIR or that the forecast is such that this will soon be the case.

Define Event Background Information – Trigger. The outline of an Area Situation Report has been created.

Define Event Background Information – Description. For an Area, the event background is the recording of useful information that will 'set the scene' and mark the opening conditions of the event. It is usually composed by the FWDO or AFWDO and notes existing weather

conditions, recent rainfall amounts and the initial characteristics of the event. It also will note the time and date the Incident Room opened.

Define Event Background Information – Post-Conditions. The background information relating to an Area would have been recorded for dissemination on Situation Reports and will serve as a historical reference for possible post-event analysis.

Define Event Background Information – Performance Goals. Background information should be recorded as an event is recognised as beginning in an Area and an initial flooding incident situation report is being drawn up.

Define Event Background Information – Category and Risk. Background information is useful for dissemination to Agency staff and for communication to professional partners, the public and the media. Defining an Event Background is a Flood Incident/Event Management System business use case.

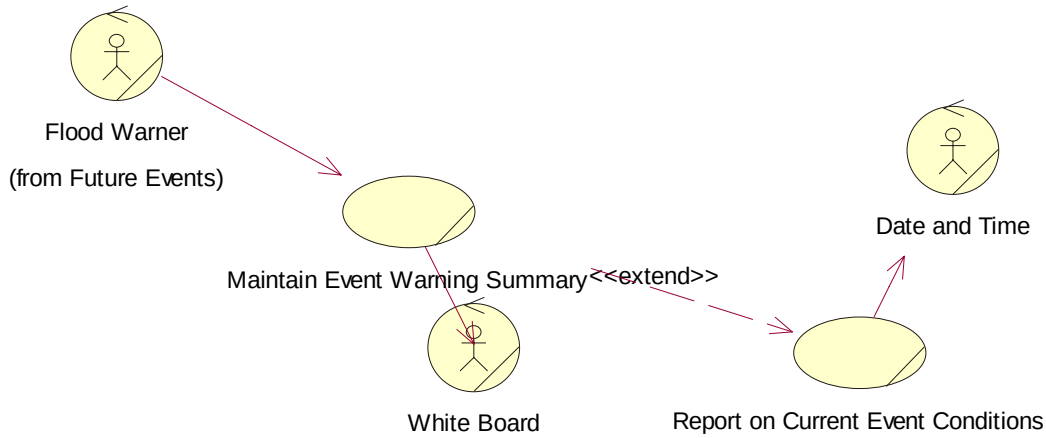
Failure to record immediately will not prevent the information being gathered at another time. The recording of the opening time of the Incident Room is a useful audit in relation to the performance of the Flood Warning function.

Define Event Background Information – Issues and Opportunities.
Background information isn't always stated on all situation reports.

Specific information that is required in relation to 'significant rainfall' event background could be more formally defined.

The need for an area 'event' background to be described and captured helps build an overview at Regional and ultimately National level if required.

Maintain Event Warning Summary



Maintain Event Warning Summary – References. Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

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North East Dales Area 12/11/00 – 18:00
North East Don & Aire Area 1/11/00 – 16:00

Maintain Event Warning Summary – Pre-Conditions. A flood warning for a current flood event has been issued. Existing FloodLine and AVM systems have been updated.

Maintain Event Warning Summary – Trigger. The details of the flood warning issued need to be captured for Incident and Forecasting Room visibility and dissemination to other EA staff.

Maintain Event Warning Summary – Description. In the Areas and Regions visited it was described how an event warning summary was maintained for reference by staff in various locations. These locations included AIR's, Forecasting Rooms, RIR's, PR and Strategic Planning offices. [11] These summaries were often displayed on a white board.

The Event warning summaries also make up a regular and substantial element of Incident Room Situation Reports.

(Event warning summaries are also available on the EA intranet and to the general public on the EA internet web site. This information is driven directly by the dissemination of warnings from the existing AVM system. This use case does not describe that process, but relates to the manual effort made in addition to these sites.)

In an AIR, a FWDO or Assistant will keep a record of warnings currently in force for a particular flood warning area. They will note against the flood warning reference no. the type of warning[12]issued, the time and date it was issued and the next required time to update recorded message information. These records are often displayed in the AIR on a white board.

The AIR Situation Report section referring to 'Summary of all warnings currently in force can also be updated. This summary may require additional information relating to alert method, number of properties to be alerted, times of expected peaks and levels if known[13] and whether information has changed since the last Situation Report issued.

[11] The need for a summary 'board' around the business related to the physical proximity of staff to an Incident Room and also directly related to staff visiting an Incident Room on a regular basis to get up-to-date information.

[12] Flood Watch, Flood Warning, Severe Flood Warning and All Clear. In the Upper Severn Area of the Midlands Area, they have a particular approach which sets out to 'Update' a Flood Warning if certain conditions are met in certain flood warning areas. These Updates create a 'grade' within the Flood Warning designation and are designed to ensure that stakeholders receive appropriate warning messages and details as conditions change but before a Severe Flood Warning is required to be issued.

[13] Rarely completed in examples seen.

This process of displaying an event warning summary is often repeated around the business. Information is either gathered directly from the AIR by phone, transcribed from Situation Reports or relates to intranet data. Staff will have the responsibility of maintaining and updating white boards and other displays.

Maintain Event Warning Summary – Post-Conditions. A summary of warnings currently in force will be known to those business users, both in the Incident Rooms and throughout the business as a whole, who need this information.

Maintain Event Warning Summary – Performance Goals. In the AIR, maintaining a 100% accurate event warning summary is necessary to manage the required updating of public information recorded and available to the public. It aids the hand-over of roles and responsibilities as staff begin and end duty shifts. It represents an easily visible reference for all business users who can gain access.

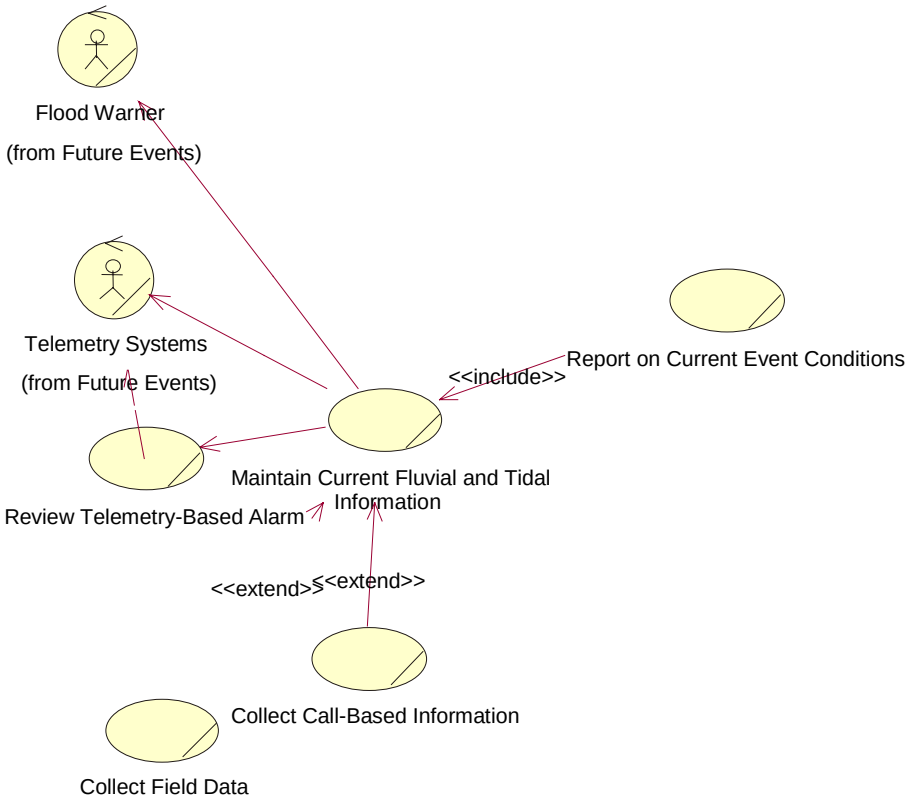
Maintain Event Warning Summary – Category and Risk. The maintenance of an accurate event warning summary within the AIR is a core Flood Warning Management System business use case. The failure of this process can mean that AIR staff lose track of warnings currently in force and the next time that updated information relating to those warnings needs to given out. The quality of flood warning details in the public domain could suffer.

For other EA staff, at Regional and National level, an accurate knowledge of the flood warnings currently in force help them understand, manage and communicate issues relating to the current flood incident/event.

Maintain Event Warning Summary – FWMS Issues and Opportunities. Current intranet and internet flood warning summaries do not meet the needs of AIR staff. These summaries may also not contain the details required by other members of staff in relation to the understanding and management of the event.

There is an opportunity to ensure that the issuing of flood warnings also includes the creation and maintenance of flood event warning summary information that can be used and displayed in various ways, at various locations and meet the needs of various users, both internal and external.

Maintain Current Fluvial and Tidal Information



Maintain Current Fluvial and Tidal Information – References. Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

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North East Don & Aire Area 1/11/00 – 16:00

Maintain Current Fluvial and Tidal Information – Pre-Conditions. An event has been recognised as being in progress that might result in flooding. Monitoring and observation of event conditions is underway.

Maintain Current Fluvial and Tidal Information – Trigger. Tidal or fluvial current conditions are such that monitoring and observation have begun.

Maintain Current Fluvial and Tidal Information – Description. A baseline of information is kept in relation to a developing tidal or fluvial event in relation to current conditions by the Area Base Controller. This baseline information has been compiled from information delivered to the Area Base Controller from the FWDO, the ODO and any direct observations

delivered from EA data gatherers, the public and professional partners. This information is distributed as a summary in any related Situation Report.[14]

The current fluvial and tidal information maintained relates a specific event location (e.g. the River Derwent) and will cover:
General status of warnings.
General conditions – levels rising, levels falling.
Specific river levels and related locations.
Status of associated Control Centres, e.g. York Silver Command stood down 09:30hrs 12/11/00.
Overtopping of flood banks and defences.
Damage to defences.
Extent of floodwaters.
Floodwater effects on associated roads, railways and utilities.
Floodwater effects on drains and culverts.
Evacuation of properties.

Maintain Current Fluvial and Tidal Information – Post-Conditions. The maintenance of current fluvial and tidal information will create an up-to-date summary of significant information relating to a flood event.

Maintain Current Fluvial and Tidal Information – Performance Goals. The need to present up-to-date information in summary form on the Situation Report is the only current general performance goal. Flood event Monitors will have specific goals relating to the review and passing on of information to Forecasters and FWDO's. FWDO's will be closely monitoring levels and general current tidal and fluvial information in relation to issuing timely and effective warnings.

Maintain Current Fluvial and Tidal Information – Category and Risk. The maintenance of current tidal and fluvial information is a core Flood Incident/Event Management business process. It also includes elements that are derived from an effective Flood Warning Management System. Failure to maintain current information can seriously effect the EA's ability to carry out its allotted flood event tasks and impair the EA's performance and co-operation with professional partners. Lack of accurate current information made available to the public can damage the EA's reputation during a flood incident/event.

Maintain Current Fluvial and Tidal Information – Issues and Opportunities.
The current information known and available in one form or another[15] of a flood event will quickly surpass what is summarised on any Situation Report. The issues related to this business process is how much of the information available needs to be captured and presented to certain EA business users at all levels of the organisation, professional partners, the media and the public?

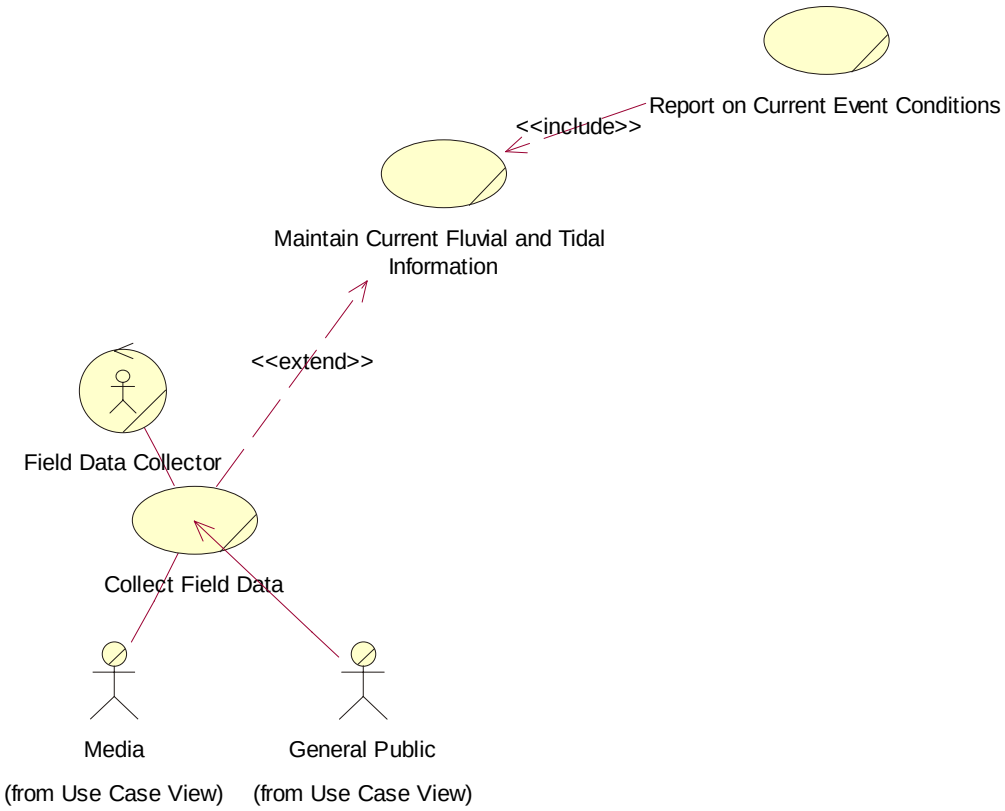
[14] AFWDO's may often have the task of preparing the Situation Report summary of the current tidal and fluvial conditions.

[15] Information gathered relating to an event can be held in various logs, displayed on white boards, captured in video and photographic mediums, held in IT systems and simply be 'known' to the participants without any specific record being kept.

The current users of this information at the 'managing edge' of the event tend to gather the data they need in conversation with each other. Can basic information be defined and shared so that the bulk of the time spent talking is about decisions and actions and not answering questions relating to 'what's going on?' enquiry's?

The current tidal and fluvial information described in Situation Reports represents the basic needs of RBC and National Emergency Room management information. Does the information they receive meet their requirements?

Collect Field Data



Collect Field Data – References. Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Field Collection of Flood Event Data, NFWC, EFAG/A1.28, V2.0, October 2000.

Collect Field Data – Pre-Condition. An available, suitably trained and equipped member of staff will have been dispatched to a location associated with an event with instructions to collect specific information or data.

Collect Field Data – Trigger. Staff will have reached the appropriate river, coast or site location, by the most suitable and safest route, and will begin to collect field data associated

with the location, gauge boards and structures as requested. (This can include assignments associated with aerial surveys.)

Collect Field Data – Description. Staff will carry out the agreed inspections and surveys. Staff are required to record their observations on Data Collection Sheets. Associated photographs need to be recorded on Data Collection Sheets. When the data collection is complete, staff must phone in a report to the ABC or AFDWRM if the data collection is being made during an event. They may also have to make lone worker calls to the Regional Communication Centre. (Post-event data collection may not need these calls as they will not involve an ABC or the issues of event management and staff safety.)

Business Rule - A copy of the Data Collection Sheet must be handed to the ABC/AFDWRM on the same or next working day. The original Data Collection Sheet and any associated photographs should be submitted to the ABC within 2 working days, allowing for film processing.

Collect Field Data – Post-Conditions. The staff associated with a field data collection task will have completed the task, taken any required photographs and completed the associated Data Collection Sheet. The ABC/AFDWRM will have received a phone report and the RCC will have been informed re lone worker status if the RCC are managing that process. Within 24 hours a copy Data Collection Sheet will have been handed to the ABC/AFDWRM. Within 2 working days or as soon as film can be processed, the original Data Collection Sheet and photographs will have been handed to the ABC/AFDWRM.

Collect Field Data – Performance Goals. 100% of all readings, observations, photographs, videos etc. must include a location, date and time, (24 hour clock local time) and must relate to whether levels are considered to be rising or falling. If the level is considered to be falling, reference to a time of peak must be made.

100% of all completed data collections need to be reported to the ABC/AFDWRM as a phone call and supported by copy Data Collection Sheets within 24 hours. All original Data Collection Sheets and photographs should be with the ABC/AFDWRM within 2 working days or as soon as film can be processed.

Collect Field Data – Category and Risk. The business use case Collect Field Data can be categorised as a Flood Incident/Event Management System business use case. Where it occurs during an event it may involve elements of the wider Agency Event Management System, i.e. Health and Safety and Lone Worker.

Outputs from the use case, i.e. phone calls to the ABC and Data Collection Sheets can have direct impact on the Flood Warning Event Management System. During an event, field data collection can inform the decision to issue flood warnings.

Post-event, field data collection can add to the body of knowledge used to model and predict future flood events and event conditions.

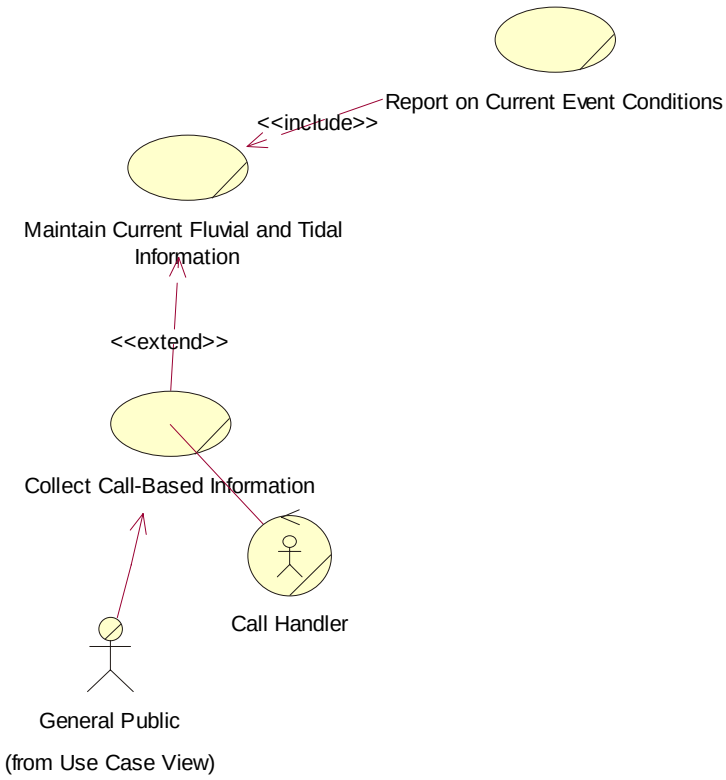
Failure to successfully collect data where required will compromise the ability to collect detailed information, impact on the potential to predict future event conditions and will have an adverse impact on the public perception of the Agency during an event.

Collect Field Data - Issues and Opportunities. If suitably trained and equipped staff are available, the main issues relate to the ability of field data collectors to present their data and findings in a usable form and in a timely way. These issues are crucial during an event. Observed data can aid the decisions relating to flood warning and guide the actions that may need to be taken *proactively* to reduce the impact of an event. Post-event, data collected may be used to address modeling and procedural shortfalls.

The current process relies on phone communication, written records, photographs and video. Only the phone communication will reach the ABC/AFDWRM near the time the data was collected. Written records are mostly used to provide records for post-event analysis.

There are opportunities to use more electronic means to submit data collections and to present this data to the ABC/AFDWRM to support phone conversations with data collectors, AIR and RIR decision making and post-event analysis.

Collect Call-Based Information



Collect Call-Based Information – References. NCSG – Dealing with Telephone Calls – Policy Statement - http://intranet.ea.gov/Projects_and_Groups/Groups/NCSG/codeofpractice.htm

Procedures for Handling Incident Calls

Flood Defence Emergency Response Report - roles/responsibilities http://badger.ea.gov/commondata/105385/126703

FloodLine User Guide

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Incident Management Process (IMP) http://146.213.80.51/knowledge/default.asp

Collect Call-Based Information – Pre-Conditions. An individual has collected information relating to what they believe is a flood event.

Collect Call-Based Information – Trigger. An individual contacts the Environment Agency by phone to pass information relating to what they believe is a flood event.

Collect Call-Based Information – Description. An individual can contact the Environment Agency by phoning a Regional Office or via the FloodLine service. In any Region, the Regional Communications Centre takes public calls on a 24/7 basis on the Agency Incident Hotline (0800 607060).

Also the FloodLine service takes calls 24/7, and refers those it cannot satisfy to Area Offices to a dedicated phone (during office hours). If a customer phones FloodLine and wishes to report flooding a dedicated option on FloodLine forwards the call to an RCC.

RCC staff then attempt to forward the call to Area Duty staff (FWDO, ODO, and AFWDO) as appropriate. In a major incident call handling teams are set up at Area offices to deal with these calls (PILs – Public Information Line).

Calls are assessed by the RCC or PIL staff for content and then either answered or routed to an appropriate Duty Officer or assistant for further information or action. Often RCC staff or PIL staff attempt to record basic details about the customer on written log sheets.

Often dedicated lines exist in RCCs and incident rooms for professional partners and Agency staff.

An appropriate officer then deals with the customer, imparting information, offering advice and support, taking details of a necessary task to be completed. Duty staff record details about the caller on written log sheets. Some Area Incident Rooms operate paper-form based business processes for routing information/actions around the Area Incident Room.

Duty staff keep abreast of the current situation by looking at updated whiteboards, pieces of paper with new information and listening to or consulting with colleagues.

Collect Call-Based Information – Post-Conditions. Once the call is complete the appropriate officer has a record of the conversation. These records can then result in:

No action being needed as the customer was satisfied by information.
A task to be passed to an ODO or FWDO.
New information that needs to be shared with colleagues.

Collect Call-Based Information – Performance Goals. The Agency Customer Charter states: -

To answer 95% of all calls within 15 seconds (approx. 5 rings).

To operate minimum office opening hours of 09.00 – 17.00 every working day. This requires switchboards. To be operational between these times and for departmental cover to be provided between these times."

Collect Call-Based Information – Category and Risk. The business use case 'Collect Call-Based Information' is aids the effective building up of a picture of current events. It is a core activity of the Flood Incident/Event Management process. Failure to collect call based information would damage the reputation of the Agency with both the general public and its professional partners.

Collect Call-Based Information – Issues and Opportunities.
Out of office hours it is not clear how the FloodLine operators refer callers to the Agency.

Detailed business processes and supporting technology vary from Region to Region.

Opinions differ over the veracity and usefulness of information from the public or professional partners.

Analysing and sharing information. Once information or actions are extracted from a caller they are committed to paper and thus difficult to share or analyse. To share information with colleagues a Duty Officer might have to walk around the incident room or public information line. Putting a picture together of the situation on the ground from these calls can be a matter of chance, say 3 reports of flooding from the same area being taken by two staff members next to each other, who then suspect wider scale flooding is taking place.

Measuring performance. Within incident rooms as long as phones are not ringing un-answered the perception is that 'we are doing well'. What this fails to show is how many customers are queued to speak to Agency staff at the following stages: -

In the 0800 system getting engaged when calling 0800 80 70 60.
In the Agency's switchboard in a call queue waiting for a free phone.
Between FloodLine and the Agency.

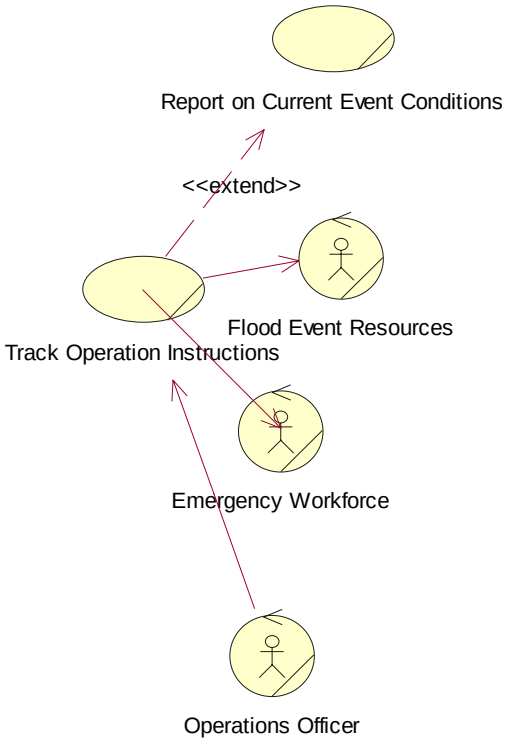
Call queue monitoring. Anglian Region have piloted the use of call queue monitoring systems which help measure call handling performance during an incident.

The Agency is considering installing customer relationship management technology as part of the proposed 'Customer Contact' project which would help log calls and transmit and share information. North Area of North West Region has a comprehensive flood warning database system based on access that records customer contact information.

FloodLine. The FloodLine call center consider that if they had more access to 'live' incident data they could reduce the number of calls being forwarded to the Agency. They are particularly interested in accessing live information from the Agency web site, perhaps based on FloodLine RMS scripts.

MMWDS. The introduction of MMWDS with its faster rate of issuing warnings could produce much higher peaks of calls back into FloodLine and the Agency by the public requiring reassurance and more information.

Track Deployment of Operations



Track Deployment of Operations – References. EA North East Region Flood Warning and Flood Defence Operations Procedures 1R, EA North East Region Emergency Workforce Response Procedures (Don & Aire) Volume 2R D&A.

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North East Don & Aire Area 1/11/00 – 16:00

Track Deployment of Operations – Pre-Conditions. An operational requirement has been met that means operational resources have been deployed to action a specific flood event related task.

Track Deployment of Operations – Trigger. There is a need to understand the current status of an operational flood event task and its related operational resources.

Track Deployment of Operations – Description. Through the liaison between the ODO and EDO, the ABC is kept informed of the current status and issues relating to the carrying out of operational tasks and the deployment of the operational (emergency) workforce and resources.

The ODO and EDO manually log significant details. Significant issues may be displayed on Incident white boards for general AIR and wider dissemination. A summary of current operations and operational issues will form parts of the ABC's Situation Report. RBC's will communicate these matters on where needed and will further summarise the Regional view in their Regional Situation Report.

Track Deployment of Operations – Post-Conditions. The current status of an operational task and the condition of the deployed resources is now known. These facts can become part of any report on current event conditions.

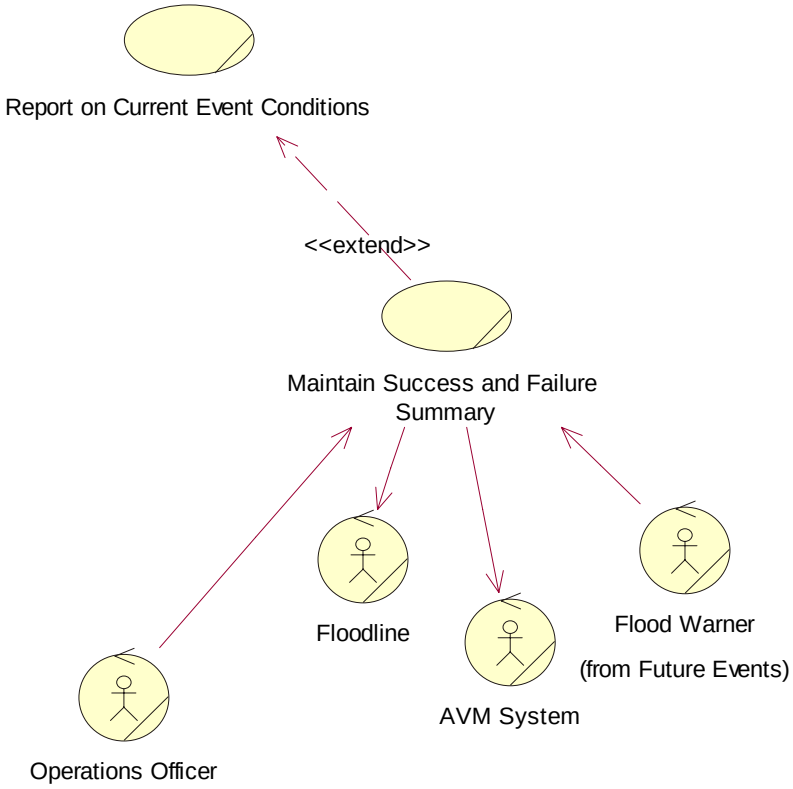
Track Deployment of Operations – Performance Goals. There are no set performance goals for tracking the deployment of operations staff and resources other than the need for ODO's and EDO's to report to the ABC on actions and status. These activities are often summarised in Situation Reports.

Track Deployment of Operations – Category and Risk. Tracking the deployment of Operations staff and resources in relation to flood events is a core Flood Incident/Event Management System business use case. Failure to do so will result in the effective and efficient management of the event being seriously put at risk. Operations resources are scare, especially during a large flood incident/event, and must be managed and prioritised effectively to ensure maximum benefit to the public and the continued health and safety of staff.

Track Deployment of Operations – Issues and Opportunities. The main issues and opportunities in this business process relate to the on-going tracking of the operational actions underway, the status of these activities, their link to a particular flood warning area/location, the resources currently employed, the status of these resources and the details of available resources yet to be employed.

If these facts were tracked accurately and effectively and made available in the correct form to various management levels during a flood event, then this would aid the Agency management of the event. This process could also support the tracking of health and safety issues relating to individuals and hours worked during an event.

Maintain Success and Failure Summary



Maintain Success and Failure Summary – References. Flood Warning Service and Standards Guide -
Head Office Liaison Procedure v4 Nov 01
Agency Customer Charter
Operational Performance Measures
National Flood Report Standard
http://146.213.80.51/icontent/DocDir05/national_flood_report_standard_v1.doc

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

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North East Don & Aire Area 1/11/00 – 16:00

Maintain Success and Failure Summary - Pre-Conditions. A flood event is in progress and an AIR has been opened, prompting the initial recording of some event details, which may include an AIR perception of success and failures related to the event.

Maintain Success and Failure Summary – Trigger. Any of the following may act as a trigger for the recording of a success and failure summary:

AVM / FloodLine – flood warnings being issued.
Operational activities being undertaken (e.g. deployment of sandbags, barrier closures).
Flooding occurring (in areas where we have flood defences or provide a warning service).
Properties being flooded (in areas where we provide a flood warning service).

Maintain Success and Failure Summary – Description. Various staff may be asked to report on Agency performance during a flood event. Examples of this are: ABC/RBC contributing to or writing a SITREP, attending periodic meetings in RIR/AIR, briefing PR or officers about to be interviewed by the press, dealing with professional partners at Gold Control, or dealing with ad-hoc verbal enquiry's from senior managers. The maintaining of a basic summary of current Agency perceptions of event successes and failures helps inform these views. This summary is usually a paper based exercise and often forms an element of Situation Reports. Examples seen in the North East relate to:

Number of AVM calls made and % successful.
Number of AVM faxes sent and % successful.
FloodLine.
Trashscreens. Levels of monitoring and clearances of note.
Sandbagging. Numbers deployed, locations, times and dates. Issues relating to transportation.
Tidal Barrages.
Regulators. Operational team deployment.

Maintain Success and Failure Summary – Post-Conditions. A summary of current flood event successes and failures will be up-to-date and available for dissemination from the AIR.

Maintain Success and Failure Summary – Performance Goals. Updated successes and failures are required for inclusion in Situation Reports. Below is a table relating to the performance criteria relevant to Flood Event Management:

AGENCY CUSTOMER CHARTER		
	Answering telephone calls	All calls should be answered within 15s
	Flood Warning	People flooded living in areas where we provide a flood warning service should receive a warning 2 hrs in advance *** Note: Welsh Assembly requires only 1 hours warning*
HELP PROCEDURE v4 – SITREP CONTENTS		
OPMs – OUTPUT PERFORMANCE MEASURES		
FLOOD WARNING SERVICE	No. flooded properties	4.1a) Properties flooded are those where flood water enters property and damage occurs. OPM's have in the past defined damage as starting at 150mm of lower floor level. 4.1b) "Properties" include domestic buildings, commercial, industrial, and recreational ***Note: Requested in SITREPS*
	Numbers of Flood Warnings issued	4.4) & 4.5) Number of flood warnings issued both within and out of the standard lead times
	(Tidal, Fluvial)	ie; within two hours of the onset of flooding. ***Note: Covered in events by National Flood Reporting Standard*
	No of Properties serviced by direct flood warning	Number of properties that could receive a direct Flood Warning as a percentage of the total number of properties in the At Risk Database. Equates to the Coverage term of the Flood Warning Investment Strategy. ***Note: Relevant during events?*
Technical Solution	No of Failed Warnings	Number of Flooded Properties that could have received a direct Flood Warning in time but did not. This is the inverse of the Investment strategy "System Effectiveness" To include the absolute number and the relative ratio to total number of warnings iss ***Note: Is this the acid test of success or failure?*
Social Interaction	No of Properties willing to take action	The percentage of the general public on the "At Risk" database who report that they are willing and able to take action if given a direct flood warning. The sum of the general public knowing what can be done (Damage Reduction), are willing to receive a d **Note: Is this operationally relevant? Up for discussion……
Total Process	Effectiveness of warning process	The percentage saving made in properties that flooded, or properties would have flooded if no action had been taken, as a ratio of savings over loses and savings. This value is the sum of all elements of the Investment Strategy. ** Note: Relevant during events?

Figure 3.1 Performance Criteria Relevant to Flood Event Management.

Maintain Success and Failure Summary – Category and Risk. The business use case Maintain Success and Failure Summary can be categorised as a Flood Event Management System use case. Outputs from the use case i.e. information passed to:-

Regional Base Controller for SITREPS thence to DEFRA / Directors Ministers.
Those being interviewed by the Media.
Professional Partners.

Getting these activities 'fit for purpose' to ensure an accurate, consistent and positive message is conveyed to stakeholders is a key part of event management. Failure to maintain an adequate summary of the Agency's view of flood event successes and failures puts event communication and the learning process at risk.

Maintain Success and Failure Summary – Issues and Opportunities. Agency staff need to disseminate information on Agency actions and related perceptions of flood event successes and failures. From the results of interviews and investigations, we can't find explicit procedures or record keeping standards for this business use case. Each region seems to have a slightly different approach.

Putting out inconsistent mixed messages based on out-of-date, incomplete or un-assessed information is recognised as a risk already, however, beyond the SITREP template we cannot find much evidence of a consistent supporting system to help manage that risk.

Issues:-
From interviews we have found that staff find undertaking the above activities difficult and stressful. We suspect this is because there are no explicit systems (manual or IT) to drive the data collation to allow information to support this process.

We note that there is pressure from outside stakeholders (DEFRA) and internally to report the same information during an event that we normally deal with after an event, for example, numbers of flooded properties.

Keeping track of what properties have flooded where and when is extremely difficult, reports from the public and professional partners can be inaccurate, overlap or contradict

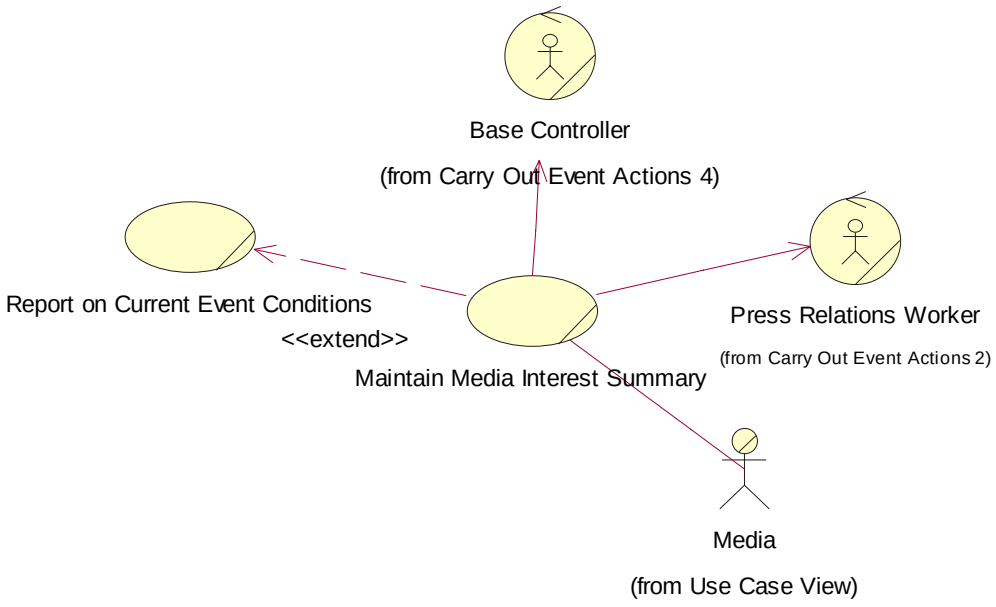
Opportunities:-
If an explicit 'information officer' role were active within the AIR / RIR team structure with a supporting system (manual or IT) this could ease pressure on the ABC and others during an event. This role could:-

- maintain the success and failure summary
- collate and summarise incoming information
- prompt the ABC over any emerging issues
- brief staff about to undertake media interviews
- manage information and produce reports on 'reports of flooded properties'.

IT systems / tools could contribute to:-

- The collation and assessment of incoming information, much of it with a geo-spatial context, e.g. reports of flooding from FloodLine, direct from the public, direct from professional partners, and from Agency staff
- The assessment of the success of Flood Defences during an event, perhaps by linking to NFCDD data
- The assessment of the success of the flood warning dissemination process during a flood event by linking and analysing live data from AVM logs, FloodLine message box use, hits on flood warning pages of our internet site, calls received by the agency, dates and times of media broadcast
- Assessing times/locations of reported flooding and comparing with the timeliness of warning dissemination during an event to measure success or failure. If 'failures' were detected early enough there might be opportunities to utilise alternative means of message dissemination. An example of good practice is in NW Region where they can cross-match AVM logs with warning recipient address within a GIS system to check for clusters of failed warning attempts.

Maintain Media Interest Summary



Maintain Media Interest Summary – References. Various Regional and Area historical Situation Reports:
Midlands Region 01/02/02 – 15:00
North East Region 12/11/00 – 08:00
North East Dales Area 12/11/00 – 18:00
North East Don & Aire Area 1/11/00 – 16:00

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Maintain Media Interest Summary – Pre-Conditions. A flood event is in progress that has attracted the attention of local, national or international media.

Maintain Media Interest Summary – Trigger. A media reference to the flood event or enquiry from the media relating to the flood event has been noted by the EA.

Maintain Media Interest Summary – Description. The FWDO, AFWDO or another AIR member of staff will keep an on-going record of media references to the local flood event on behalf of the ABC. This can include radio and TV coverage, local and national. The reference will be noted. It could include details of a particular time, date, program, radio or TV channel. It could indicate if an EA member of staff was involved. The records will also include reference to any direct contact with the media and any problem issues. These will be reported to the appropriate Regional contact, either the RBC or Regional PR manager.

Maintain Media Interest Summary - Post-Conditions. A summary of media interest has been updated and can be included in the next Situation Report.

Maintain Media Interest Summary – Performance Goals. Media interest in an event should be recorded at the local AIR level. All requests from the media for access to Area staff for interviews made directly to the Area concerned should be directed to the appropriate Region.

Maintain Media Interest Summary – Category and Risk. Maintaining the media interest summary at the AIR level is a Flood Incident/Event business use case. It allows a record of media contact and media interest to be maintained for ongoing event and post-event analysis. Media recordings are possible sources of information for future planning and training.

Maintain Media Interest Summary – Issues and Opportunities. The main opportunity in this area lies in being able to track quickly and effectively which particular events and issues have attracted the most media interest. These locations and media issues can then be the focus of EA media response and management. As well as presenting the EA with potential allies for disseminating appropriate messages and advice.

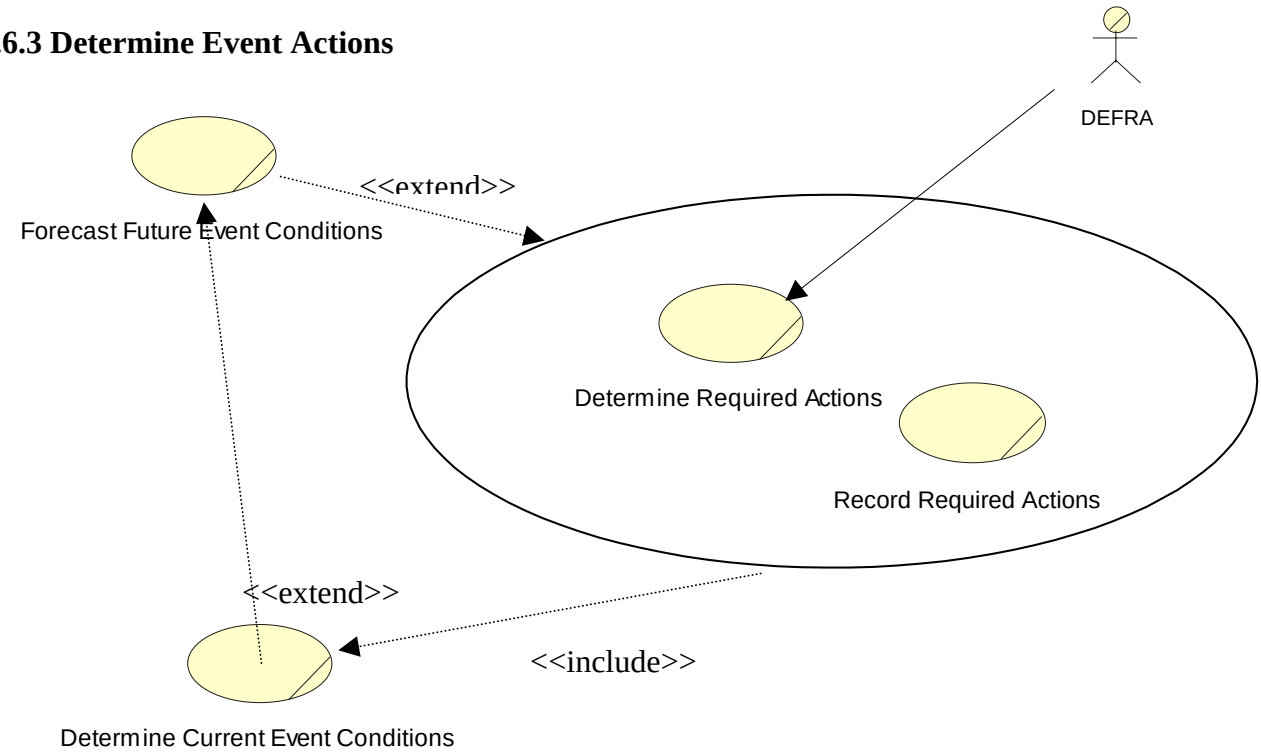
It wasn't made clear why Area staff have to track media interest. This could be done at Regional level, especially as all requests for direct contact between Area staff and the media should be agreed and managed at the Regional level. Perhaps this general rule is not always applied.

Listening and watching media coverage is useful for Area staff. Again, not sure why they need to track and keep a record of coverage. This could be done at the Regional level, unless very local media are unavailable at Regional offices, e.g. local radio broadcasts?

Not sure if any media coverage outside the UK is reviewed. The Autumn 2000 event attracted foreign media attention.

The content of media coverage doesn't seem to be remarked upon at the time in Situation Report summaries other than in some as an opportunity to report 'media issues'.

3.3.6.3 Determine Event Actions

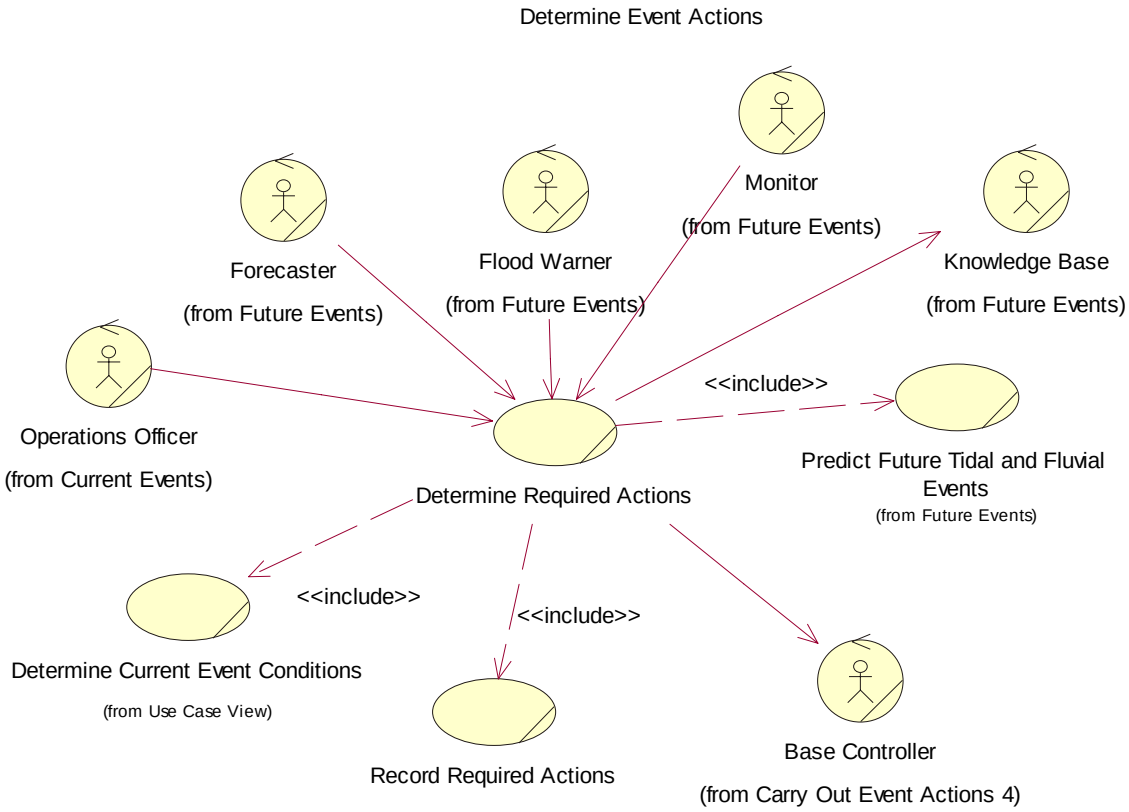


This section will consider the business use cases that currently make up the processes associated with the abstract ‘Determine Event Actions’, as described on page 11 above. To aid clarification, the business use case diagrams below show ‘business system actors’. The business use cases covered in this section are:

Determine Required Actions

Record Required Actions

Determine Required Actions



Determine Required Actions – References. Environment Agency North East Region Flood Warning Manual Volume I Regional Arrangements for Flooding Incidents.

Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Determine Required Actions – Pre-Conditions. Understanding of the current tidal or fluvial conditions and /or a prediction of future tidal or fluvial conditions are known to a Forecaster, Monitor, Flood Warner, Operations Officer or Base Controller.

Determine Required Actions – Trigger. A current and/or future tidal or fluvial condition exists for which a potential action may be required.

Determine Required Actions – Description. Currently a number of business roles have certain decision making responsibilities. These responsibilities can come into play if certain conditions have been met. The basic business use case description is that;

A condition has arisen or has become known for which a decision is required,
The person who currently has responsibility related to know of the condition has been informed,
The appropriate options for action are considered and a decision is made and logged.

Flood Event Condition	Responsibility	Action Options
Monitoring alarm received	MDO,	Acknowledge Alarm No Action Monitor rainfall and river levels Log
Request to monitor rainfall and river levels	MDO,	Decline request Monitor rainfall and river levels Log
Telemetry thresholds met to issue a flood warning, carry out operational instruction and/or forecast future tidal or fluvial conditions	MDO	Record Threshold Details Alert Duty Officers No Action Log
Forecasting alarm received	FDO	Acknowledge Alarm No Action Alert Duty Officers Create Forecast Log Forecast Details
Request to create additional forecasts	FDO	Decline Request Create Forecast Log Forecast Details
Telemetry thresholds met to issue a warning	FWDO	No Action Monitor rainfall and river levels Issue a Flood Warning Log
Current forecast indicates a probability of a flood event	FWDO	No Action Monitor rainfall and river levels Issue a Flood Warning Log
Operational alarm received	EDO, ODO	Acknowledge Alarm No Action Alert Duty Officers Request Emergency Task Log
Request emergency task or the implementation of an Operational Instruction	ODO, EDO, Emergency Workforce	Decline Request Carry out task and report. Log
Carry out emergency task or operational instruction	Emergency Workforce	Report

Flood Event Condition	Responsibility	Action Options
Flood event requires the opening of an Area Incident Room	FWDO	AIR Open Log Inform RCC Create Outline Sit Rep
Flood event requires the opening of the Regional Forecasting Room	FDO, MDO	RFR Open Log Inform RCC
AIR requires adequate staffing and arrangements during an event	FWDO, ABC	Allocate staff to required roles and rosters. Implement staff H&S provisions Communicate.
Significant flood event	FWDO, ABC	Inform RDO, RBC. Log
Meet schedule for AIR Situation Reports	ABC	Submit Situation Reports to agreed schedule
Request for flood event information for PR purposes.	FWDO, ABC	Liaise with PR Log
Criteria reached for issuing HELP report.	ABC	Complete and Submit
Event conditions require the collection of field data.	ABC, ODO, EDO	Request the collection of data Log
A Request has been made to collect event data.	Emergency Workforce, Field Data Collectors	Decline Accept Log and Report
Media have requested an interview	RDO, RBC, PRDO	Decline Schedule Log
Delivery of a media Interview	PR Worker	Log
Event conditions require a Severe Flood Warning	FWDO, ABC	Inform RDO/RBC Inform MAFF Regional Engineer
Request from Professional Partners for event information	FWDO, ABC	Liaise with Professional Partners Log
Regional situation requires the calling in of an RBC	RDO	Establish RBC role.
The Regional and/or National flood event situation requires the mobilisation and opening of a Regional Incident Room.	RDO, RBC	Establish RIR staff and Open RIR Submit HELP report Inform FWDO's/ABC's

Flood Event Condition	Responsibility	Action Options
Meet Head Office schedule for Regional Situation Reports		Compile Report Submit & Distribute Decline
Area needs additional assistance and resources	ABC	Request RDO/RBC Log
Regional resources require co-ordination following request for inter-Area assistance	RDO, RBC	Review request Authorise inter-Area assistance Decline inter-Area assistance Log
Regional resources require inter-Regional or Military assistance	RDO, RBC	Request approval from HO for inter-Regional assistance & Log
Request for inter-Regional or Military assistance needs approval	NDO	Approve Decline Log
The flood event requires the co-ordination and the provision of or acceptance of inter-Regional or military assistance	RDO, RBC	Co-ordinate actions Log
The event has a Flood Warning in force and 2-3 line Regional outlook must be sent twice a day to Thames Barrier Control	FDO	Complete and send to schedule Log
The event requires a press release or media statement	RDO, RBC, PRDO	No Action Create Disseminate Log
The event no longer requires the RIR to be open	RBC	No Action Close RIR Inform
The event no longer requires a AIR to open	FWDO, ABC	No Action Close AIR Inform
The event is now over and a Post Incident Debrief 'Wash-Up' is required	ABC	Provide Information Log comments
A Post Incident Report is required	ABC, RBC	Facilitate the production of reports Distribute

Figure 3.2 Flood Event Action Determination Table

Determine Required Actions - Post-Conditions. A particular condition would have resulted in a member of staff deciding the required action that is appropriate.

Determine Required Actions – Performance Goals. Each condition would require its own performance specification. Individual event conditions may relate to recognised business use cases. See Carry Out Event Actions below for further analysis.

Determine Required Actions – Category and Risk. Determining required actions is a critical business process for both the management of Flood Warnings and the management of the Flood Incident/Event. Depending on the condition in force, failure to determine an appropriate action may seriously effect the performance of the Flood Incident/Event team and damage the reputation of the EA.

Determine Required Actions – Issues and Opportunities. Important aspects of determining the required actions in a flood event are:
Staff Training.
Staff Experience.
Flood Warning and Flood Incident/Event Procedures and Plans.
Event 'Knowledge Base'[16].

There are opportunities to support the decision making process and make available required event information from the local 'Knowledge Base', current fluvial and tidal conditions and any predictions and forecasts in force with technology.

Tracking event conditions that have been met and the actions taken over time, supporting action decisions with relevant information, could be facilitated with Information Technology.

Record Required Actions

Record Required Actions – References. EA North East Region Flood Warning Manuals – Volumes; A, 2R D&A, 1R, E, I and J.

Record Required Actions - Pre-Conditions. At a particular moment in an event a decision will have been made by one or more of the Flood Incident/Event Team that a specific action is required.

Record Required Actions – Trigger. A particular action is required or has been performed that must be recorded for dissemination to other staff or for event audit purposes.

Record Required Actions – Description. The specific Flood Incident/Event Team member will log the details of a required action, its status and any supporting contextual information.

[16] 'Knowledge Base' is a broad term for the purposes of this report. It encompasses a range of materials and data appropriate to the specific event e.g. maps, recorded detailed procedures and information relating to previous events. It is supported by information relating the current event and any event predictions and forecasts that are in force.

The North East Region have created a substantial body of procedural documentation and this represents a significant contribution to its 'Knowledge Base'.

There are a number of existing log sheets in the two Regions visited and examples of these gathered to date can be summarised as:

Environment Agency Incident Log Sheet
RCC Duty Staff Logs, which have specific forms for particular tasks (NE)
Regional Duty Officers Area Flood Incident Status Report Form (NE)
Regional Base Controller (flooding) Log, (NE)
Regional Flood Defence Emergency Log Sheet (Mid multi-use)
Monitoring Duty Officer Log (NE)
Forecasting Duty Officer Logs and location specific Forecasting Sheets(NE)
Forecasters Record Sheet, Flow Forecasting Duty Officers Log and Flood Reports (Mid)
Flood Warning Duty Officer Log (NE & Mid)
Area Base Controller (flooding) Log (NE
Operational Duty Officer Operational Instructions Log (NE)
Flood Defence Emergency Response Message Sheet (NE)

Record Required Actions - Post-Conditions. A record has been created of a required action. The action may be complete or currently on-going or scheduled to occur at a specific future date and time.

Record Required Actions – Performance Goals. For any defined action that requires a record, details must be recorded each time to enable the action to be understood and disseminated and to act as an event audit record for possible post-event analysis.

Record Required Actions – Category and Risk. Recording required actions is a core Flood Incident/Event Management and Flood Warning Management process. It enables key decisions and timings to be recorded for post-event analysis. It facilitates a ‘walkthrough’ of recent event developments when staff duty hand-over occur. Failure to record required actions in force and their particular status can seriously impair the effectiveness of Flood Incident/Event Management and make post-event analysis a difficult and unrewarding exercise.

Record Required Actions – Issues and Opportunities. Current methods to record required actions are mainly related to the manual completion of paper log sheets. (Important exceptions are the audit trails in telemetry systems and reports available from the AVM system and FloodLine.)

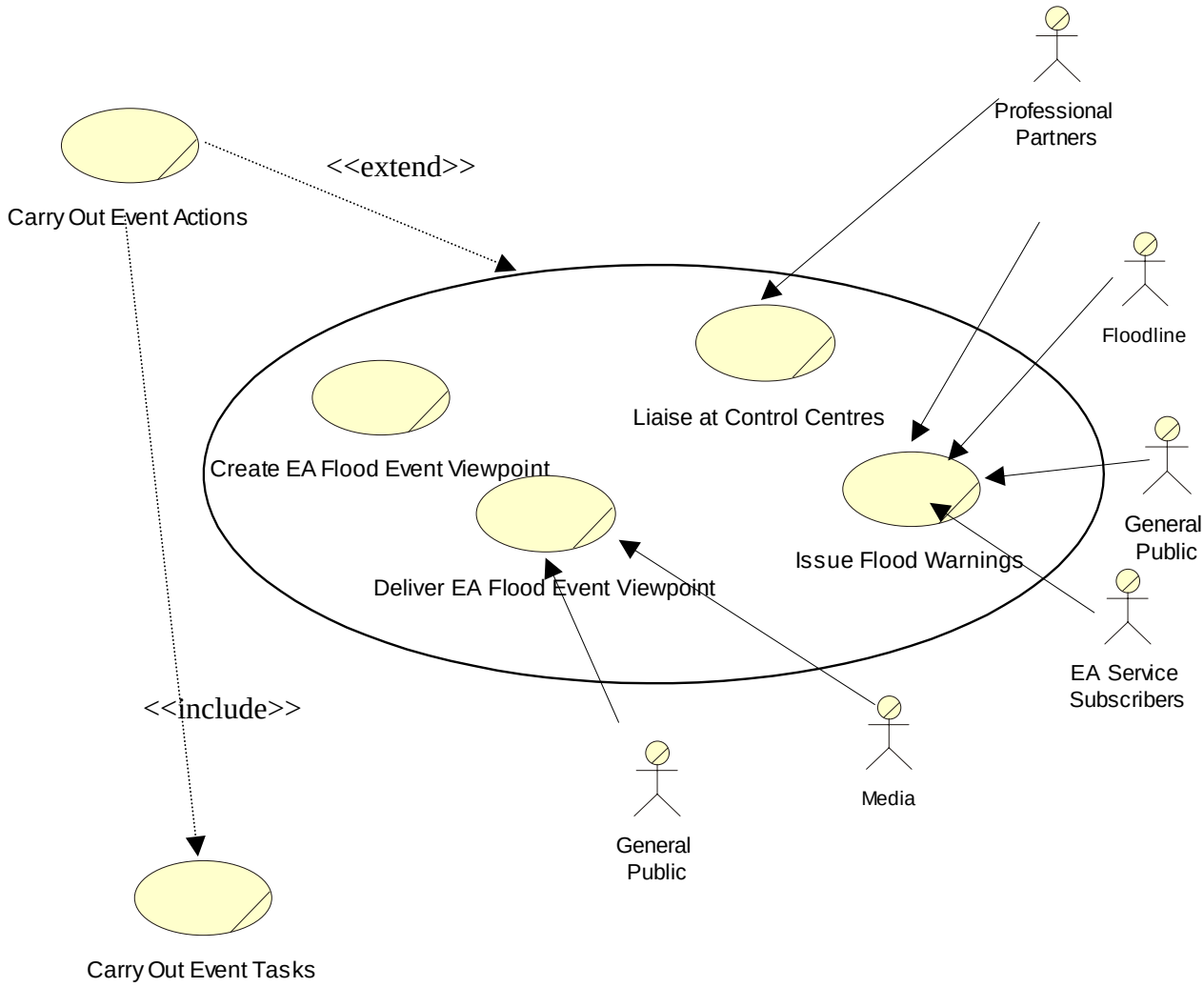
There are a number of issues related to the various manual logs maintained by the business that affects their value to the business both during an flood event .
Lack of standard log sheets across Regions.
Different members of staff may approach completing any specific log in different ways.
Hand written logs can be difficult to interpret, even for the staff who originally filled them in.
Important required actions or decisions may not be recorded in the ‘heat’ of an event.
Paper Log sheets may be damaged or lost.
Analysis requires a complete reading, specific data being difficult to extract.
Log sheets may be written or details added at times not close to the action being described.
Log sheets are difficult to share across the Flood Incident/Event Team. This may have implications for overall event management.
Some log sheets may be duplicating data held elsewhere (telemetry Monitors log sheets).

Tracking event conditions that have been met and the actions taken over time, supporting action decisions with relevant information, could be facilitated with Information Technology.

There are opportunities to create a form of flood event log sheet for specific Flood Event Roles that record required actions and required contextual data electronically.

3.3.6.4 Carry out Event Actions

As previously explained, see page 8 above, the abstract business use case 'Carry Out Event Actions' has been initially divided into 'Make Event Communication' and 'Carry Out Event Tasks'. There are a number of 'communication' and 'task' business use cases that could be appropriate to the particular circumstances of a flood event. These are described below.



The Carry Out Event Actions – Communications abstract business use case covers the following business use cases:

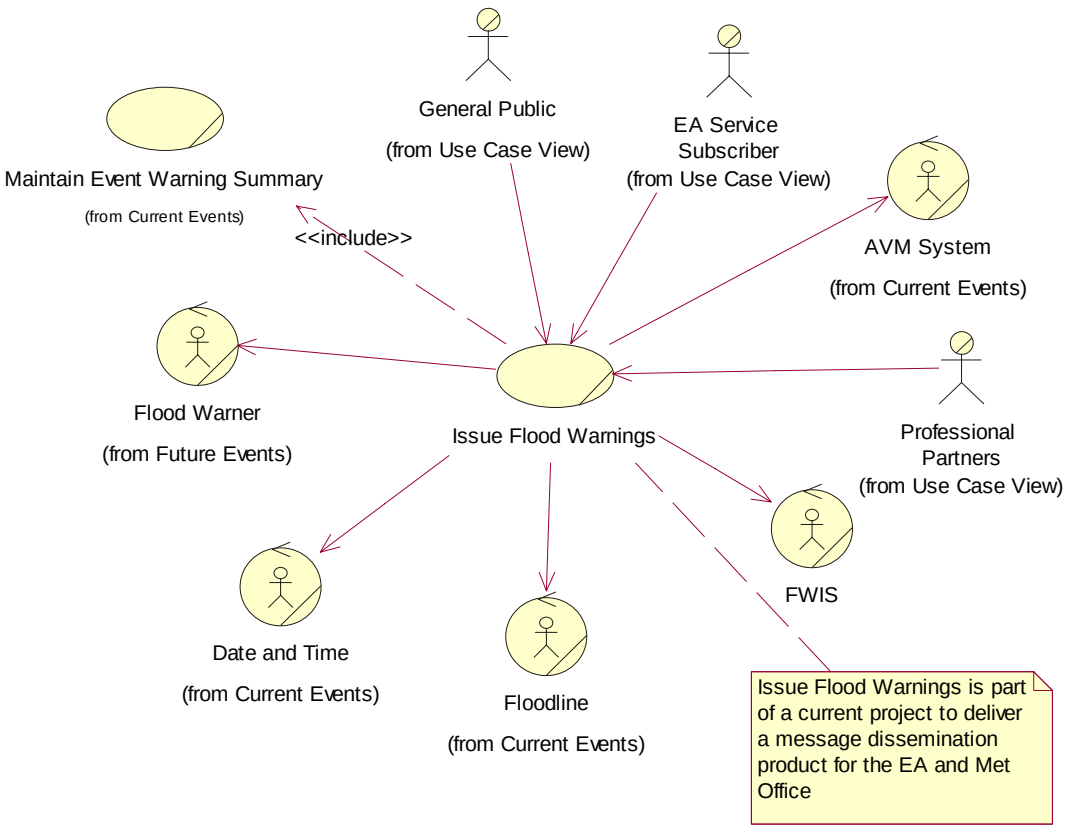
Issue Flood Warnings

Create EA Flood Event Viewpoint

Deliver EA Flood Event Viewpoint

Liaise at Control Centres

Issue Flood Warnings – Event Communication



Carry Out Event Actions 1 - Make Event Communication 1

Issue Flood Warnings – References. Environment Agency North East Region Flood Warning Manual Volume A Monitoring and Forecasting Procedures.

Environment Agency Multi-Media Warning Dissemination System Project – Issue a Message Business Use Case Specification Version 1.0

Issue Flood Warnings – Pre-Conditions. Flood event conditions are such that a FWDO has decided to issue a Flood Watch, Flood Warning, Severe Flood Warning or All Clear flood warning message.

Issue Flood Warnings – Trigger. The FWDO's decision to issue a flood warning is the trigger for the Issue Flood Warnings business use case.

Issue Flood Warnings – Description. The FWDO decides that a warning message needs to be sent to a specific set of recipients in relation to the desired message to be sent and the associated geographic location. [17]

The FWDO or AFWDO will script and update the FloodLine system with the appropriate voice message or messages of the event details for the designated warning and set of recipients.

When the FloodLine messages have been recorded successfully, the FWDO or AFWDO will update the Automatic Voice Messaging System (AVM) with a short voice message and prepare and save all required fax files.

The FWDO or AFWDO will use the AVM system to attempt to deliver the required messages to the selected AVM groups. The AVM system dials out to the selected groups to deliver the alert that a new or updated flood warning message is in force. The AVM system will deliver a short message advising the subscribers to the service that full details are now available on FloodLine and will send out the required faxes associated with the flood warning message.

The current AVM system will make a number of attempts to deliver the required calls and faxes. These attempts will eventually be reported as an AVM success or failure in relation to the attempt to contact the recipient groups with the flood warning message.

The FWDO or AFWDO will note, usually on a white board, the warning area, the message in force, the date and time issued and/or the next date and latest time the message should be updated.

Data from the AVM system relating to flood warnings in force is collected as a data file and used to update the Flood Warning Information System. This system updates EA intranet and internet pages.

EA staff and the general public can review Flood Warnings in force via a browser application if they have access to the EA intranet or the EA internet web site.

Issue Flood Warnings - Post-Conditions. A flood warning flood event communication will have been issued to a designated target audience. The details of this flood warning will now form one of the warnings in force for a particular Area and Region.

Issue Flood Warnings – Performance Goals. Flood Watches raise the possibility that flooding may occur. They are meant to raise awareness in the recipient groups and prompt them to consider making preparations and arrangements if a flood does occur. The triggers for issuing a Flood Watch are meant to be general e.g. a Met Office Heavy Rainfall Warning.

The minimum lead time before the conditions that relate to a particular Flood Warning and Severe Flood Warning message become true is 2 hours. This is a minimum. The goal as described to me re flood warnings is to issue a warning at a reasonable time (not middle of the

[17] 'Flood Watch' flood warnings are usually issued for large geographic areas and often relate to a number of catchments and Flood Warning areas. 'Flood Warnings' and 'Severe Flood Warnings' are usually related to smaller geographic locations and specific Flood Warning areas.

night unless conditions dictate) that gives the recipient as much time as possible to take appropriate action whilst being as accurate as possible in terms of its predictions. Accuracy and timing are important.

Issue Flood Warnings – Category and Risk. Issue flood warnings is a core business process of Flood Warning Management. Knowledge of the current warnings in force is also a key element in the wider Flood Incident/Event Management process.

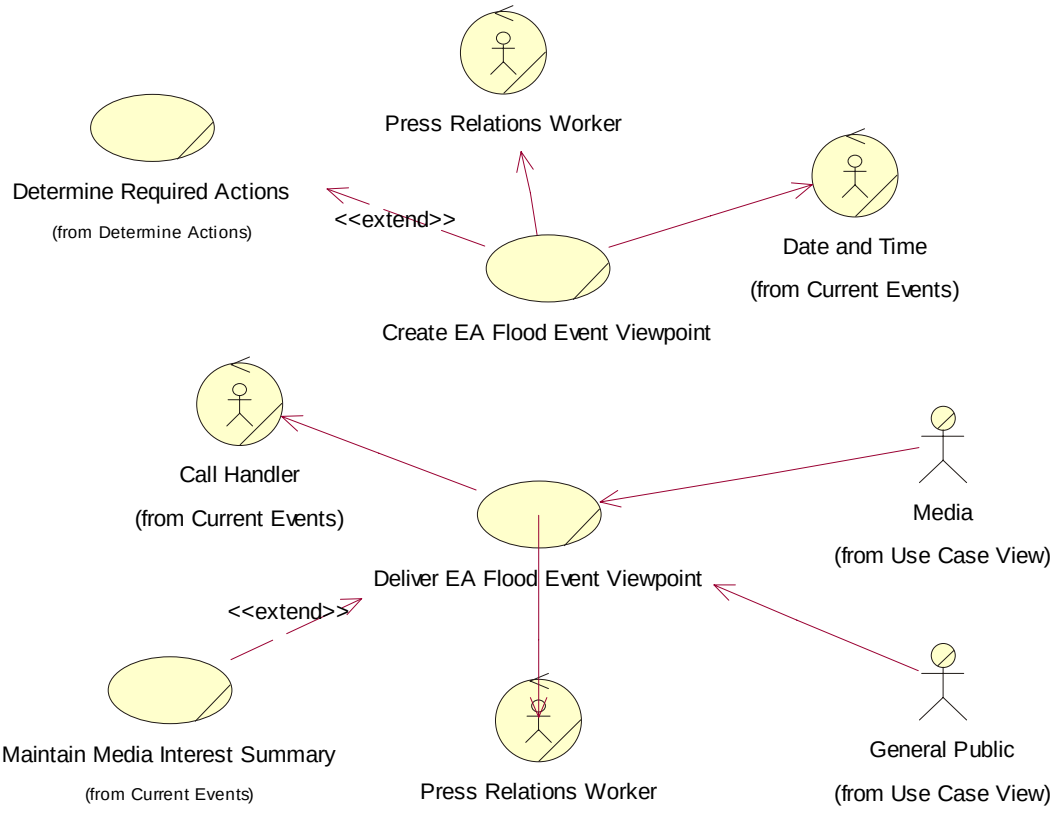
Failure to issue timely and/or appropriate flood warnings can seriously effect both the public and professional partners' perception of the competency and professional capabilities of the EA. It can also endanger the lives and property of those at risk.

Issue Flood Warnings – FWMS Issues and Opportunities. The issuing of a flood warning poses several problems for the EA. Is it an appropriate warning? Is it being delivered to the 'At Risk' groups in a timely and effective manner? Is it being presented in the most easily understood and accessible format? Does it have the desired effects? Are the status changes of cumulative messages within any Area and Region being followed by the many interested people trying to understand, report and manage the flood event as it evolves?

Many of these issues are being addressed within the current Multi-Media Warning Dissemination System project. However, there is an opportunity to disseminate, from the earliest possible moment, a shared summary of the warnings currently in force and the associated details to many internal and external users and stakeholders. IT could help realise this opportunity.

Create EA Flood Event Viewpoint – Event Communication

Carry Out Event Actions 2 - Make Event Communications 2



Create EA Flood Event Viewpoint – References. EA North East Region Flood Manual Volume I Regional Arrangement for Flooding Incidents.
EA North East Region Regional Flood Warning Manual Volume E Regional Base Controller (Flooding) Procedures.
'Wise Up to Flooding. Flood Awareness 2001 Internal Campaign Briefing'.
Regional Incident Procedures.

Create EA Flood Event Viewpoint – Pre-Conditions. A potential or actual flood event is in progress.

Create EA Flood Event Viewpoint - Trigger. A representative of the Agency is presented with the opportunity to form a viewpoint on a flood event for the purpose of informing the public or media.

Create EA Flood Viewpoint – Description. There are a number of opportunities to create an EA Flood Viewpoint within the overall management of any flood Incident/Event. The first viewpoints created will be those in relation to the messages that will have gone out in relation to the event from the FWDO. These will encompass possible FloodLine details and AVM messaging and any initial contact between the FWDO and other Agency staff and professional partners.

Public phone enquiry's relating to a potential or actual flood event will be routed to an Area or specific Area Incident Room. Area staff will deal with the issues raised from information they have been given by the FWDO or AIR staff.

Another current opportunity to create an Agency Viewpoint, related to the updating of a flood warning, is the presentation of the Current Flooding Situation – National Summary for England and Wales on the Agency internet web site http://www.environment-agency.gov.uk/subjects/flood/floodwarning. Here, both the public and media, have access to web pages giving some details of Flood Warning Areas and Flood Warnings in force.

Direct media interest will be routed to the Regional PR Office or Duty PR Officer. The PR staff will gather from conversations with AIR staff, the RDO or RBC and current Situation Reports etc. the status of the flood event. They will ensure that, where required, a consistent and co-ordinated Agency response is available to those who need it when dealing with the public and media.[18] This response will deal with specific issues that the flood event is generating and will also ensure that general Agency messages and positions regarding flood events are presented to all the recipients.

If the event attracts the attention of National or International media, the Head Office Public Relations Team will become involved in the process of creating the EA Flood Event Viewpoint.

[18] In the Midlands Region a 'Lines to Take' document is created to assist in the process of ensuring a clear and consistent set of flood event EA viewpoints are given out by all those who will be dealing with the public and the media. This document can make reference to both the specific flood event messages the Agency wishes to get over and more general flood event communications, e.g. 'Flooding. You Can't Prevent It. You Can Prepare For It.'

Create EA Flood Event Viewpoint - Post-Conditions. An EA Flood Event Viewpoint is available to those staff who need to present the Agency's position to both the media and the general public.

Create EA Flood Event Viewpoint – Performance Goals. This process and its outputs are tasked to the Regional PR Office or Duty PR Officer. (They can request the RDO to open the Regional Incident Room in the event of intense media interest).

Actual performance goals are related to the ability to create and disseminate effectively the needed EA Flood Event Viewpoints as required. These performance goals are general rather than specifically documented.

Creating EA Flood Event Viewpoints in relation to information made available on external and internal web pages are dependant on the current processes for transferring AVM data to the required web pages. Changes in Flood Warnings will be seen by the public and media on the Agency internet site up to 15 minutes after they have come into force and on the intranet (for designated users) site up to 1 minute after they have come into force.

Create EA Flood Event Viewpoint – Category and Risk. The Create EA Flood Event Viewpoint business use case is a core Flood Incident/Event Management process, with links to wider Agency Press Relations practice.

Create EA Flood Event Viewpoint - Issues and Opportunities. Co-ordinated messages and response to a flood event and the associated public and media interest depends on the availability and quality of event information available to PR workers. Most opportunities related to improving this process relate to the effective access to event information and awareness of the issues being or likely to be raised by public and media alike. This Incident/Event Management information is currently based on phone communications with already busy Area staff and paper Situation Reports. IT systems could help in gathering and presenting required event management information.

Deliver EA Flood Event Viewpoint – Event Communication

Deliver EA Flood Event Viewpoint – References. EA North East Region Flood Manual Volume I Regional Arrangement for Flooding Incidents.
EA North East Region Regional Flood Warning Manual Volume E Regional Base Controller (Flooding) Procedures.
Best Practice Guidance for Media Handling During Flooding Events.
'Wise Up to Flooding. Flood Awareness 2001 Internal Campaign Briefing'.
Regional Incident Procedures.

Deliver EA Flood Event Viewpoint – Pre-Conditions. A member of the public or a representative of the media require information relating to a potential or actual flood event.

Deliver EA Flood Event Viewpoint – Trigger. A member of the public or media have access to an EA source of flood event information and requires a specific or general question or issue to be resolved.

Deliver EA Flood Event Viewpoint – Description. There are a number of ways that the EA Flood Event Viewpoint is delivered during an event. The primary source of flood event

information is the Area FWDO and/or AIR staff. Initial Agency Viewpoints on any flood event will be a combination of local specific details and general PR guidance, delivered by those who have direct contact with the public over the phone.

As the flood event develops, the Agency will, through the use of the Regional PR Office or Duty PR Officer, co-ordinate the delivery of a consistent viewpoint through several possible medium. These can include formal press statements, media interviews and possible co-ordinated PR responses with professional partner organisations as well as the on-going verbal delivery of help and assistance offered by numerous Agency staff.

In a developing flood event situation, Agency staff are likely to begin to come into direct contact with the public and media. Regional Incident Procedures request that staff should follow some basic guidelines whenever possible. These guidelines are[19]:

Information to the Media –

- Always Liaise with the Press Office.
- Stick to the facts – do not offer personal opinions.
- Never say 'no comment'.
- Beware of prejudicial comments where legal actions are a possibility.
- Do not give out names of people affected by the incident – unless they have already agreed.
- Do not be drawn into public conflict with other organisations.
- Remember you are never 'off the record', even if you are not being filmed or recorded.

Information to the Public –

- Be proactive and open.
- Respond politely and answer questions whenever possible.
- If information is not yet available, try to say when it will be.
- If the question is not appropriate for the Agency to answer, state this and guide people to the correct organisation they should approach.

If the event attracts the attention of National or International media, the Head Office Public Relations Team will become involved in the process of creating the EA Flood Event Viewpoint.

Delivery of the EA Flood Event Viewpoint can continue long after the event has finished. The Agency must be prepared to continue this process, possibly with additional information from post-event data gathering and analysis.

Deliver EA Flood Event Viewpoint - Post-Conditions. The public or media will have been given the EA Flood Event Viewpoint for a specific potential, current or *historical* flood incident/event.

Deliver EA Flood Event Viewpoint – Performance Goals. Goals related to this business process are currently general rather than specific. The major exceptions to this are:

[19] Regional Incident Procedures, Version 3, September 2001 pages 6-7.

The Current Flooding Situation – National Summary for England and Wales on the Agency internet web site will be delivered every 15 minutes and on the Agency intranet site every 1 minute.`

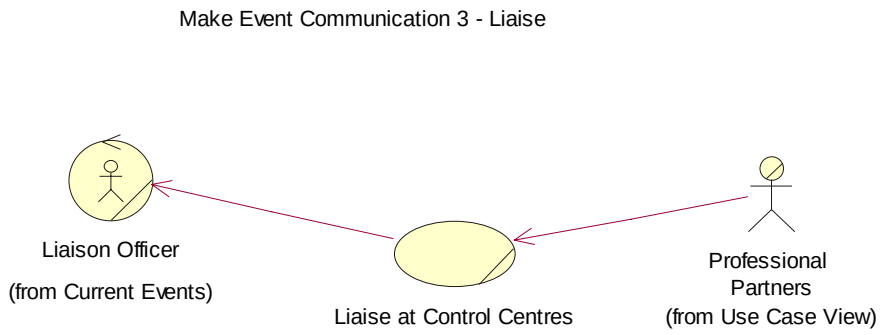
Deliver EA Flood Event Viewpoint – Category and Risk. The deliver EA flood event viewpoint business process encompasses elements of Flood Warning Management, Flood Incident/Event Management and wider Agency PR policies. This cross-cutting process is core in ensuring that the Environment Agency's messages and viewpoint is effectively created and consistently disseminated at all levels and in the multiple delivery systems of the Agency.

Deliver EA Flood Event Viewpoint – Issues and Opportunities. A number of issues and opportunities related to the delivery of EA Flood Event Viewpoint process have been raised.

Staff Training – There are opportunities to formalise staff training in relation to the verbal delivery of the EA flood event viewpoint. This holds true for Area call handlers, staff encountering the public face-to-face during a flood event and all forms of media interviews.

Viewpoint Co-ordination – There is an opportunity to ensure that Regional and/or National viewpoints are delivered more effectively to those that need them by using IT in a connected process, where core information is not continually manually gathered, re-worked and re-presented.

Liaise at Control Centres – Event Communication



Liaise at Control Centres – References. Dealing with Disaster http://www.co-ordination.gov.uk/contingencies/dwd/
Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc
Incident Management Process (IMP)
http://146.213.80.51/icontent/DocDir05/eas_08_01_imp_oview.doc

Liaise at Control Centres – Pre-Conditions. A multi service/agency control centre has been convened. Opening a control centre can be the decision of the Police or the result of a request made by representatives of another emergency service, authority or agency. The Environment Agency can request a control centre to be opened.

Liaise at Control Centres – Trigger. Agency staff have been asked to attend a co-ordination centre that has been established to respond to a flood event. This request can go to an Area Incident Room or RCC.

Liaise at Control Centres – Description. The liaison officer represents the Agency to other agencies and services at the control center. The liaison officer is not necessarily from a Flood Defence background. They: -

(From RIPS Annex I-1 to Section 1)
- Provide specialist advice and information on Agency activities to other representatives at the center.
- Obtain Agency assistance for other bodies involved in the emergency.
- Keep Agency Base Controller informed of developments and ensure all relevant details received from the Base Controller are passed to other organisations at the center.
- Keep Agency Base Controller informed of organised press briefings.

This is done by participating in regular liaison meetings, supplying information updates from the Agency and feeding back information, action and agreements to the relevant ABC and/or RBC.

At the most basic level this is done using phones alone, or phones and faxes.

Liaise at Control Centres - Post-Conditions. The Control Center will have closed. The staff associated with Control Center Liaison will have returned completed log sheets and equipment to the AIR.

Normal practice is for a series of post-event reviews to be held, both internally and with external professional partners. The results from these can be written up in a post-event report detailing performance, lessons learned and sometimes accompanied by an action plan.

Liaise at Control Centres – Performance Goals. From RIP's Sec 1/19.1:
"It's important to establish liaison with external agencies at an early stage…Where an agency establishes a co-ordination centre for other agencies, and requests Agency attendance, the Agency shall ensure a liaison officer is sent as soon as possible".

Liaise at Control Centres – Category and Risk. The business use case Liaison at Control Centers can be categorised as a Flood Event Management System use case. Outputs from the use case i.e. phone calls to the ABC and Log Sheets can have direct impact on the Flood Warning Management System.

During an event, liaison with professional partners adds a lot of value to the warning message and ensures that timely and appropriate actions are taken in response to flooding by partners. Post-event reviews can add to the body of knowledge used to revise procedures and improve the management of the next event.

Failure to perform liaison effectively when required could have an adverse impact on the political perceptions of the Agency during an event.

Liaise at Control Centres – Issues and Opportunities. From interviews we know that in NE Region liaison officers are taking laptops to share telemetry and/or forecast data with

customers. Paper logs are kept of these activities. Liaison officers might do an 8hr/12hr or longer shift.

From interviews we know that this can be a difficult role with some agencies demanding black and white answers on where and when it will flood, to base life and death decisions on. One example is the evacuation of old people's homes, where some residents might perish if they were evacuated, and more might if they were allowed to stay put, and they were flooded.

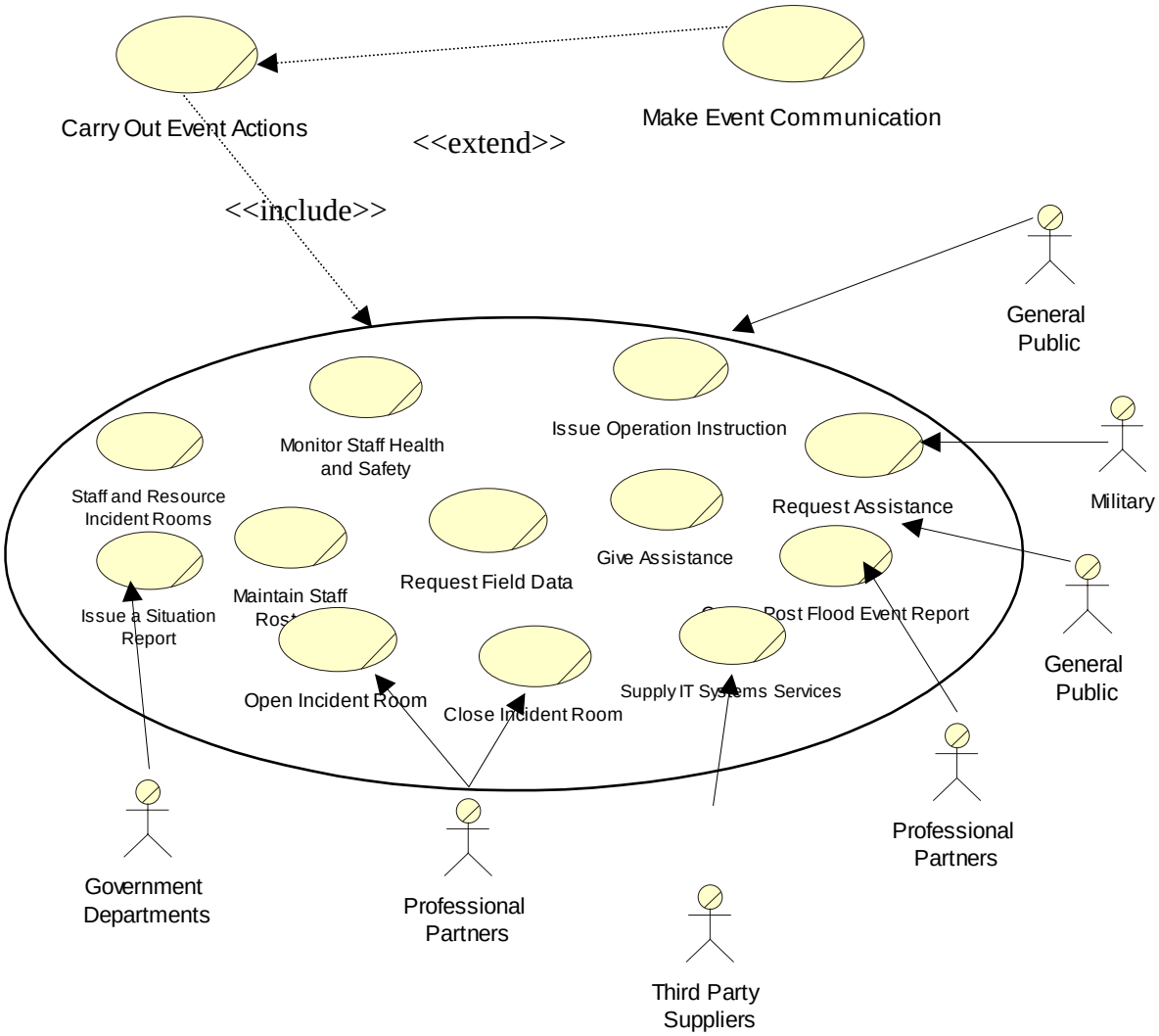
From interviews in Midlands Region "*Too many Golds and Silvers to go to – Upper Severn – 1 Gold and 6 Silvers. Maybe we can't even get to them (cut off by flood water, for example, Powis).*"

From interviewing Midlands REO – "*Ideally Liaison officers would have a laptop with access to remote email, - radar display- forecasting data. Some Areas in Midlands experimenting with Videoconferencing.*"

We could make more use of IT to facilitate Agency liaison, for example:-

- Build on use of videoconferencing / videophones to allow more than one control to be serviced by one liaison officer
- Use collaborative working tools or shared IT systems (something like but not necessarily MS NetMeeting to facilitate the discussion of areas of expected flooding
- Consider Liaison Officers as a specific use-case in any system that gets developed
- Consider more use of the internet to publish live data for professional partners and facilitate interactive discussions

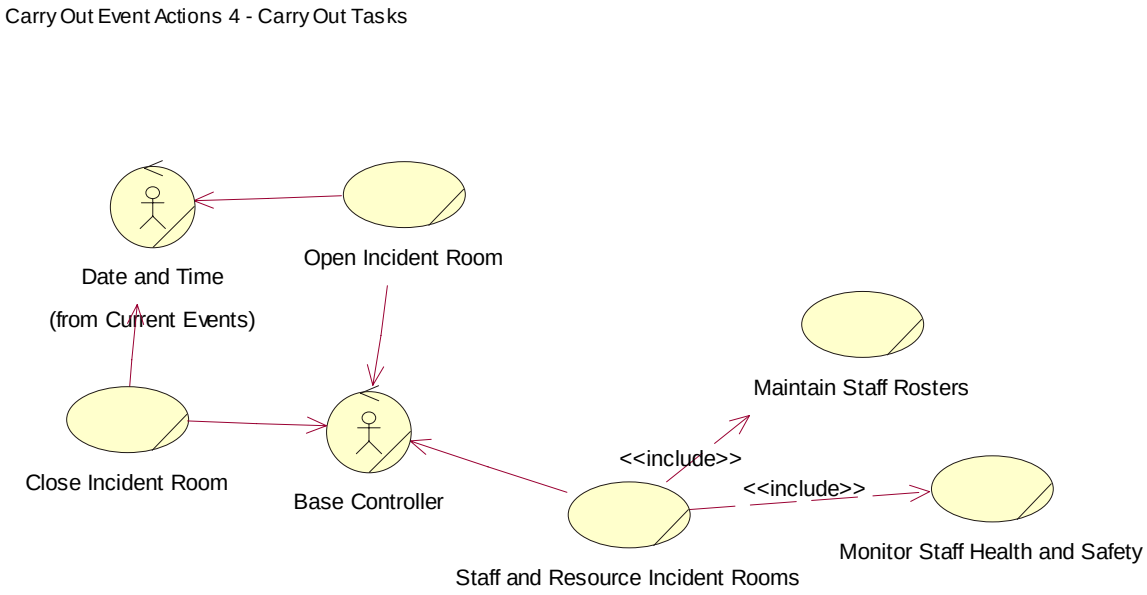
There are synergies between multi-agency working here and areas being tackled by the Virtual Communications Strategy being developed by the Agency.



The Carry Out Event Actions – Tasks abstract business use case covers the following business use cases:

Open Incident Room
Close Incident Room
Staff and Resource Incident Rooms
Maintain Staff Rosters
Monitor Staff Health and Safety
Issue Operation Instruction
Supply IT Systems Services
Issue a Situation Report
Request Assistance
Give Assistance
Request Field Data
Create Post-Flood Event Report

Open Incident Room – Event Task



Open Incident Room – References. Regional Incident Procedures V3
http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Incident Management Process (IMP) http://146.213.80.51/knowledge/default.asp

Open Incident Room – Pre-Conditions. A flood event is in progress.

Open Incident Room – Trigger. The Area Base Controller or Flood Warning Duty Officer decides to open an incident room to deal with the (anticipated) work load of managing an event.

RIPs follow the principle set in 'Dealing with Disaster' of bottom-up incident management, i.e. when two Area Incidents Rooms are open the Regional Incident Room may be opened and if two or more Regions have open rooms the National Incident Room may open.

However, rooms may be opened based on weather forecasts, perhaps with a skeleton staff of FWDO/ODO for 'monitoring' purposes, and to avoid a start from scratch.

Reasons to not open an incident room and instead work from home can include:-

Concern over what might happen whilst duty staff are travelling into the incident room, not all duty staff live close to offices and this is likely to become more of an issue after BRITE

Believing that the incident isn't large enough to warrant it, based on received information

Staff exhaustion

The full opening of an incident room is often accompanied by the declaration of a 'Major Incident' by the Area.

During a National Major Incident, Regions not directly affected may nominate a Regional Base Controller / open an RIR to deal with inter-Regional assistance requests.

Open Incident Room – Description. A number of tasks must be carried out to open an Incident Room. They can be briefly described as:

- Locate staff to man incident room and wait for them to arrive
- Inform RCC / Region, including contact details
- Inform customers (fire, police ambulance) including contact details
- Declare Major Incident (optional) issue HELP Report
- Set up equipment (some incident rooms are set up in meeting rooms or other locations used for other purposes) including telephones (with hunt groups, call queuing), computers, white boards
- Put out stationary (log sheets, pens) and operational manuals / maps
- Brief arriving staff, not all of whom will have been on duty immediately before the incident
- Assume open more than 8 hours and arrange shift rostering
- Locate supplies of food / arrange catering
- Consider staffing office switchboard

Opening an incident room may take up to an hour and occupy 2 or more staff, working in parallel with the staff managing the incident.

Open Incident Room - Post-Conditions. The Incident room will be open and operational.

Open Incident Room – Category and Risk. The Open Incident Room is a core Flood Warning Management and Flood Event Management Systems business process. Failing to open incident rooms early enough in a major incident can lead to under-performance in managing the incident and thus later criticism from professional partners, the public and thus damage to the Agency's reputation. Opening incident rooms late can cause a resource drain and distraction from managing the incident itself.

It could also lead to key information flowing slowly through the incident management team, subsequent delays in issuing flood warnings and thus increased flood damage suffered.

Open Incident Room – Issues and Opportunities. Having an incident room open makes communication between staff managing an incident much easier.

There are opportunities to:-

- Ease communication to all those involved that a room is open, manned by certain staff and provide contact details.
- Ease communication with staff that the room is opening and needs manning.

Close Incident Room – Event Task

Close Incident Room – References. Regional Incident Procedures V3
http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Incident Management Process (IMP) http://146.213.80.51/knowledge/default.asp

Close Incident Room - Pre-Conditions. The Incident Room is open. The conditions that warranted the opening and running of the Incident Room have now past.

Close Incident Room – Trigger. The Base Controller decides that the Incident Room can close.

Close Incident Room – Description. A number of tasks must be carried out to close the Incident Room:-

- Inform RCC / Region
- Inform customers (fire, police ambulance)
- Stand down Major Incident (do we ever do this?)
- Pack up equipment (some incident rooms are set up in meeting rooms or other locations used for other purposes) including telephones (with hunt groups, call queuing), computers, white boards
- Collect and store log sheets/incident records for future audit / post incident review
- Clean room
- Stand down existing and rostered staff.

Close Incident Room - Post-Conditions. The Incident Room is closed. All Flood Event Incident records have been stored and are accessible for post-event review.

Close Incident Room – Performance Goals. None known.

Close Incident Room – Category and Risk. Closing an Incident Room is a core Flood Warning and Incident/Event Management System business use case. Closing an incident room early, for example on incorrect weather forecast information could lead to under-performance by the Agency and consequent damage to its reputation.

Close Incident Room – Issues and Opportunities.

There are opportunities to:-

- Ease communication to all those involved that an incident room is closing.
- Ease communication with staff that the room is closing and no longer needs manning.

Staff and Resource Incident Rooms – Event Task

Staff and Resource Incident Rooms – References. Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Incident Management Process (IMP) http://146.213.80.51/knowledge/default.asp

Staff and Resource Incident Rooms - Pre-Conditions. An Incident Room is opening and needs to be staffed and resourced.

Staff and Resource Incident Rooms – Trigger. A relevant Duty Officer has decided to open an Incident Room in relation to a Flood Event.

Staff and Resource Incident Rooms – Description. The Duty Officer opening the Incident Room has to populate and implement Incident Room staff rosters, taking the following into account:

- Staff experience and training

Through IMP key competencies and training packages have been introduced for staff on Duty Rosters. More experienced staff may be able to fill different roles on different shifts. The balance of experience between staff on the same shifts, and assigning experienced staff to the 'hardest' shifts all need taking into account:

- Staff availability.

Filling rosters can be complicated as usually once the first duty officer has been used, volunteers are requested. It can take 5 people to fill a role for 4 days, and they may be rostered around previous personal commitments.

- Working time directive – local shift pattern arrangements.

Shifts between 8-12 hours with 11 hours unbroken rest.

- Human factors.

People perform better if rostered allowing for their body-clock i.e. 3 night shifts in a row.

- Event factors.

The balance of experience between staff on the same shifts, and assigning experienced staff to the 'hardest' shifts all need taking into account.

Once a roster is populated a copy is kept in the incident room and staff have to be contacted to confirm their shifts. In a long event they may contacted to remind them of their shifts / check on their ongoing availability.

Staff and Resource Incident Rooms - Post-Conditions. Records of shifts worked have to be kept for:-

- Verification of overtime, travel and subsistence claims.
- To confirm who was present at key decision points during the event.
- To show health and safety considerations were taken into account.

Staff and Resource Incident Rooms – Performance Goals. None documented.

Staff and Resource Incident Rooms – Category and Risk. Staffing and resourcing Incident Rooms is a core Flood Warning and Incident/Event Management System business process. Failure to adequately staff or resource an Incident Room during a flood event can have serious effects on the performance of the Flood Event Team.

Staff and Resource Incident Rooms – Issues and Opportunities. Filling the roster is a work intensive and pressured role, often delegated. If a system held details of trained staff, with locations, contact details, personal details, with a template roster and a rule checker to check for appropriate rostering and other business rules, this might assist.

In a flood event consideration also has to be made for travel through a countryside that may have been badly affected by flooding, roads blocked, train lines cut or services disrupted.

Having a geo-spatial view of staff locations and flooding, and details of transport could help this process.

Maintain Staff Rosters – Event Task

Maintain Staff Rosters – References. Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Incident Management Process (IMP) http://146.213.80.51/knowledge/default.asp

Maintain Staff Rosters - Pre-Conditions. An Incident room is open and a staff roster has been already started.

Maintain Staff Rosters – Trigger. Incident rooms are normally opened 24/7, rosters have to be written ahead to allow staff to make arrangements at home (child care, partners etc) in advance of performing duties.

After initial set-up rosters may be refreshed on a daily basis, say for 5 days ahead.

Therefore the trigger is recognition by the relevant controller that the roster needs extending.

Maintain Staff Rosters – Description.

As for staff and resource incident rooms except that:-

- care has to be taken not to wake staff asleep resting from incident work to ask about their future availability

- information underlying the building of the roster, such as 'John Smith is not available at the weekend' should be passed from shift to shift

Transport may become a larger issue if the flood plain extends and disruption increases

More staff may be needed, increasing the workload of the rosterer

Maintain Staff Rosters - Post-Conditions. Staff Rosters have been maintained to ensure Incident Room effectiveness throughout a Flood Event.

Records of shifts worked have to be kept for:-
- Verification of overtime, travel and subsistence claims
- To confirm who was present at key decision points during the event
- To show health and safety considerations were taken into account

Maintain Staff Rosters – Performance Goals.
No official goals. Goals can include:-
- Not waking sleeping staff
- Not repeatedly asking the same staff about availability for when they are un-available

Maintain Staff Rosters – Category and Risk. Maintaining Staff Rosters is a core Flood Warning and Flood Incident/Event Management System business process. Failure to maintain

staff rosters both before and during an event will make running an Incident Room effectively extremely difficult, if not impossible.

Maintain Staff Rosters – Issues and Opportunities. Problems with rostering could have the following impacts:-

- Inexperienced staff on duty during critical times and experienced staff during quiet times.
- Staff not turning up at the right moment.
- Waking resting staff unnecessarily.

Any of the above could lead to Agency under-performance in event management and subsequent criticism.

Having a system of guided prompts might assist. There is also the opportunity to facilitate publishing the roster somewhere, like on the intranet. This could also assist with justifying and organising inter-Regional assistance. Having a computer based roster as opposed to a paper-based would could assist with version control and recording additional detail such as staff availability to pass on between shifts.

Having a system might reduce the workload and speed up the production of good quality rotas.

Monitor Staff Health and Safety – Event Task

Monitor Staff Health and Safety – References. Regional Incident Procedures V3 http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Incident Management Process (IMP) http://146.213.80.51/knowledge/default.asp

Agency Health and Safety Policy

Monitor Staff Health and Safety - Pre-Conditions. Staff may have been deployed into the field before the opening of an incident room, for example EWF to patrol, clear blockages or sluice keepers to manage structures, or hydrometric staff to perform flood gauging. Other staff may be in the field attending other incidents or performing routine work.

If appropriate, some of these staff may already be complying with the ‘at risk’ worker policy and be registered with their appropriate ‘at risk’ monitor, whether an RCC or Area Office.

Other staff will be located a Area, Regional and National Incident rooms when and if these are opened.

Monitor Staff Health and Safety – Trigger. The employment of staff in any flood event role should be the trigger for effective monitoring of their health and safety issues.

Monitor Staff Health and Safety – Description. Health and safety monitoring activities that are commonly undertaken in incident rooms include:-

- Monitoring rosters to ensure staff are adequately qualified
- Monitoring rosters to ensure that staff are not overworked
- ‘At risk’ worker monitoring for workers considered ‘at risk’

This is involves keeping track of the whereabouts of ‘at risk’ workers and logging safety check telephone calls from them at regular intervals. Failure to make a safety call or acknowledge follow-up calls triggers a search after a pre-determined period.

- Briefing of staff dispatched from the incident room into the field, and issue them with appropriate PPE (Personal Protective Equipment)
- Consideration of additional risks due to the incident and communicating to staff

Examples: Angry threatening residents, blocked roads, slumping river banks

At the start of this process incident room staff may have to take over responsibility for monitoring ‘at risk’ workers from another point in the Agency.

Monitor Staff Health and Safety - Post-Conditions. At the end of this process incident room staff may have to hand over responsibility for monitoring ‘at risk’ workers to another point in the Agency.

Monitor Staff Health and Safety – Performance Goals. Complete fulfillment of the Agency’s Health and Safety Policy.

Monitor Staff Health and Safety – Category and Risk. Monitoring staff health and safety is a core Flood Warning and Incident/Event Management System process and a wider EA employment process. Failure to put in place measures to meet the Agency’s Health and Safety policy could lead to accidents causing injury to staff and prosecution of the Agency.

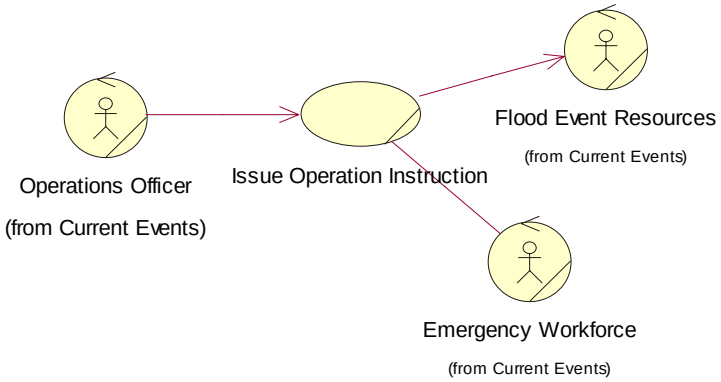
Monitor Staff Health and Safety – Issues and Opportunities.
Safety has a geo-spatial element in that there is the opportunity for staff who notice or assess risks as they move about during an incident to have them recorded on a map, or asset based risk register, for relaying to the next staff to be dispatched to a location.

Using a spatial database and interpreting existing data (river level, asset data, asset reports) in new ways combined with a knowledge base could result in useful safety prompts based on experienced engineers knowledge being generated and targeted at appropriate staff.

Locational devices for vehicles are much cheaper than 5 years ago. For example Vodaphone offer a black box that could be fitted in a car boot that reports vehicle location using SMS technology. This costs about £50 to install and £12 per month to rent.

Staff monitoring ‘at risk’ workers could benefit from a logging and prompting system, ideally with a shared database with other Agency locations performing the same task for easy handover.

Issue Operation Instruction – Event Task



Issue Operation Instruction – References. EA North East Region Flood Warning and Flood Defence Operations Procedures 1R, EA North East Region Emergency Workforce Response Procedures (Don & Aire) Volume 2R D&A.

Various Area and Regional historical Situation Reports:
Midlands Region 01/02/02 – 15:00
North East Region 12/11/00 – 08:00
North East Dales Area 12/11/00 – 18:00
North East Don & Aire Area 1/11/00 – 16:00

Issue Operation Instruction - Pre-Conditions. A current or predicted fluvial and /or tidal condition has been met that requires the issuing of an Operational Instruction.[20]

Issue Operation Instruction – Trigger. The Operational Duty Officer will have decided, often in consultation with the FWDO, that conditions require the issuing of a specific Operational Instruction.

Issue Operation Instruction – Description. The Operational Duty Officer will contact the Emergency Duty Officer and request that a specific Operational Instruction be carried out. The Emergency Duty Officer will confirm that this will be done and will instruct the Emergency Workforce to carry out the appropriate Operational Instruction. Both the ODO and the EDO will log the request.

Exception – Some requests for Operational Instructions will be made by an automatic alarm that is delivered to the EDO before or at the same time as the ODO receives it. The alarm is the request to issue the Operational Instruction.

Operational Instructions will cover a variety of tasks associated with operating flood control structures and keeping the waters of main rivers within flood defences. Operational Instructions and the work of the Emergency Workforce may cover but will not be exclusively limited to:

[20] The North East Region have documented a number of conditions that will require the issuing of an Operational Instruction in any particular Area.

Patrolling flood defences and monitoring flooding.
Monitoring the filling of controlled washlands.
Closing flood gates and putting stop-logs etc. in place.
Operating sluice gates, regulators, barriers and pumping stations.
Undertaking emergency pumping, earthworks and sandbagging.
Operating Loud Hailer vans.

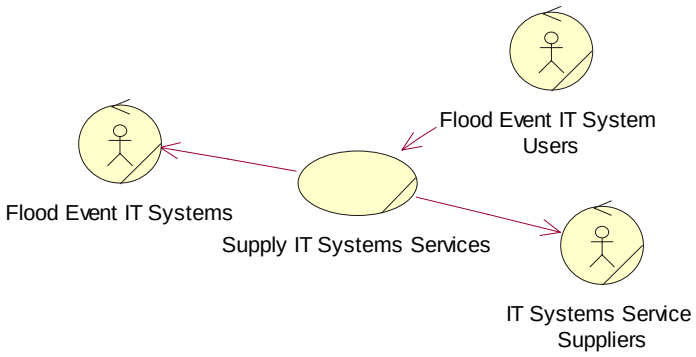
Issue Operation Instruction – Post-Conditions. The specific Operational Instruction will have been issued to the EDO, who will deploy the Emergency Workforce and appropriate flood event resources to carry out the Operational Instruction.

Issue Operation Instruction – Performance Goals. Each specific Operational Instruction may have its own performance goals and optimum resource needs.

Issue Operation Instruction – Category and Risk. The Issue of Operation Instruction business use case is a core Flood Incident/Event Management process. If the process should fail there could be serious consequences for the management of the flood event. Failure to issue a particular instruction at an appropriate time could put public lives and property at risk.

Issue Operation Instruction – Issues and Opportunities. The issue of an Operation Instruction depends on the ability for the ODO and EDO to communicate effectively. Issues may arise around communications and the shared view of current resource deployment and priorities. It systems could track the issuing of an Operation Instruction, its status and associated resources to aid event communication, resource and event management.

Supply IT Systems Services – Event Task



Supply IT Systems Services – References. EA North East Region Flood Warning Manual I Regional Arrangements for flooding Incidents

Supply IT Systems Services - Pre-Conditions. One or more IT systems are recognised as a requirement of the management of flood warnings and flood events.

Supply IT Systems Services – Trigger. Any condition that requires a flood event IT system User to request the use of an IT Systems Service.

Supply IT Systems Services – Description. In both the two Regions investigated, a number of IT systems and IT services support the management of flood warnings and flood events. These current services can be briefly described as:
Supply of Network Infrastructure and Hardware and failure procedures.
Supply of Telemetry systems data services and system failure procedures.
Supply of Met Office radar data services and system failure procedures.
Supply of Messaging systems and system failure procedures.
Supply of regular checks and routines to ensure systems are operational.
Supply of systems documentation and training.

The supply of these services and the processes that support them will be described in more detail when the scope of the FWMS is better defined.

Supply IT Systems Services - Post-Conditions. The Flood Event IT Systems Users will have the IT Services they require to ensure effective IT support for Flood Warning and Flood Incident/Event Management.

Supply IT Systems Services – Performance Goals. Each IT Service should have its own minimum Service Level and performance goal.

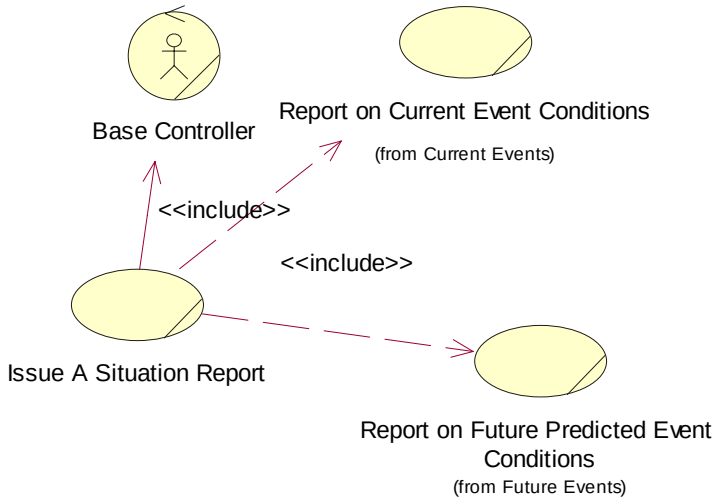
Supply IT Systems Services – Category and Risk. The supply of IT systems services is a core business use case for Flood Warning Management. The wider management of a Flood Incident/Event will rely on the effective supply of IT systems services. Failure of the Supply IT Systems Services processes could be critical to an effective Flood Warning and Flood Incident/Event Management system.

Supply IT Systems Services – Issues and Opportunities. A number of issues and opportunities are applicable to this business use case. The over-riding areas of concern for now would seem to be:

Multiple systems across the Agency doing essentially the same thing.
Robustness during a flood event.

These issues lead to further issues around service supplier negotiations, pricing, training, National business processes, systems integration and National business change.

Issue a Situation Report – Event Task



Issue a Situation Report – References. Regional Incident Procedures V3
http://146.213.80.51/icontent/DocDir05/em005ripsv3.doc

Incident Management Process (IMP) http://146.213.80.51/knowledge/default.asp

EA North East Region Flood Warning Manual Volume I Regional Arrangements for Flooding Incidents

EA North East Region Flood Warning Manual Volume E Regional Base Controller (Flooding) Procedures

Issue a Situation Report - Pre-Conditions. An event requires the opening of an Area Incident Room.

Issue a Situation Report – Trigger. An Area Incident Room is opened.

Issue a Situation Report – Description. The FWDO or ABC ensures that a regular Situation Report is issued to the RDO or RBC.[21] The report is a paper document. Its layout or contents are not standard across Agency Regions. It basically will have information from each Area relating to;
Warnings In Force
Current Tidal and Fluvial Flooding
Forecasts
Operational Action Taken
Known Successes and Failures
Assistance Given, Received or Required
Media Issues and Interest
Event Context/Background

Each Region will, if required, send a Regional Situation Report to the National Incident Room, which will be a summary of the Area Situation reports.

The successful issuing of a Situation report needs a copy of the report to go to a defined set of recipients.

Exception. Some conditions will require both a Situation Report to be created for distribution to Regional level and also a HELP (Head Office Emergency Liaison Procedures) report to be created and sent to Head Office. These are the event conditions that should influence the creation and distribution of a HELP report.

The flood event represents:

Significant risks to life or health.
Is of National significance.
There is significant public, media or government concern.
Major environmental impact.

[21] EA North East Region request that Area Situation Reports arrive with the RDO/RBC by 25 minutes past each hour, to allow for media broadcasting at 45 minutes past the hour.

A stated and imminent threat to the Agency's services.
Loss of life.
Criminal acts or sabotage of flood defence assets which threaten public safety.
Serious structural damage to or failure of dams, reservoirs, river control structures, flood defences which causes damage to property.
Reports of 10 or more properties flooding (whether from main rivers, surface water, non-main river).

Issue a Situation Report - Post-Conditions. A defined set of recipients will have received a current Situation Report at an agreed time.

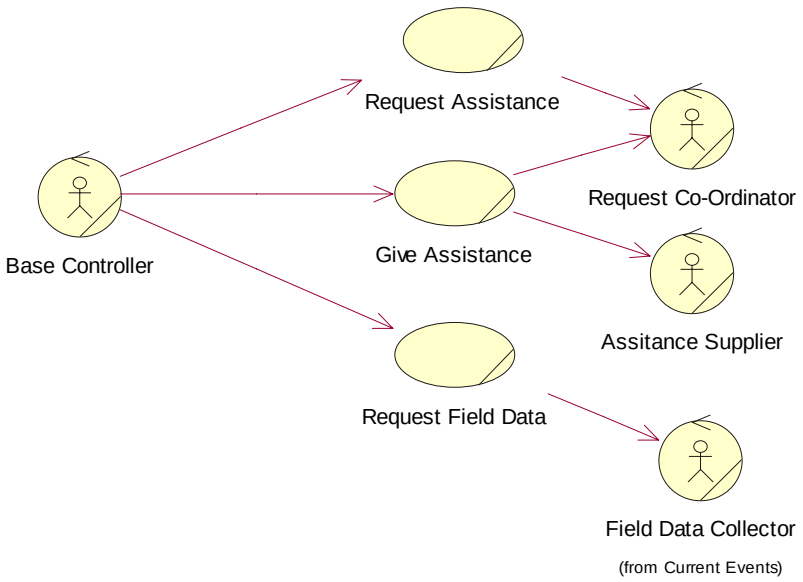
Issue a Situation Report – Performance Goals. Area Situation Reports will be issued and delivered to Regional Management as locally agreed. HELP reports will be issued and delivered when applicable. Regional Situation Reports to the National Incident Room will be issued and delivered by 10:00 hrs and 1500 hrs each day.

Issue a Situation Report – Category and Risk. Issuing a Situation Report is a core Flood Incident/Event Management system business process. Failure to issue required reports can seriously effect the ability of the Agency to disseminate information internally, to professional partners, to the government and the public.

Issue a Situation Report – Issues and Opportunities. It's not clear who has the responsibility for creating HELP reports if no RBC is in place or who should normally be doing this if the RBC is available. ABC's can log HELP reports if the event merits it. 'Significance of the event' is not quantified and much is left to judgement. Harder rules would help.

Situation Reports are essentially an event information communication device and a management information tool. There are opportunities to utilise IT to aid these requirements.

Request Assistance – Event Task



Request Assistance – References. EA North East Region Flood Warning Manual Volume A, Monitoring & Forecasting Procedures.

Request Assistance - Pre-Conditions. A required Area flood event action cannot be carried out without the assistance of resources from outside the control of the Area concerned.

Request Assistance – Trigger. An Area Incident Room Base Controller or a designated member of staff who is responsible for the co-ordination of the Area response to a flood incident decides that assistance is required to carry out required actions in a flood event.

Request Assistance – Description. Area Base Controllers or other senior Area managers designated as co-ordinating the Area response to the flood event can contact other Areas in their Region directly to request assistance in carrying out a required Area flood event task.

Business Rule - When they do so they must also inform the RBC or Regional Duty Officer that they have made a request and give the details of the request.

Business Rule - All requests for assistance from another Agency Region or the military must be made through the Regional Base Controller/Regional Duty Officer.

The Regional Duty Officer is responsible for contacting the National Duty Officer at Head Office in these inter-Regional cases. The requests for assistance will be logged in the appropriate Area, Regional and National Duty Officer logs. These requests for inter-Regional assistance would usually be made following consultations between the Regions involved.

Request Assistance - Post-Conditions. A request for assistance from an Area to another Area within its Region will have been made and the RBC or RDO will know of its details and will be considering the request.

A request for assistance from an Area that cannot be met by another Area in its Region will be known to the RBC or RDO. The RDO/RBC will investigate the options related to the request concerning getting the assistance from another Region. The details of the is request and a suggested solution will be passed onto the NDO at Head Office. The NDO will be considering the request.

Request Assistance – Performance Goals. All requests for assistance during a flood event made from an Area will be known to the RBC or RDO and will be logged at Area and Region. Where an Area cannot get the assistance it needs from within its Region, all the requests for help will be made known to the NDO by the RBC/RDO and will be logged at Area, Region and National levels.

Request Assistance – Category and Risk. Requests for assistance are a core Flood Incident/Event Management business process. Failure to make them known when appropriate to Regional and National managers can hinder the effective management of a flood event.

Request Assistance – Issues and Opportunities. It’s not clear that all inter-Area requests get to the RDO or RBC for consideration and agreement.

Are there limits on resource transfers?
There are opportunities to build event resource pools and track usage during an event so that Area, Regional and National resources usage and availability can be more visible. Monitoring

during an event may spot potential resource issues before they become problems and action accordingly.

Give Assistance – Event Task

Give Assistance – References. EA North East Region Flood Warning Manual Volume A, Monitoring & Forecasting Procedures.

Give Assistance - Pre-Conditions. A request for assistance from an Area to another Area within its Region will have been made and the RBC or RDO will know of its details and will be considering the request.

A request for assistance from an Area that cannot be met by another Area in its Region will be known to the RBC or RDO, who will have passed the details of the is request onto the NDO at Head Office. The NDO will be considering the request.

Give Assistance - Trigger.
Business Rule - A RDO or RBC has sanctioned the transfer of resources from one Area to another within the same Region.

Business Rule - A NDO has sanctioned the transfer of resources from one or more Regions to another.

Give Assistance – Description. In the case of inter-Area support, requested resources and will be transferred from the control of one Area to another. The details of the resources required, what their initial instructions are and how they fit into the receiving Area event management structure and processes will be agreed by the Area management concerned and agreed with the RBC/RDO as part of the sanctioning process. From that point on they become the responsibility of the receiving Area until such time as they are returned to the originating area.

Inter-Regional resources apply essentially the same approach as above but from a Regional perspective. Once sanction for the transfer has been gained from the NDO, RBC's/RDO's agree the details of the allocation of resources from Region to Region in relation to initial deployment and event management.

Give Assistance - Post-Conditions. Resources will have shifted from one Area to another within the same region with instructions for initial deployment and management. Resources will have shifted from one Region to another with instructions for initial deployment and management.

Give Assistance – Performance Goals. The main goals relate to the correct procedures being followed each time to ensure the most effective use of resources is made and that Regional and National managers have a clear picture of current assistance needs and agreements.

Give Assistance – Category and Risk. Give assistance are a core Flood Incident/Event Management business process. Failure to make them known when appropriate to Regional and National managers can hinder the effective management of a flood event.

Give Assistance – Issues and Opportunities. There are opportunities to build event resource pools and track usage during an event so that Area, Regional and National resources usage and availability can be more visible.

When the initial deployment and instructions for a resource have been met, what are the conditions under which they return, if possible, to the originator?

Request Field Data – Event Task

Request Field Data – References. Field Collection of Flood Event Data, NFWC, EFAG/A1.28, V2.0, October 2000.

Request Field Data - Preconditions. The decision to start data collection in relation to any flood event will have been taken by either an Area Base Controller (ABC), if the Area Incident Room (AIR) has been opened, or the Area Flood Defence and Water Resources Manager (AFDWRM) or a recognised deputy if the AIR has not yet opened.

The decision to request field data can be as a result of a subjective discussion between Area Flood Warning Duty Officer and Regional Forecaster or be associated with previously agreed trigger levels and procedures for specific locations.

Business Rule - Staff associated with field data collection will have been appropriately trained and will be familiar with any special equipment required. Health and Safety and Lone Worker concerns associated with any particular task need to be addressed.

Business Rule – As a general rule, Flood Warning, Operations and Regional Works Contractor (emergency workforce) staff will be fully occupied in their own emergency response activities. Staff requested to collect field data will have been drawn from other business disciplines.

Business Rule – The ABC (AIR Open) or AFDWRM has ultimate responsibility for the decisions relating to staff being sent to collect field data. The ABC can designate an AIR team member (FWDO or ODO) to manage this process.

Request Field Data – Trigger. The decision has been made to request that field data be collected from a particular flood event location.

Request Field Data – Description. The ABC or AFDWRM role must set up a Communications Log for requests made for field data collection. The log must contain reference to a number of items. They are; the time contact is made between the AIR and the field data collector, field data collector details re name, location, mobile/pager numbers, whether the call has been made into the AIR or out to the data collector, an agreed call back time, and details of any instructions given or significant phone conversations.

Additional details may be required if the AIR or Regional Communications Centre are operating the necessary health and safety and lone worker procedures. These will include keeping a record of associated vehicle description and registration number, expected location and when they will be in that location.

Once the log is established, all requests, instructions and contact with data collectors is recorded at the time of contact and maintained throughout the event.

General Business Rule – Staff will only be requested to collect field data during the hours of darkness if it is considered absolutely necessary.

Request Field Data - Post Condition. An available, suitably trained and equipped member of staff will have been dispatched to a location associated with an event with instructions to collect data.

Request Field Data – Performance Goals. 100% of all staff requested to collect field data will have received appropriate training and will have access to all necessary equipment and adequate clothing.[22]

The details related to all staff who accept a request to collect field data will be entered on the Field Data Communications Log, which will be maintained throughout the event. Health and safety and lone worker procedures will be followed for all relevant field data collectors.

Request Field Data – Category and Risk. This business use case is considered a Flood Event Management System use case. Failure to successfully request field data where required will compromise the ability to collect detailed information, impact on the potential to predict future event conditions and will have an adverse impact on the public perception of the Agency during an event.

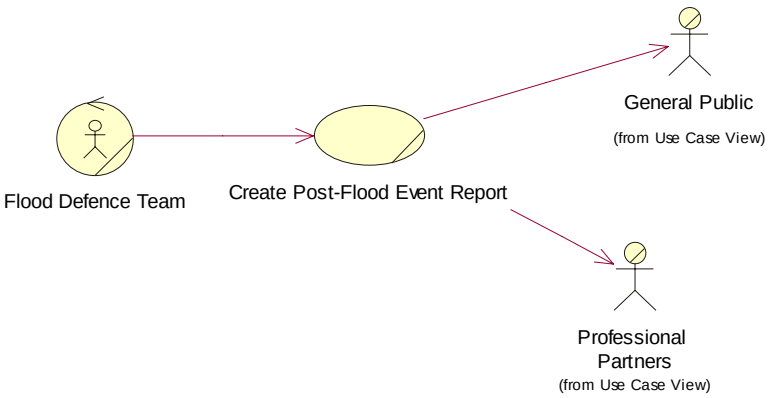
Request Field Data – Issues and Opportunities. The main issues relate to the ability to train and equip sufficient staff to fulfill the required roles and to keep accurate records. Prior to the event, records are needed of trained and available staff and equipment.

As an event begins, ABC's will need access to these records. During an event, records need to be kept of staff who have accepted an assignment to collect data, contact with assigned staff needs to be recorded and staff safety monitored.

Currently, these activities are paper based and responsibilities possibly split between AIR's and Regional Communication Centres. Keeping paper records during a possibly dynamic and difficult flood event can lead to errors and omissions. Communicating and agreeing responsibilities for staff safety monitoring can lead to further misunderstandings.

[22] See Field Collection of Flood Event Data, NFWC, EFAG/A1.28, V2.0, October 2000, page 9 for required minimum equipment.

Create Post-Flood Event Report – Post-Event Task



Create Post-Flood Event Report – References. EA North East Region Autumn 2000 Floods Review Regional Report, 12th March 2001.

EA Midlands Region 28th October – 20th November 2000 Flood Report.

Autumn 2000 Floods. Performance Review and Action Plan. Ridings Area, North East Region. January 2001.

Environment Agency Midlands Region. Review of February 2002 Floods Severn Basin, April 2002.

Create Post-Flood Event Report –Pre-Conditions. A Flood event has been recognised as being at an end. All related logs, documents and materials are available for post-event analysis.

Create Post-Flood Event Report –Trigger. A Flood event has been recognised as being at an end.

Create Post-Flood Event Report –Description. Each Area and Region must create and review with all concerned staff a post-flood event report.

Area post-flood event reports are created by the Area Flood Defence Manager or others under their supervision. The report is created with the active assistance and involvement of the Flood Defence Team and those who formed the staff and workforce during the related flood event, including external professional partners. It should reflect feedback from local communities.
The report is a mainly textual and narrative document that makes reference to:
Properties flooded,
Area Incident Room logs and records
Regional Incident and Forecasting Room logs and records,
Regional Communications Centre logs and records,
Liaison records and feedback from Liaison Officers,
Incident Room Call Logs,
Issues arising from the event,

EDO logs re emergency response and operations,
Field Data collected,
Flood Defence records,
FloodLine and AVM data,
Antecedant event conditions,
Telemetry and Outstation records,
Details of Flooding (including images),
Timesheet and overtime details,
PR Office logs and documents,
Historical flood event records,
Economic Assessments and
Views of professional partners.

These elements are drawn together, drafted, reviewed and agreed at initially Area and then Regional level.[23] The reports are then published and action plans are implemented. As an example, the main sections of the North East Regional Report relating to the Autumn 2000 flood event were:

North East Region Autumn 2000 Floods
Review Regional Report
Contents
Abbreviations
Executive Summary
1. Introduction

2. Event Management –
Environment Agency Procedures

- Area Incident Rooms (AIR)
- Regional Monitoring and Forecasting Incident Room (RIR)
- Regional Base Controller Room (RBC)
- Regional Communications Centre (RCC)
- Site Staff
- Changing Needs in Flood Defence Review (CNFDR) roles
- Liaison (Internal/External)

Communications
Numbers of Staff Deployed
Range of Functions Involved
Scale of Calls Received
Issues Arising
Recommendations

[23] Midlands employ an Access database system to help capture and record data at a Regional level from its Area and Regional sources. The version seen was 'The Flood Event Database V4 Upper Severn'.

3. Flood Monitoring and Forecasting

Met. Office Forecasts
Impact of Inaccurate Meteorological Forecasts
Environment Agency Telemetry and Outstations
Environment Agency's Flood Forecasting Capability and Performance
Issues Arising
Recommendations

4. Flood Warning
General
Flood Warnings Issued
Summary of Warning Performance
AVM
FloodLine
Sirens and Loudhailer / Public Address Systems
Issues Arising
Recommendations

5. Event Impact
Antecedant Conditions
Rainfall
River Levels and Flows
Properties Flooded and Source
Major Infrastructure Affected
Properties Protected by Flood Defences
'Near Misses'

6. Emergency Response
Major Flood Incident Plans Activated
Gold and Silver Control
Inter Agency Response
Asset Inspection and Further Repairs
Health and Safety Issues
Issues Arising
Recommendations

7. Public and Other External Relations
Media Links
Public Meetings
Notable Visits
Parliamentary Issues
Recommendations

8. Incident Specific
Retrospective Views of Others

Appendices
- Development in the Floodplain
- Public Response
- Public Reaction/Opinion
- Organisational Issues
- Economic Impacts
- History of Flooding
- Views of Professional Partners

The Midland Region produced a similar report in structure, but at times specific content differed.

Create Post-Flood Event Report –Post-Conditions. Appropriate Area and Regional post-event reports will have been created, agreed and published. Issues raised and lessons learned will have been reflected in the documents and in agreed action plans. Action Plans will have been put in place at Area and Regional levels. National issues would have been tabled with the National functions consideration.

Create Post-Flood Event Report –Performance Goals. Not clear what criteria are used to determine if an Area post-flood event report is required? More than one Area report in an event period must require a Regional report or always a Regional report, even if only one Area affected?

Create Post-Flood Event Report –Category and Risk. Creating Post-Flood Event Reports is a core process of overall Flood Warning and Incident/Event Management Systems. Failure to effectively deliver this process risks losing the opportunity review performance, learn from shared experience and enhance and develop existing systems and ways of working.

Create Post-Flood Event Report –Issues and Opportunities. The effort currently required to gather, analyse and present post-flood event data is considerable, given the large amount of manually recorded information that may be available following a flood event. If more of this data were initially stored electronically, the process of post-flood event reporting could be made easier.

It’s not clear which quantifiable data is actually required. Information content can differ from Region to Region.

It’s not clear how lessons learned and actions planned and implemented in any one Area or Region are easily disseminated to others as ‘good practice’ by the current process?

Specific Area and Regional reports are not easy to track down or access

Plans and activities arising from the recommendations of any report are hard to track historically. What actions did take place following a post-flood event report? What is the current status of these actions?

Analysis of public perceptions, responses and opinions are limited in the reports seen to date.

3.4 Current Business Processes

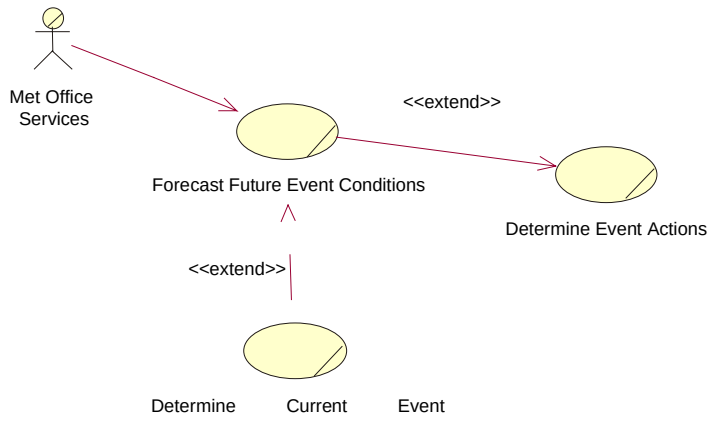
The business use case descriptions describe the functional, behavioral aspects of the current business system as described by members of the North East and Midlands teams and supported by current documentation. These business use cases describe what the business considers currently must be done and what the current system does when presented with certain information or conditions.

Other aspects need to be considered when describing the current business system and its attributes. These can be considered as 'non-functional' and add to the understanding of the business system being described. The following sections are given as a starting point at this stage of the analysis. It is recommended that if certain business use cases become the focus of potential software support and are subjected to detailed analysis, that these non-functional aspects be described on a use case by use case basis.

3.4.1 Volumes[24]

The Autumn of 2000 was the wettest on record in England and Wales for over 270 years. The period of recurrent heavy rainfall in October and November 2000 provides a good benchmark for the 'upper-capacity' volumes that might be considered when reviewing the current business system. Some current predictions talk of the Autumn 2000 flood events as becoming, with climate change, events that might occur as often as every 10-20 years.

3.4.1.1 Volumes - Forecast Future Event Conditions



[24] Both Volumes and Resources Employed sections have been written with reference to 'Lessons Learned - Autumn 2000 Floods, Environment Agency, March 2001,'Midlands Region 28th October - 20th November 2000 Flood Report, 'North East Region Autumn 2000 Floods Review Regional Report, 'Autumn 2000 Floods. Performance Review and Action Plan. Ridings Area, North East Region' Environment Agency, January 2001. 'Review of February 2002 Floods Severn Basin, Environment Agency , April 20002.

In the current business model, the Review Weather Forecast and Predict Future Tidal and Fluvial Events business use cases are within this abstract.

For the Autumn 2000 flood events, quantative records relating to these processes also relate to different Met Office Service providers, Telemetry systems and Forecasting systems. The following facts were reported in the Regional Reports:

Midlands Region
No quantative records were reported re Met Office forecasts. Met Office forecasts were disseminated by email and the Flow Forecasting System. Daily Regional forecasts were issued after 14:00 each day of the event. The Forecasting Officers Duty Logs reveal 250 verbal forecasts were documented as being relayed to the FWDO's. More verbal forecasts were likely to have been issued but never logged, as forecasts were discussed each morning of the event.

The Flow Forecasting System produced almost 500 separate forecasts for the Severn and Trent basins. Reliability and accuracy of these forecasts were rated as 'generally very good'.

A total of 87,513 calls were made to outstations by the FFS. Data collection rates were 98.5%.

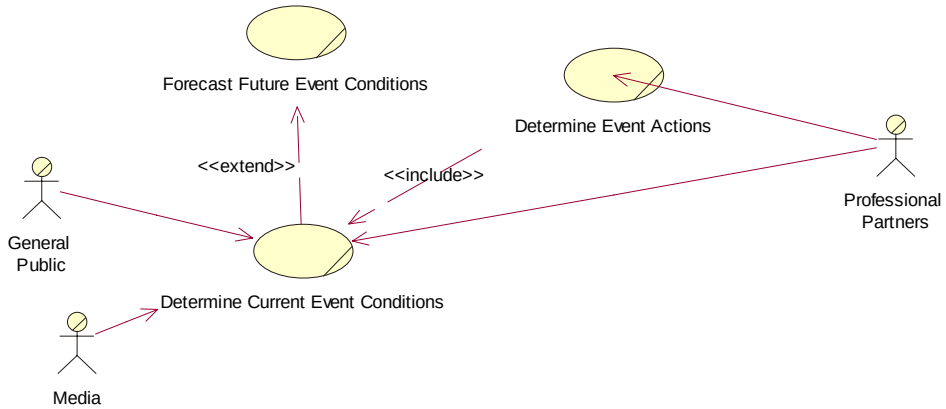
Flow Forecasting System usage during the event saw 19 different user Id's, with 9 of these concerned primarily with flow forecasting. The FFS system was accesssed 1250 separate times during the event.

North East Region
No quantative records were reported re Met Office forecasts. Qualitatively, the Met Office forecasts caused some problems for the 'flashy' river catchments. No quantative records were reported re Forecasting Officer Duty Logs.

The performance of the River Flow Forecasting System, with some exceptions, was rated as 'did not perform particularly well'. Model calibration and components based on 1980's data were recognised as factors, along with unreliable Met Office forecasts. An estimated 100,000 calls were made by the Northern Telemetry System (NTS) to rain and river level outstations during the event period.

No quantative records were reported re system usage.

3.4.1.2 Volumes – Determine Current Event Conditions



In the current business model, the Determine Current Event Conditions abstract represents a number of business use cases identified as being able to support adequate reporting of the current flood event. The following volumes may be of use when considering these business activities.

Midlands Region
334 outstation alarms, 274 from river and 60 from rainfall sites were received. Other Flood Operations and Business Services alarms gave a final total of over 1000 alarms during the event.

Media interest was described as 'exceptionally high' between Monday 30th October and Tuesday 14th November 2000. 1065 media enquiry's were handled; 357 from the print media, 332 from television and 376 from radio.

Flood Warnings were issued for 73 out of 76 Flood Warning Areas in the Region. 297 Flood Warnings and 36 Severe Flood Warnings were issued over the duration of the event across the Region. 18 All Clears were issued. No quantative record is available for the collective effort to track and summarise these warnings across the various Regional and Area offices and Incident Rooms.

58,000 calls were made by the Region's AVM systems to 3671 people or organisations. The proportion of recipients who actually received the warning through at least one number was somewhere between 82% - 98%.

2200 RMS messages were recorded across the Region for the FloodLine Service. This represents around 200 man hours effort over the event.

The numbers of calls taken in Incident Rooms across the Region were 15,600. The vast majority of these would have been to request information or assistance.[25]

No quantative records are presented in the Regional Report relating to the effort or volumes involved in:

Maintaining event warning summaries – *How much effort does it take to display and maintain the changes in event warnings around the business?*

Maintaining current fluvial and tidal information – *How much is being recorded in various locations, by various people and in various media (logs, situation reports, white boards, notes etc.) and how often?*

Collecting field data – *How much is done? By the Emergency Workforce? Others?*

Collecting call based information – *How many of the calls received give the EA useful information. How much current effort is required to ensure this information gets to those who need it?*

[25] Based on personal experience of Phil Foxley, Flood Warning Team Leader, Upper Severn Area.

Tracking the deployment of operations – *How much effort is required to track the flood event operations that are requested. ODO logs, EDO logs, Stores logs, Situation Reports at all levels of the organisation, etc.*

Maintaining Success and Failure summaries – *How easy is it to determine, track and record event 'successes and failures'?*

North East Region

No specific volumes relating to alarms raised during the flood event are mentioned in the Regional report.

The North East Region issued 194 Flood Warnings and 53 Severe Flood Warnings throughout the duration of the flood event. No quantative record is available for the collective effort to track and summarise these warnings across the various Regional and Area offices and Incident Rooms.

30,000 messages were sent via the Automatic Voice Messaging (AVM) systems in the North East Region. The average success rate for voice messages was 78% and for fax messages was 93%. The average time required to deliver voice messages related to a Flood Warning was found to be 18 minutes. The Severe Flood Warning for the River Aire at Aireworth, which required 245 calls, was issued within 30 minutes.

The numbers of calls taken in Incident Rooms across the Region were 3,650. 16,000 calls were handled by the Regional Communications Centre during this period.

Media interest in the North East Region situation was intense, and involved requests for information and access to staff from Japan, USA and European media representatives. Between Monday 30th October and Saturday 18th November 2000 over 2000 media enquiry's were handled. The Region issued 35 News Releases and helped deliver 50 TV interviews and many more radio and print interviews with Agency staff.

As with the Midlands Region, no quantative records are presented in the Regional Reports relating to the effort or volumes involved in:

Maintaining event warning summaries – *How much effort does it take to display and maintain the changes in event warnings around the business?*

Maintaining current fluvial and tidal information – *How much is being recorded in various locations, by various people and in various media (logs, situation reports, white boards, notes etc.) and how often?*

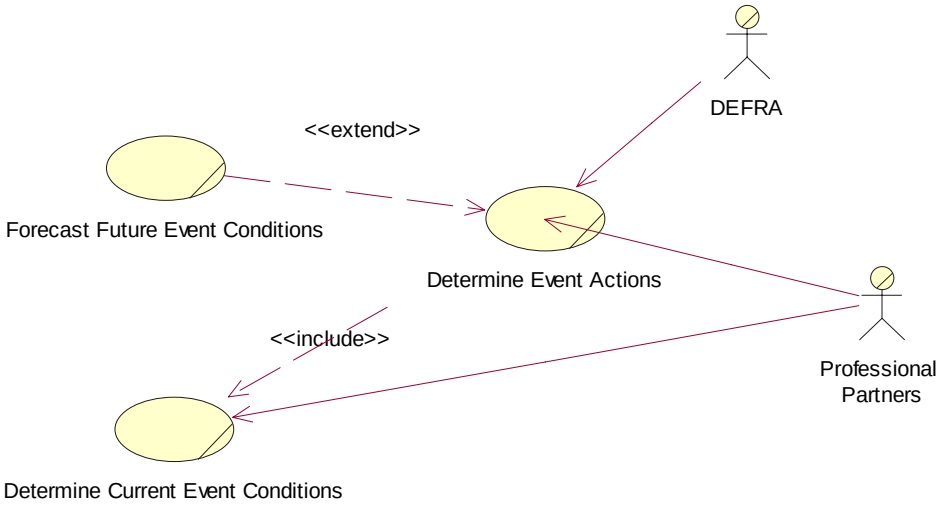
Collecting field data – *How much is done? By the Emergency Workforce? Others?*

Collecting call based information – *How many of the calls received give the EA useful information. How much current effort is required to ensure this information gets to those who need it?*

Tracking the deployment of operations – *How much effort is required to track the flood event operations that are requested. ODO logs, EDO logs, Stores logs, Situation Reports at all levels of the organisation, etc.*

Maintaining Success and Failure summaries – *How easy is it to determine, track and record event 'successes and failures'?*

3.4.1.3 Volumes - Determine Event Actions



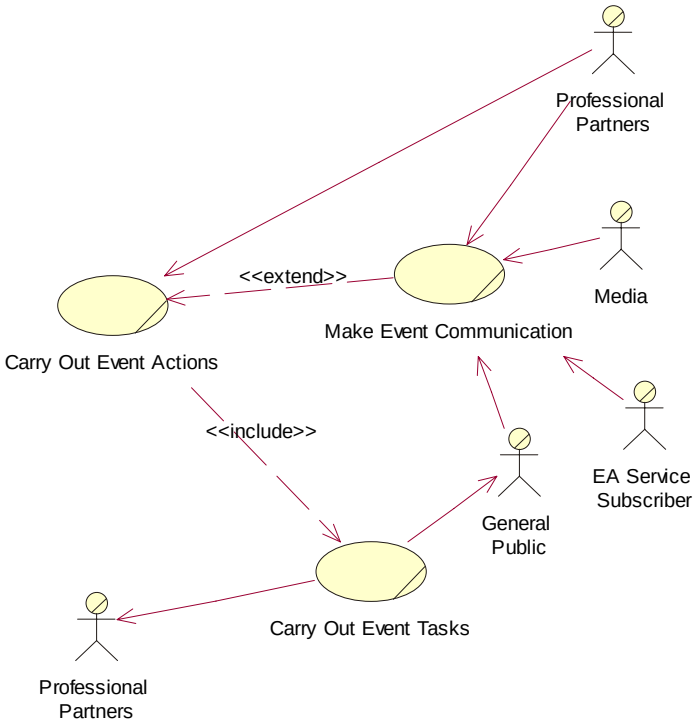
Much of the determining of event actions is done by verbal consultation between various EA Flood Event staff and Professional Partners in relation to the agreed responsibilities that the Environment Agency must fulfill during a flood event.[26]

How much effort goes into this process and how often it occurs throughout an event are hard to measure from interview and report data. Direct event observation would give a better indication.

Things to look for during an event observation might be the determining conditions that require a decision, information that needs to be to hand to support a decision and how easy it is for parties involved in the decision process to share required information and agree a 'view'.

[26] The North East Region have formalised within procedure manuals the process of determining or at least suggesting which event actions would be appropriate for specific flood event conditions and locations re Flood Warnings and Operation Instructions.

3.4.1.4 Volumes - Carry Out Event Actions



In the current business model; the Issue Flood Warnings, Create EA Flood Event Viewpoint, Deliver EA Flood Event Viewpoint, Liaise at Control Centres, Open Incident Room, Close Incident Room, Staff and Resource Incident Rooms, Maintain Staff Rosters, Monitor Staff Health and Safety, Issue Operation Instruction, Supply IT Systems Services, Issue a Situation Report, Request Assistance, Give Assistance, Request Field Data and Create Post Event Report are all business use cases are within this abstract. The following volume notes may be of use when considering these processes.

In the National Autumn 2000 flood event 1,437 Flood Warnings were issued. 190 of these were Severe Flood Warnings.

Midlands Region
Flood Warnings were issued for 73 out of 76 Flood Warning Areas in the Region. 297 Flood Warnings and 36 Severe Flood Warnings were issued over the duration of the event across the Region. 18 All Clears were issued. Of the 1195 properties estimated to have been flooded within designated Flood Warning Areas, 1110 received a direct Flood Warning and/or Severe Flood Warning from the Environment Agency via the AVM system, a loud hailer or flood warden.

58,000 calls were made by the Region's AVM systems to 3671 people or organisations. The proportion of recipients who actually received the warning through at least one number was somewhere between 82% - 98%.

2200 RMS messages were recorded across the Region for the FloodLine Service. This represents around 200 man hours effort over the event based on each message taking 5-10 minutes to write, record and check.

In the Midlands Region, Agency staff attended as Liaison Officers 9 out of 10 Gold and Silver Controls activated.

Media interest generated 1065 media enquiry's; 357 from the print media, 332 from television and 376 from radio. 58 television and 164 radio interviews were undertaken.

The numbers of calls taken in Incident Rooms across the Region were 15,600. The vast majority of these would have been to request information or assistance.

Emergency response effort associated with the Midlands Region during the Autumn 2000 flood event has been costed as:

	Costs
Regional Office:	
Regional Flood Defence	20000.00
Water Resources - Forecasting	21000.00
Public Relations – Staff	17000.00
" " - Media monitoring	25000.00
NCPM	8000.00
RCC – (Extra over normal costs)	1000.00
Others – Senior management etc	5000.00
Lower Severn	45000.00
Upper Severn	50000.00
Upper Trent	26000.00
Lower Trent	50000.00
Direct Works	
Lower Trent North	123000.00
Lower Trent South	110000.00
Upper Trent	60000.00
Upper Severn	55000.00
Lower Severn	60000.00
Other Costs identified to date:	
Additional FloodLine charges	41000.00
Data collection costs	100000.00
Other costs - unidentified	308000.00
Total	1125000.00

North East Region

The North East Region issued 194 Flood Warnings and 53 Severe Flood Warnings throughout the duration of the flood event. No quantative record is available for the collective effort to track and summarise these warnings across the various Regional and Area offices and Incident Rooms.

30,000 messages were sent via the Automatic Voice Messaging (AVM) systems in the North East Region. The average success rate for voice messages was 78% and for fax messages was 93%. The average time required to deliver voice messages related to a Flood Warning was found to be 18 minutes. The Severe Flood Warning for the River Aire at Aireworth, which required 245 calls, was issued within 30 minutes.

The numbers of calls taken in Incident Rooms across the Region were 3,650. 16,000 calls were handled by the Regional Communications Centre during this period.

Media interest in the North East Region situation was intense, and involved requests for information and access to staff from Japan, USA and European media representatives. Between Monday 30th October and Saturday 18th November 2000 over 2000 media enquiry's were handled. The Region issued 35 News Releases and helped deliver 50 TV interviews and many more radio and print interviews with Agency staff.

It has been estimated that the emergency response cost the North East Region £2.3 million. In March 2001, the North East estimated that improvements and extensions to the flood forecasting and warning service would be £9 million over the following 10 years. This did not include estimates related to the required immediate maintenance of flood defences of £2.5 million.

Initial estimates of required New defences over the next 10 years suggest a further spend of £120m.

3.4.2 Resources Employed

This section gives a brief 'flavour' of the current area of resourcing that are related to the current business system of Flood Warning and Flood Event Management.

References:

Lessons Learned. Autumn 2000 Floods. Environment Agency, March 2001.

EA North East Region Autumn 2000 Floods Review Regional Report March 2001

Autumn 2000 Floods. Performance Review and Action Plan. Ridings Area, North East Region. January 2001.

Midlands Region Flood Report 28th October – 20th November 2000

Midlands Region. Review of February 2002 Floods. Severn Basin. April 2002.

Human Resources.

The 'Lessons Learned. Autumn 2000 Floods' document states, 'it is estimated that approximately 3,500 Agency staff were involved in maintaining a 24-hour service in the worst affected areas'[27]

For the North East Region during this period, 193 non-Flood Defence staff were involved, along with 82 Flood Defence Staff in the Region and Dales, Northumbria and Ridings Area offices. Time spent on the event totaled 1572 staff days and 7102 hours overtime.

For the Ridings Area, the most affected Area in the North East Region during this period, the Area Incident Room was manned 24 hours a day between 30th October and 15th November.[28] At its most intense period, the Ridings Area Incident Room was manned by 20 people, which included an Area Base Controller, two Flood Warning Duty Officers, Operational Duty Officers and Emergency Duty Officers, three Assistant Flood Warning Duty Officers and a number of call handlers. Overall, Ridings estimate that 50 staff were involved in the AIR throughout the event and a further 200 were working on flood duties. This total includes the Emergency Workforce, flood defence and other Agency functions.[29] Available human resources in any Area or Region can be supplemented by requesting assistance from other Areas and Regions.

In the Midlands Region during the Autumn 2000 flood event, 142 non-Flood Defence staff were involved, along with 80 Flood Defence Staff in the Region and Upper Severn, Lower Severn, Upper Trent and Lower Trent offices. Time spent on the event totaled 554 staff days and 4482 hours overtime.

Flood Defences.

The 'Lessons Learned. Autumn 2000 Floods' document has a reference to the visual survey of the condition of the defences on main rivers carried out by the Environment Agency. The vast majority (90%+) are rated somewhere between Fair and Very Good. These are the initial flood defence resource that the Agency employees during an event. However, Midlands Region estimated that essential repairs to flood defences, which were either damaged or identified as inadequate during the event, amounted to some £1,760,000.

However, local authorities and internal drainage boards have responsibilities relating to ordinary watercourses and these are the subject of some Agency concern in critical areas.

During an emergency, static Agency Flood Defence resources can be supplemented by using Agency pumps or hiring special equipment. In the Autumn 2000 event, the North East Region hired three mobile pumps from Holland at an overall cost of around £400,000. Resources can also be requested from other Areas and Regions.

[27] Page19.

[28] Autumn 2000 Floods, Performance Review and Action Plan, Ridings Area, North East Region. January 2001. Page7.

[29] Ibid. page 5.

Sandbags.

The 'Lessons Learned. Autumn 2000 Floods' document states that the national usage of sandbags for that exceptional event was 2.5 million. The sources for this resource were Agency stores, commercial suppliers, local authorities and army stores. The report did not go into any further details. In the Ridings Area, North East Region, 32,000 sandbags were laid by the Environment Agency. The Ridings Area differentiated between those used for strategic flood defence purposes, 20,000, and those that were distributed to the public, 12,000. Local authorities in the Ridings Area supplied further sandbags but estimates were not available in the report. The Ridings Area also noted the use of hesco bastion defences, 570m and concrete blocks, 120m. In the more recent event of February 2002 in the Midlands region, 'approximately 400 sandbags were filled at Agency Depots'. No other record of sandbag usage is given. [30]

3.4.3 Usability, Reliability, Performance and Supportability

These attributes of the current business system have not been considered at this level of analysis. (Some references may have been made in the description of current business use case issues and opportunities.) These attributes would be best considered against selected business use cases. They would form an important part of the user statement of requirements for systems design and development for any business software that would support some elements of selected business processes. For future reference purposes they can be understood as relating to:

Usability. It would be advisable to determine the required time for a user to become marginally productive – able to accomplish simple tasks – and operationally productive – able to accomplish the normal tasks. Types of required user might be specified – 'beginners', 'normal' and 'power' users. Typical tasks should be identified and the measurable task times agreed. (These measurements might be influenced by other systems that users know and like.) Features like online help, user manuals, wizards and other forms of assistance should be agreed.

Reliability. These attributes usually specify the degree to which a system *must* behave in a user-acceptable fashion. They cover statements relating to system availability for operational use, system repair and resumption after failures and system accuracy.

Performance. These attributes usually cover transaction response times, throughput, capacity, CPU needs, memory, communication channel needs, disk storage, network bandwidth etc.

Supportability. The need for the software to be easily modified to accommodate enhancements and repairs needs to be explored and stated.

[30] Midlands Region. Review of February 2002 Floods. Severn Basin. April 2002, page 41. 400 seems a little low for a month long event which involved 124 Flood Warnings and 8 Severe Flood Warnings. However, what Midlands may be pointing out here is the supply and distribution of filled sandbags, a point raised in the 'Lessons Learned' report.

4. INTERNATIONAL GOOD PRACTICE

4.1 Purpose

The purpose of this section of the report is summarised below:

- To provide a description of best practice of some Flood Warning organisations other than the Environment Agency in the area of Flood Warning Management.

- To provide a description of the functionality of incident command and control systems used by other relevant organisations in the UK and identify its relevance to the Agency in its incident management role.

- To compare with Agency current practice and make recommendations for consideration for change as part of the FWMS project.

- To provide input for workshops as part of the FWMS project and to seed new ideas into discussions with workshop attendees.

- To inform the design of a new business process to be introduced alongside the FWMS.

4.2 Methodology

The methodology involved three stages:

(a) Literature review and web search identifying source material, relevant R&D work and potential contacts/organisations. Resources utilised include the Middlesex Flood Hazard Research Centre library and some information available from an earlier study.

(b) Identify potential organisations and contacts using the above literature review/web search, recent Agency/NFWC international contacts and Mott MacDonald international contacts (e.g. US office and Danish Hydraulic Institute).

(c) A structured interview/questionnaire (Appendix A) was then used focusing on how floods are managed in their country, how they judge the performance of their Flood Warning service and how and what data they gather to manage a flood incident effectively. Interviews with international organisations were conducted by telephone. Meetings were held with UK organisations to enable demonstration of the systems they employ.

4.2.1 Selection Criteria

The Business Use Case Analysis (ref 1.) indicated a greater need for generic incident management functionality. Consequently, the Project Board at their meeting of 24th July 2002 revised the scope from a study of wholly international good practice in flood management, to include a review of three UK emergency services in addition to five international flood management organisations.

The UK Emergency Services chosen were:

- The **Cheshire Fire and Rescue Service (CFRS)** as an identified source of potential good practice in command and control arrangements and systems.

- The **Metropolitan Police (Met)** because of their experience in managing large scale incidents.

- The **Maritime and Coastguard Agency (MCA)** were chosen as an organisation with structural similarities to the Environment Agency (i.e. a national Agency whose services are delivered through a number of operational Areas) and who manage a similar number of incidents (circa 10,000 per year).

Five countries were targeted for study:

- Australia

- Denmark

- Germany

- Netherlands

- USA.

The basis of this selection was that good practice of relevance to the Environment Agency was most likely to emanate from a developed nation and that there were known potential contacts and leads into these countries. Geographic and hydrological similarity was a secondary consideration of less relevance to this study. During the identification and selection of organisations firm contacts in Germany and Denmark were not forthcoming. A contact was however established, with the OSIRIS project, which served as an example of flood management arrangements in the participating countries of France, Germany and Poland.

4.2.2 Structured Interview/Questionnaire

The questionnaire (appendix A) used in the interviews is based around 6 subject areas:

- Flood warning roles and responsibilities (Who does what?)

- Communications (How is information shared?)

- Incident Management (How are decisions made and resources managed?)

- Data Collection (What data is collected and how is it collected?)

- Post Incident Performance Measurement (What is measured and how is it reported?)

- Future Proposals (Current and future Flood Management System proposals)

The questions also formed the basis for the interviews with UK emergency services although the emphasis was changed to suit the context.

4.3 Results

The results are presented under the same subject area headings as the questionnaire. The results of the UK emergency services interviews are presented first, in alphabetical order, followed by the international organisations also in alphabetical order by the country of origin.

4.3.1 Cheshire Fire and Rescue Service

Assistant Divisional Officer Mike Hillier and Senior Fire Control Operator Brian Litherland of Cheshire Fire Service (CFS) were interviewed in the Control Room at Fire Service Headquarters at Winsford on Friday 27th September. A live demonstration of the command and control system was used to explain the functionality of the system. The system is approximately 7 years old.

4.3.1.1 Flood Warning Roles and Responsibilities

Not applicable.

4.3.1.2 Communications

The CFRS deal with approximately 22,000 incidents per year. The majority of calls are received through the 999 service. All calls are routed through the control centre at Winsford. Call handling and resource deployment is managed in one process by the same operator. Incident details are recorded onto the system by an operator including caller details and incident location and type. The system automatically creates an incident number enabling tracking of the incident. If the call is from a public phone the location is automatically entered into the incident details. Caller Line Identification (CLI) is not currently used.

The System has no specific external communications capability (e.g. fax , email, SMS) but the incident details are automatically relayed to the responding crew for viewing in the response vehicle.

4.3.1.3 Incident management

After entry of the initial incident details the system will use the Parish in which the incident is located to generate a resource proposal based on the nearest available resource. The system maintains a database of resources including resource type and equipment details. This enables selection of the most appropriate resource for the incident type.

Some special procedures are stored on the system which prompt a standard response for a given incident type i.e. number and type of resources to be deployed to incidents at certain pre-defined sites (e.g. fire at an oil terminal at Ellesmere Port). The Hazard Management

System contains a database of the chemicals stored at COMAH registered sites which can be viewed in the responding vehicle.

During the response to an incident any major decisions and actions are relayed back to the control room via the radio system for logging onto the system.

The system does not include a mapping facility but does show a schematic of the fire stations and resources available for deployment. Different colours are used to represent the status of each resource on the schematic.

4.3.1.4 Data Collected During a Flood Event

Not applicable.

4.3.1.5 Post Incident Performance Measurement

CFRS have various response time targets to achieve based upon the type of incident and its location. The system logs incident response times which are used to report on achievement against the targets.

4.3.1.6 Future Proposals

The system is being continually developed and improved. A GIS Mapping facility is to be added within the next 12 to 18 months.

4.3.1.7 Relevance to the Environment Agency

There are many sound incident management principles featured within the CFRS system that are relevant to the Environment Agency. The system tracks an incident from its first report through to closure, it aids the selection of resources required to respond and it can provide relevant health and safety information about the hazards that may be encountered by responding staff.

4.3.2 Maritime and Coastguard Agency

Peter Dymond, Head of Search and Rescue was interviewed at the MCA Head Quarters in Southampton on Thursday 5th September. A live demonstration of the Incident Management System (IMS) was given at Lee on Solent The system is approximately 12 to 15 years old but has undergone several enhancements over this period. The old text based system has just been upgraded with the first phase of a new windows based system including GIS facility.

4.3.2.1 Flood Warning Roles and Responsibilities

Not applicable.

4.3.2.2 Communications

The MCA deals with approximately 10,000 incidents per year but do not frequently have to deal with intense volumes of public calls. The majority of calls are received either through the 999 service or via radio communications. All calls are routed through the nearest of 19 Operations Rooms located around the coast. Call handling and resource deployment is managed in one process by the same operator.

The system also assists with the creation and dissemination of Search and rescue situation reports (SITREPs) and Pollution Reports (POLREPs). The system produces a preformatted form for completion by the operator, which is then disseminated by the system via fax or telex.

The new incident management system allows remote access to incident information via the internet and intranet. This allows managers to view incident information directly either at their work desk or from home and so reduces the need for purpose written SITREPs or lengthy verbal telephone briefings.

4.3.2.3 Incident Management

Incident details are recorded onto the system by an operator including caller details and incident location and type. For example, a report of a Flare sighting is classified as an incident type and the operator is presented with a preformatted set of questions for that type of incident (tick boxes). Before closing down an incident a final incident type is given as this may have changed during the response to the incident. The system automatically creates an incident number enabling tracking of the incident. CLI and EISEC (Enhanced Information System for Emergencies) is used to identify the callers number and location automatically.

The operator selects the resources (e.g. helicopter, lifeboat, search and rescue team) required to respond to an incident and the system then automatically alerts the team using pager messages. During the response to an incident any major decisions and actions are relayed back to the control room via the radio system for logging onto the system.

The MCA have 12 helicopters, 231 RNLI lifeboats and 403 search and rescue teams at their disposal, these are referred to as “Declared Facilities”. In order to assist with the selection of appropriate resources to respond to a specific incident, a database of Declared Facilities is maintained on the system. Information held includes:

- Competencies of individuals and teams for particular tasks (e.g. cliff rescues, search teams).

- Operational performance characteristics of resources (e.g. helicopter search speed and range).

- Current status (e.g. assigned to an incident, standby or unavailable due to maintenance/repair).

In addition, a list of resources provided by other organisations (Additional Facilities) are also recorded on the system but without detailed competencies or resource characteristics.

The IMS is used to log when a resource has been deployed on an incident and so unavailable for other incidents. A check-in time may be specified which generates an alert message to the Watch Team (IMS operators) when contact has not been received from a resource within the allotted time (e.g. every 15minutes).

Other "decision support" systems of interest include SARIS (Search and Rescue Information System) which uses actual tide and current information to plan search and rescue operations (e.g. areas and lines of search based on resource performance statistics) and OSIS (Oil Spill Information System) which similarly helps to plot the path, location and speed of marine oil spills. These systems display actual tide and current data onto a GIS map background thereby assisting with decisions regarding search and rescue areas or oil spill land fall sites.

4.3.2.4 Data Collected During a Flood Event

Data is presented within the Operations room at Lee on Solent using magnetic wall maps and wipe boards, however the new IMS includes a mapping facility which may be viewed on a large screen or wall in the future. Counter pollution video and satellite images can also be transmitted into the operations room. This facility is being considered in future for Search and Rescue activities.

4.3.2.5 Post Incident Performance Measurement

Not Applicable.

4.3.2.6 Future Proposals

The old Action Data System (ADAS) is being replaced in three phases by a new Incident Management System (IMS). The first phase has been delivered which provides management information across the intranet and internet and also adds mapping and resource deployment facilities. The second phase will provide a Graphical User Interface to replace the existing text based system with more point and click technology and mapping facilities. The Third phase will be the full introduction of all the proposed functionality such as the ability of on scene personnel to view IMS via a Laptop and mobile phone.

There is a proposal to fit resources with "Automatic Identification Units" which transmits their position with a unique identifier. This will enable watch teams to view which resources are deployed and their current position using the GIS facility.

4.3.2.7 Relevance to the Environment Agency

Several parallels can be made between the MCA and the incident management needs of the Environment Agency:

- Similar number of incidents to manage.
- Basic incident management functionality (call handling and incident recording).

- Use of decision support tools (SARIS and OSIS), analogous to flood forecasting systems.
- An automatic message dissemination system, analogous to flood warning dissemination systems.

The IMS provides examples of how incident management needs can be met by:

- providing remote access to the system.
- standardising data entry and situation report forms.
- automating the call out of resources.
- maintaining an resource database, including competency and operational performance characteristics.
- Monitoring staff safety by use of check-in time alerts.

4.3.3 Metropolitan Police and NSPIS

Sgt Ian Grant and PC Janice Pinder of the Communication Users Support Unit, were interviewed at the Met's Tintagel House office in London on Monday 12th August 2002. A live demonstration of the Incident Management System (IMS) was given. The IMS is approximately 12 to 15 years old but has undergone several enhancements over this period. The system is likely to be replaced shortly with a command and control system called NSPIS (National Strategy for Police Information Systems). Met police officers were instrumental in the design of the NSPIS, so many of the incident management functions are similar to that employed by the Met's existing Command and Control System (CCS).

NSPIS is being made available to all forces to improve communication between each. The first NSPIS has been delivered to Cheshire Constabulary in September this year. A second interview was therefore held with the developers of NSPIS, Securicor Information Systems. A live demonstration of NSPIS was given by Bob Jones at the Agency's Stafford Office on Friday 27th September. The following summarises the basic functionality common to both systems and describes the enhancements available in NSPIS.

4.3.3.1 Flood Warning Roles and Responsibilities

Not applicable.

4.3.3.2 Communications

The Met deals with approximately 10,000 incidents per day (4 million per year). Public calls can come in one of three ways, 999 call, direct to the borough control room of by an attending officer over the radio. All calls are routed through the nearest Borough Operations Rooms. The Met is, however moving towards a more centralised call handling system with 3 control centres rather than one at each Borough. The call receipt and logging process is managed

separately to the deployment support process thereby preventing the delays in either call handling or response.

Each call creates its own incident record and number. NSPIS uses a gazetteer to accurately identify the incident location and associated data (beat, post code, grid reference). CLI and EISEC may also be used to identify the caller's number and location automatically.

The CCS has a common data interface with the London Ambulance Service control system so that the details of incidents requiring both organisations to attend are automatically shared with the other organisation.

NSPIS provides two types of standard messaging facilities. Operational messages are user generated and consist of a single subject line, free text and option to attach incident details. System messages are system generated such as notification of missed check in times. The System has an email and SMS messaging capability.

4.3.3.3 Incident Management

Once the mandatory location and incident type is entered by the operator the incident details can be made available to the resource dispatcher via the "issue" button. The dispatcher may then deploy resources whilst the operator obtains the remainder of the incident information.

After entry of the initial incident details the system uses the "beat area" in which the incident is located to generate a resource proposal based on the nearest available resource. The system maintains a database of resources including such details as name, rank, competencies and contact details. This enables selection of the most appropriate resource for the incident type. In support of this NSPIS includes a duty planning capability where planned tours of duty are maintained.

During incident entry, NSPIS checks the incident location and type against criteria for contingency plans. For example, a fight at a football ground may trigger a predefined riot control contingency plan with details of people to contact, locations of road blockades and resources to be deployed. The dispatcher can then implement the tasks, which is logged with the incident. A mapping reference may also be associated with a contingency plan, thus enabling the mapping system to display graphics relating to the incident (see figure 3.1).

The system provides an "Information Warehouse" as a store for documents such as aide memoirs and procedures relevant to control room staff.

Figure 4.1 NSPIS Contingency Plans

4.3.3.4 Data Collected During a Flood Event

Not Applicable.

4.3.3.5 Post Incident Performance Measurement

NSPIS contains a management information area specifically for the construction of textual and graphical reports of incident data.

4.3.3.6 Future Proposals

NSPIS went live in Cheshire during September and will shortly be delivered to Derbyshire to enable evaluation of the benefits to neighbouring forces of shared access to the same information.

4.3.3.7 Relevance to the Environment Agency

The difference in scale of the incident management task in terms of volume of incidents is two orders of magnitude greater for the Met than the Agency. Nevertheless the management of flood incidents represents a major peak in incident management workload for the Agency and some useful lessons can be learned from the Met and NSPIS:

- The separation of call logging and resource deployment processes may be appropriate at peak times.
- The use of mapping to view spatial data would help to manage resources.
- The duty planning function, to maintain details of roster and standby arrangements.

- Simple Messaging capability within the system to communicate important messages to staff involved in an incident and consequently not accessing their normal communications systems (e.g. Groupwise).

- An information warehouse for operational instructions and guidance.

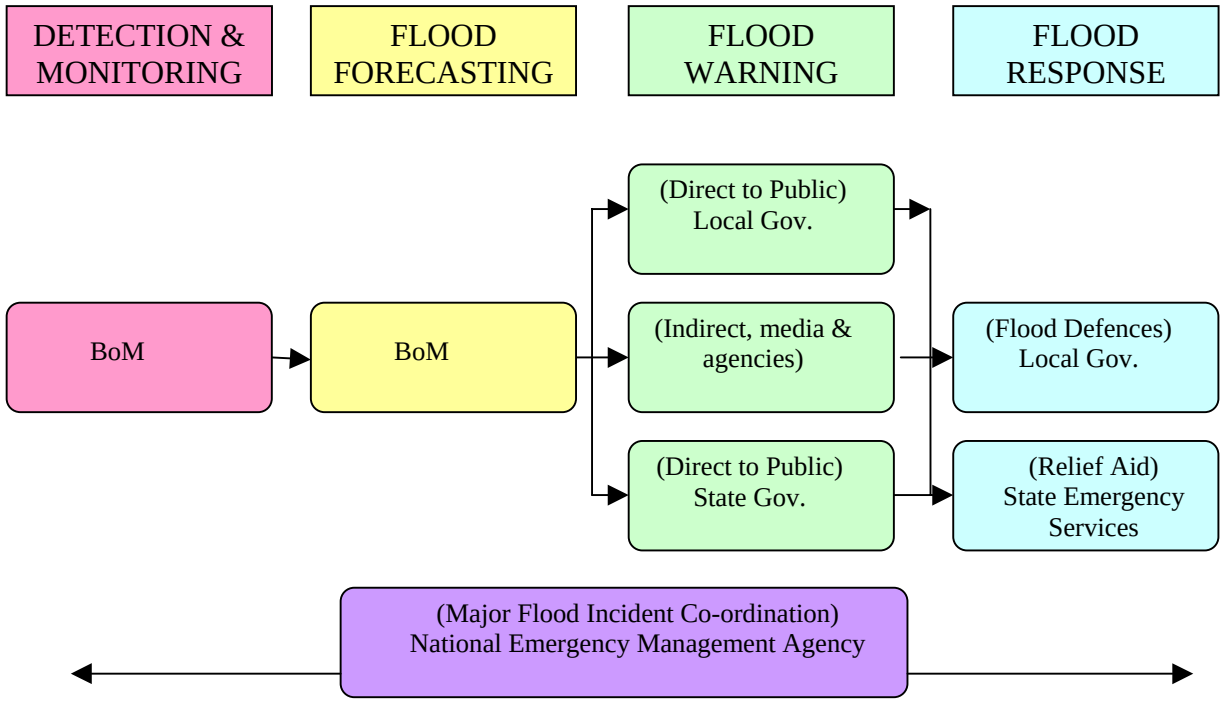
- Contingency planning to, for example, lead Flood Operations staff through predefined actions triggered by a river level; to lead a forecaster or warner through a complex forecasting/warning decision where several parameters may be relevant; to lead base controllers through specific procedures, such as actions upon declaring a major incident and inter-regional aid.

4.3.4 Australia - Bureau of Meteorology

Jim Elliot, Superintendent Hydrology of the Bureau of Meteorology (BoM), was interviewed on Wednesday 14th August 2002. The BoM work from seven Regional (state) offices. Each region has a Hydrological Services Section plus a Meteorological Services section. During a flood, Flood Warning Centres (FWCs) are set up adjacent to the meteorological forecasters. FWCs are operational rooms where all flood forecasts are made and warnings are issued. The BoM are in the process of implementing a new forecasting and warning system called FSEP (Forecasting Streamlining and Enhancement Project), see 3.4.6 for further details.

4.3.4.1 Flood Warning Roles and Responsibilities

The various agencies involved in the flood detection, forecasting, warning and response process are represented in the following schematic.



4.3.4.2 Communications

The BoM are primarily a provider of weather and related forecasting and warning services and, therefore, do not have to actively manage incidents nor manage large numbers of public calls during a flood.

The BoM does disseminate flood warnings using fax, pager, internet and the Telephone Weather Service (similar to the Agency's Recorded Message Service). The messages are created manually but the system automatically translates the message into different formats i.e. voice (for Telephone Weather service), fax and email. BoM provide information on flood levels and timing using the above methods to which State Emergency services add impact information.

The internet is also used to share forecast information (such as hydrographs) with other agencies. Web sites are password protected to prevent access by the public and hence risk misinterpretation. The BoM also operate a "weather by fax" service which is a payment service to receive a faxed map of the weather or warnings in the subscribers area.

One area of development in FSEP is the Tropical Cyclone Threat map, which shows the risk and forecast timing of the threat to areas of the coast. The product is web based and this type of approach may be extended for flooding.

4.3.4.3 Incident Management

Procedures recording the criteria for issuing flood warnings (e.g. location, trigger level and target lead time) are currently held in written documents called "Flood Warning Directives". It is proposed that these directives will be electronically stored and accessed using FSEP.

The Decision to issue a warning requires the agreement of the Senior Forecaster but is not currently recorded. Staff competencies, duty rosters and working hours are all locally managed.

4.3.4.4 Data Collected During a Flood Event

Information relating to flood damages (properties flooded, infrastructure affected etc.) is usually collected by the State or Local Government. Data collected by BoM tends to be focussed on technical performance i.e. the accuracy of the forecast, did it reach the forecast level at the forecast time and within the target lead-time? As a decision support method the Forecaster will compare forecast with actual river levels by plotting forecast levels onto observed hydrographs. This process may be automated within FSEP.

Wipe boards are used to display information targeted towards the use of the operational staff in Flood Warning Centres. Information displayed includes warnings in force, forecast levels, times to peak, time warning issued etc.

4.3.4.5 Post Incident Performance Measurement

BoM measure the technical aspects of forecast accuracy and lead time and occasionally jointly sponsor with other agencies the collection of warning recipient data (receipt of warnings and action taken etc.). The BoM have a performance indicator that is reported to parliament of "%age satisfied with the service". This has only recently been introduced and as yet there is not very much data upon which to judge performance. Example performance indicators are given in Appendix B.

A major function of FSEP will be an "automatic verification system" which should build up a time series of the performance of systems and individuals similar to meteorological service practice. E.g. records of actual temperature against forecast temperature. This sort of data can be used to determine specific performance targets.

4.3.4.6 Future Proposals

The proposed FSEP system should help to automate the production of forecasting products and aid the preparation of forecasts by presenting information in a way that helps absorption by the forecaster. The forecasts from the system will be used more directly to generate messages that are presented in formats that are more easily understood by the public. Dissemination will be by a separate system.

The system is in the early stages of development using Tropical Cyclone and Marine Forecasting services as prototypes for the rest of the system. These services should be operating by September/October 2002. It will be a further 12 months before the other services begin implementation. It is anticipated that the new system will require significant philosophical/cultural change in the organisation.

4.3.4.7 Relevance to the Environment Agency

As a provider of weather and related warning services the BoM is relevant to the "front end" processes of Detection, Forecasting and Warning rather than the Response process. A number of examples are of interest to the Agency:

- Automatic translation of text messages into several delivery formats (e.g. voice, fax and email).

- The sharing of forecast information with professional partners across the internet. The Tropical Cyclone Threat Map may provide a good example of how to present technical information to professionals and the public.

- The inclusion of an Automatic Verification System to measure performance and set targets is an approach that would be worth further research with a view to its use within flood forecasting systems. The system could be used to set targets at the local level to measure flood forecasting and warning performance against key parameters such as the forecasting of peak levels, lead times and threshold exceedance.

4.3.5 Netherlands

Information from the Netherlands came from three sources; an interview held on Friday 9th August 2002 with Judith Litjens, HIS Project Leader from the Ministry of transport, Public Works and Water Management (Road and Hydraulic Engineering Division); an interview held on Monday 30th September with Jaap-Jeroen Flikweert, Royal Haskoning GDH Project Leader; Questionnaire completed by Bart Parmet of the Rijkswaterstaat Dienst Weg en Waterbouw.

There are two relevant systems in use and currently under development in the Netherlands.

Netherlands Flood Management System (HIS)

HIS is a national Flood Management System available to Water Boards, Provinces and the Ministry. The main purpose of the system is to provide water managers with quick and accurate information on the condition of dykes, the effects of possible breaches and the safety of the public during a flood.

Automated Flood Contingency Plans (GDH)

The GDH (Geautomatiseerd Draaiboek Hoogwater) is a system designed to improve operational management of flood defences during periods of high water. The system is specifically designed for use by the Water Boards to automate operational procedures and contingency plans previously contained in manuals.

4.3.5.1 Flood Warning Roles and Responsibilities

The various agencies involved in the flood detection, forecasting, warning and response process are represented in the following schematic.

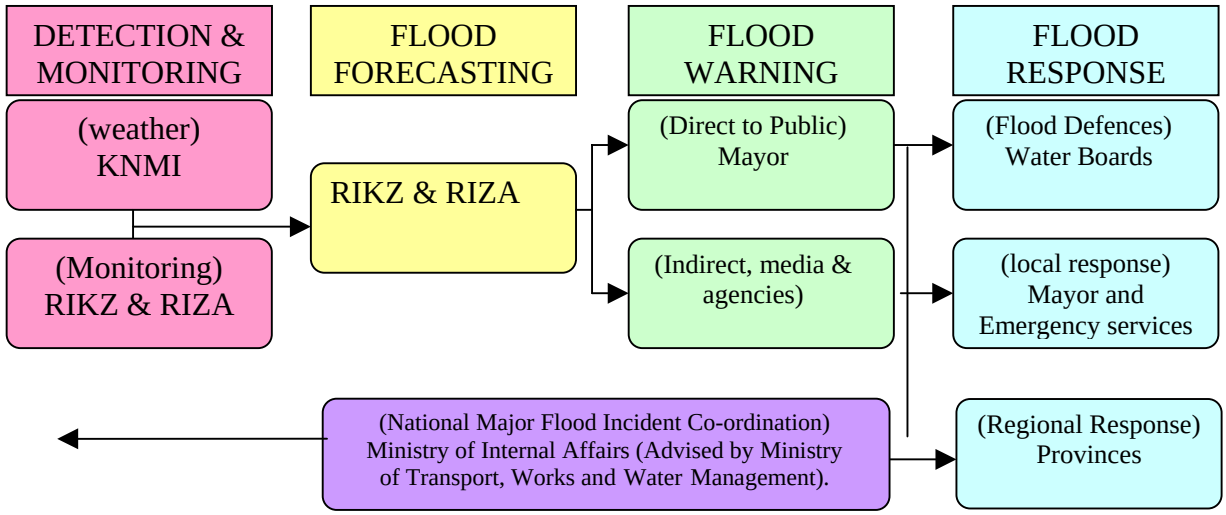
KNMI - Royal Dutch Meteorological Institute

RIKZ - Institute for Coastal Waters

RIZA - Institute for Inland Water Management and Waste Water Treatment

RIKZ and RIZA are advisory bodies for the Rijkswaterstaat (the Director-General for Public Works and Water Management).

During a flood Provincial Co-ordination Centres are activated (depending on the severity). In these centres, different government bodies (waterboards, Rijkswatestaat, communities, province) are represented, headed by the province. They issue warnings and organise evacuations. A National Coordination Centre (on ministry level) comes into action during particularly severe and widespread flood events. Co-ordination depends on the scale of the incident; locally by the Mayor, provincially by the “Commissaris der Koningin” (Queen’s representative) and nationally by the Minister of Internal affairs.



4.3.5.2 Communications

Flood warnings are issued mostly using indirect means such as the Internet, teletext, newspapers and radio. When Provincial Crisis Centres are operational, warnings may also be issued using vehicle mounted loudhailers or manually by phone (there is no equivalent system to the AVM). RIZA operate an Inland Water Information Centre which provides up-to-date information on flood levels, pollution and blockages of the rivers, estuaries and waterways.

There were no firm estimates of the number of public calls managed during floods but Inland Water Information Centre may handle up 1000 calls during a flood but that the Provincial Crisis Centres would receive many more. HIS is the primary means of presenting actual and forecast flood levels in relation to the dyke levels. The system is used to answer both public enquiries and for co-ordination of response in the Crisis Centres.

GDH fulfils a different purpose as a tool to assist the Water Boards with their operational duties regarding the flood defences. The system does, however incorporate communication technology to help with this task. For example, the system uses email, SMS or pager to contact operational staff to notify them that a flood gate (or similar) needs to be closed. The recipient must acknowledge receipt of the message or the system will try again until eventually alerting the Flood Manager that the communication has not been received.

GDH is installed and managed from the Water Boards operational/incident control rooms. Remote access is also possible across the internet (password protected). The Water Boards have access to both GDH and HIS which both use current and forecast river level data from RIZA forecasting and telemetry systems. GDH presents cross sectional data in tabular format, whereas HIS provides longitudinal level data in relation to dyke crest levels.

GDH generates simple situation reports summarising factual data such as information on water level and the current stage of the contingency plan that is in operation (see Figure 3.2). All of this data is generated automatically into a preformatted report to which other information can be added manually. These reports may be exported into other formats for onward dissemination (the system does not also disseminate the report). A GIS mapping facility is proposed which will in future allow maps to be included.

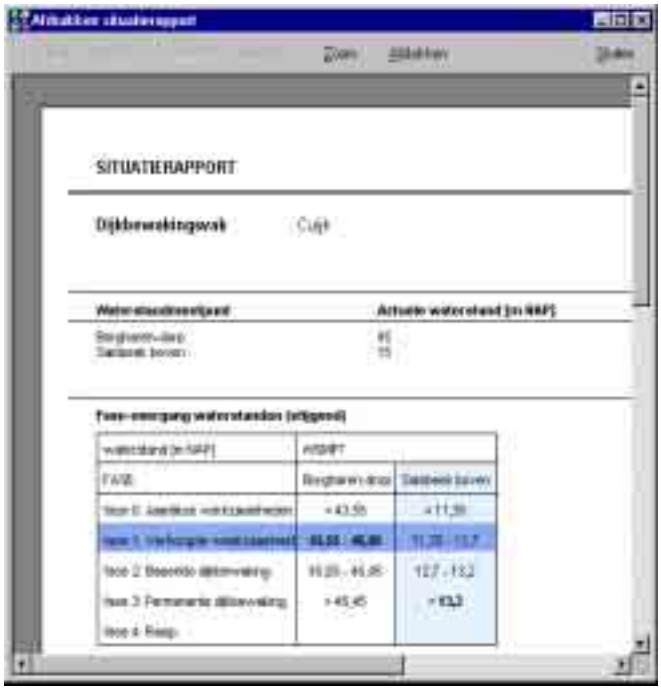


Figure 4.2 Sample GDH Situation Report

4.3.5.3 Incident Management

The master copy of the Water Board's flood procedures is recorded in operational handbooks. It is these handbooks that are used as the basis for the actions automated by the GDH system. As GDH develops, it is likely to become the master copy from which hard copies of the handbooks are produced as a contingency arrangement.

The GDH system receives water level or discharge data (either manually entered or automatically from RIZA forecasting systems) and, if a predefined trigger level is exceeded, the system gives a warning to the Flood Manager that the next stage should be started. The Flood Manager decides whether starting the next stage is appropriate and either acknowledges the alarm or proceeds to the next stage. A decision to proceed triggers a set of predefined actions, which appear on the screen, such as close a sluice gate or begin field inspection. Some actions have to be carried out by the Flood Manager himself, others are 'automatic' (e.g. contacting operational staff to complete a specific action).

The system also provides an incident management logging and recording ability. GDH is used to record and monitor operational incidents, from reports of minor defence defects to major incidents. GDH automatically logs the system's own actions, actions by the Flood Manager and actions completed by operational field teams. For specific types and locations of major incidents, existing contingency plans have been entered onto the system to lead the Flood Manager through a set of pre-defined actions.

To facilitate automatic communication with operational staff, GDH includes a database of people who are responsible for specific actions and when they are on duty to perform those actions. A Specific duty planning capability is proposed. This will allow the operator to enter

the length of each shift, the start time and then link people to each shift. It is not currently proposed to use the system to automatically contact and inform people of their assigned shift.

GDH also maintains a database of contact details of local contractors who are contracted to provide pumps and other equipment. The system is not used to monitor the deployment of the Water Board's equipment.

HIS is more specifically used to aid the co-ordination of the flood response of all the participating Agencies at the crisis centres. The system is in two parts, an operational part for monitoring flood levels and logging incidents, and a policy planning part which shows the impact of dyke breaches and overtopping events.

The operational part was implemented over 12 months ago and comprises the following modules:

- *Monitoring Module*, this module gives quick access to detailed, geographically based information on measured and anticipated water levels, data on flood defences and flood conditions in the river.

- *Logbook module*, this module is designed to ensure a single, clear record of reports received from co-ordination centres during flood events.

The policy planning part is currently under development and is not intended for operational use during a flood. The policy planning part comprises the following modules:

- *Flooding Module*, this module gives information on the effects of a dyke breach; the time it will take to fill the polder (defended area), waterflow patterns and the anticipated maximum water level within the polder.

- *Damage Module*, this module gives an impression of the anticipated effects of a dyke breach in terms of the number of victims, damage to buildings and infrastructure, economic and environmental damage etc.

4.3.5.4 Data Collected During a Flood Event

Several organisations collect flood damage data during a flood, including insurance companies. The policy and planning part of HIS will provide information on the anticipated impact of dyke breaches.

Computer displays and large presentation screens are used to display flood information including HIS within the Inland Water Information Centre and GDH within Water Board incident rooms.

4.3.5.5 Post Incident Performance Measurement

Limited information was discovered regarding flood performance measures other than that the quality (accuracy and timeliness) of flood forecasts and of advice given regarding dyke strength are used as indicators of performance.

For flood forecasting purposes, all floods above the first alarm level require a post event report. Flood management arrangements are included within flood reports after significant flood events when the crisis-centres have been operational. Both the 1993 and 1995 floods are very well documented. The logging modules of both HIS and GDH are expected to assist in the production of post event reports in the future, as well as the ability of the systems to produce nationally consistent graphs and maps.

4.3.5.6 Future Proposals

Initial phases of both HIS and GDH have been delivered and operational for over 12 months. Further phases of development are in progress including a GIS mapping facility for GDH and a programme of dyke breach modelling to support the policy planning part of HIS. HIS and GDH are currently separate systems but there are plans to join them into one multi-functional system.

GDH is currently used on the main rivers and estuary areas only but it is likely to be further developed for use in local rainfall events and for sea dykes.

4.3.5.7 Relevance to the Environment Agency

Although the nature of the flood risk in the Netherlands is very different to the UK, there are a number of similarities in the organisational arrangements for flood incident management that are relevant to the Environment Agency. For example, the Water Boards are responsible for the maintenance and operation of the nations flood defences, a role similar to that of the Agency. The incident management arrangements are co-ordinated through crisis centres similar to the tactical and strategic control centres adopted in the UK. This has meant that the Dutch have developed the GDH and HIS systems to support these arrangements.

Several of the functions of GDH are of relevance to the Agency in its operational role during a flood:

- Automation of operational procedures, contingency plans, communications and situation reporting.
- Incident logging and recording.
- Database of human resources linked to pre-defined actions and proposed duty planning functionality.
- Improved and consistent post event reporting.

HIS is relevant to the Agency in it’s advisory capacity to partner organisations during a major flood:

- Presentation in a consistent format of observed and forecast river level data linked to information on the condition and crest heights of flood defences.

- Direct access to HIS within crisis centres to aid the co-ordination of the response of all participating organisations and so that it can be used to answer public enquires as well as.

- An incident logging and recording facility for use within crisis centres leading to improved and consistent post event reporting.

- Policy planning module to help with contingency planning for worst case scenarios, such as defence failure by breaching or overtopping.

4.3.6 France, Germany, Poland – the OSIRIS project

OSIRIS (Operational Solutions for the Management of Risks in the Information Society) is a European Union funded project involving France, Germany and Poland. The project objectives, approach and expected results are contained in Appendix C. The following summary is based upon an interview with the OSIRIS Project Leader, Dr Marc Erlich held on 23rd September 2002, the demonstration sites available on the project web site and the project report, "Synthesis of Information Needs and OSIRIS Project Policy and Strategy."

The project is being piloted at three sites:

- The middle part of the Loire Valley, France.

- Part of the Oder basin at Frankfurt, Germany.

- Part of the Oder basin at Klodzko County, Poland.

The systems went operational in September 2002 and the evaluation of the first results is expected in October 2002. There are however, 5 demonstrators/mock ups available to view on the project web site (http://www.ist-osiris.org/). The following is a brief summary of the functionality of each demonstrator:

- Loire 1 - Displays forecast and observed river levels at specific sites. Users access the data that they require (passive mode) or can customise the information required so that it automatically alerts the user at the required level (active).

- Loire 2 – A decision support tool where the Mayor has responsibility for all decision making during a flood crisis but has no technical support. The system displays observed and forecast river level information as well as maps showing assets that are at risk and inundation zones generated from flood forecasts.

- Frankfurt - This is designed to meet the urgent needs of local municipalities that have no access to monitoring and forecasting systems but are responsible for decision making during flood crises e.g. evacuations. The system acts as a "Clever Collector" to fuse together data from different sources and in different formats.

- Klodzko 1 – This is a Web Site for use as an educational resource providing flood risk information and advice and is aimed at the public, the media and also to help train crisis managers. The site may be used interactively to collect public survey information e.g. Do you have an evacuation plan?

- Klodzko 2 - This system is a decision support tool for use in fast reacting catchments where lead times are 2 to 4 hours. It displays observed and forecast river levels, weather reports, radar images and flood maps. It provides a warning dissemination system using voice, fax, email and SMS.

4.3.6.1 Flood Warning Roles and Responsibilities

The following is a summary for each country of the organisations involved in the flood detection, forecasting, warning and response process:

In France, detection, monitoring, forecasting and warning services are provided by the Ministry of the Environment and operation of flood defences and emergency response is the responsibility of Local Government through the office of the Mayor.

In Germany, the Landes (Regional Government) provide Regional Flood Forecasting Centres. Local Municipalities (e.g. Frankfurt) are however responsible for emergency response and the fire brigade plays a central and co-ordinating role in disaster management (e.g. floods of 1997). Cross boundary issues between Landes and over National borders complicate the process.

In Poland, the County Crisis Intervention Staff take a co-ordination role and provide flood detection, monitoring, warning and emergency response services. Based on the information provided by the County, the Fire Brigade organises evacuations and the Police disseminate warnings to the public. Flood defences are maintained and operated by a Regional Drainage and Water Management Facilities Board.

4.3.6.2 Communications

In France, an agency that issues flood warnings is then considered liable for the result of actions taken using that information. If however, the warning recipient requests the warning and defines the criteria for receipt of the warning (e.g. river level threshold) then they accept the liability for use of that information. The Loire 1 demonstrator is a web-based product designed to overcome this issue in two ways. Users access the data that they require (passive mode) or can customise the information required so that an automatic warning message is sent triggered at a user defined river level (active). The user may also access the system via a mobile phone using WAP and text to voice technology.

The Klodzko 2 demonstrator combines forecasting, warning dissemination and emergency response functionality within one system to assist and speed up the decision making process in fast reacting catchments (see figure 3.3). Voice, fax, email and SMS messages are all used to disseminate warnings.

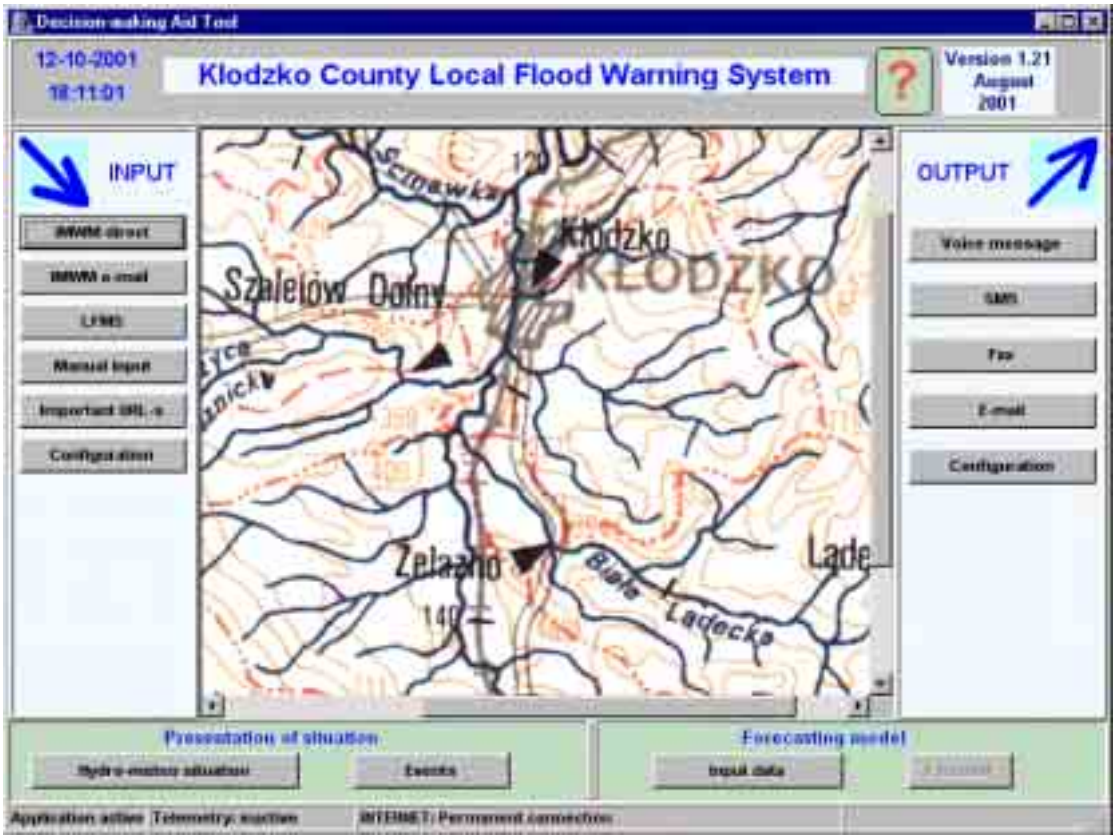


Figure 4.3 OSIRIS Klodzko 2 Demonstrator – combined forecasting warning and dissemination system

4.3.6.3 Incident Management

Loire 2 combines forecast river level with detailed topographic survey information to map inundation zones. This information is then used by the Mayor to aid emergency response decisions regarding evacuation and identify assets and infrastructure at risk.

The Frankfurt demonstrator acts as a “Clever Collector” to gather together weather reports, radar images, observed and forecast river level data. This provides a simple and cost-effective decision support tool for agencies previously without access to such information.

The Frankfurt demonstrator also provides a data repository for relevant background information, such as procedures for operational units, major flood contingency plans, historic flood information, post event reports, videos and database of stakeholder contacts.

The Klodzko 2 demonstrator provides a basic flood warning decision support tool leading the operator through the conditions that may trigger a flood event in a specific location and through to the action required, such as issuing a warning (see figure 3.4). The system also stores flood outlines from past events or model analysis.

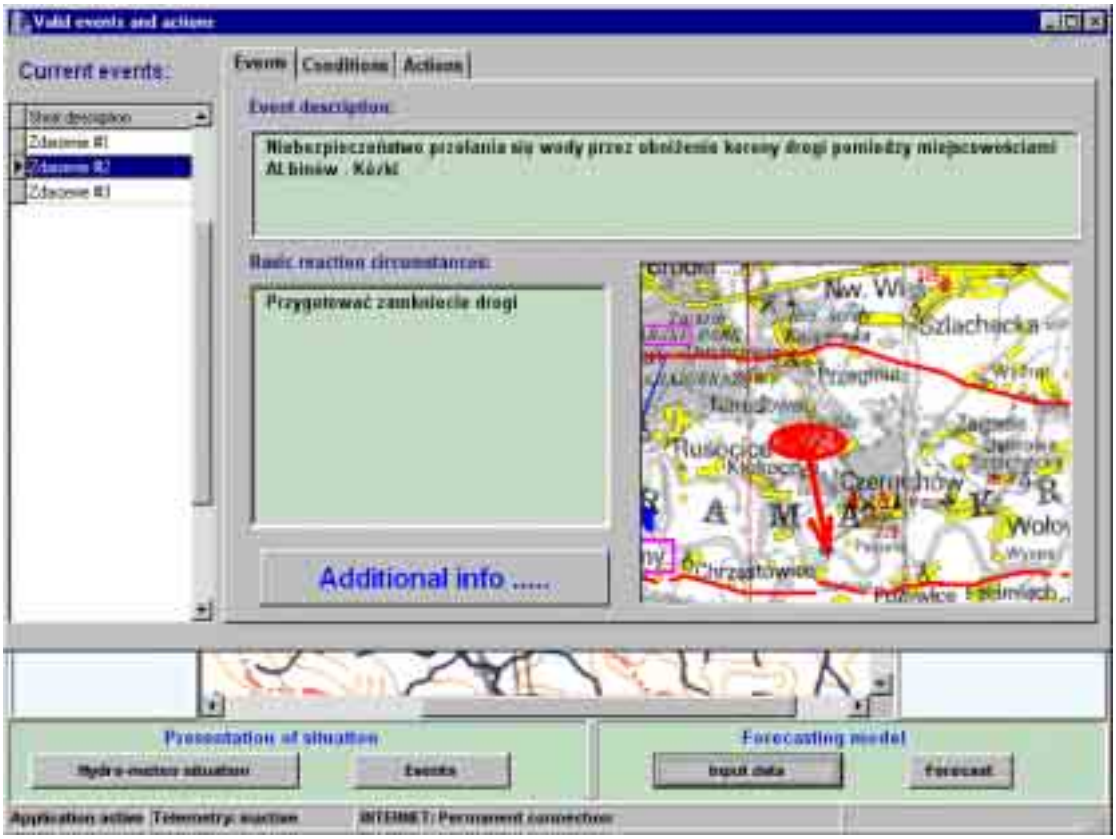


Figure 4.4 OSIRIS Klodzko 2 Demonstrator – Local Level Decision Support Tool

4.3.6.4 Data Collected During a Flood Event

No information was available regarding the methods of data collection employed in the different participating countries. The need to collect actual and forecast impact information was consistently identified in all countries, such as the number of properties flooded, transport links flooded and utility services affected.

4.3.6.5 Post Incident Performance Measurement

No information was available regarding performance measurement. The interactive collection of public survey information using the web site in the Klodzko 1 demonstrator is an innovative approach that could be applied to the post flood collection of relevant data to help to measure the performance of the flood forecasting/warning service (e.g. target warning lead times, number receiving advance warning, number taking effective action?).

4.3.6.6 Future Proposals

Some systems have been operational since September and first evaluations should be available in October on the web site. The full evaluation will take 4 months with 2 months to produce a summary report. A workshop is proposed in Berlin on March 20/21st 2003.

4.3.6.7 Relevance to the Environment Agency

The various demonstrators provide several examples of relevance to the Environment Agency:

- Innovative use of web based solutions to:
  - provide wider access to forecast and observed river level information for both professional partners and the public.
  - Allow users to interactively define their own warning requirements and feedback on the service provided.
  - Act as a “clever collector” and data repository of flood related information.
- Klodzko 2, as an example a flood warning decision support tool that combines forecast data with trigger criteria and warning dissemination capability within one system.
- Loire 2, as an example of a system that takes flood forecast information and converts it into inundation maps for use by the emergency response agencies.

4.3.7 USA

Information from the USA comes from several sources including an interview with John Gardner (consultant and Director of WaterCycle Inc.), correspondence with Killam (Mott MacDonald US subsidiary), correspondence with Ken Crawford (Oklahoma University/Oklahoma Climatological Survey (OCS)) regarding the OK-FIRST (**OK**lahoma's **F**irst-response **I**nformation **R**esource **S**ystem using **T**elecommunications) and ONALERT (**O**bservations **N**ecessary for **A**iding **L**ocal **E**mergency **R**esponse via **T**elecommunications) initiatives.

4.3.7.1 Flood Warning Roles and Responsibilities

The various agencies involved in the flood detection, forecasting, warning and response process are represented in the following schematic.

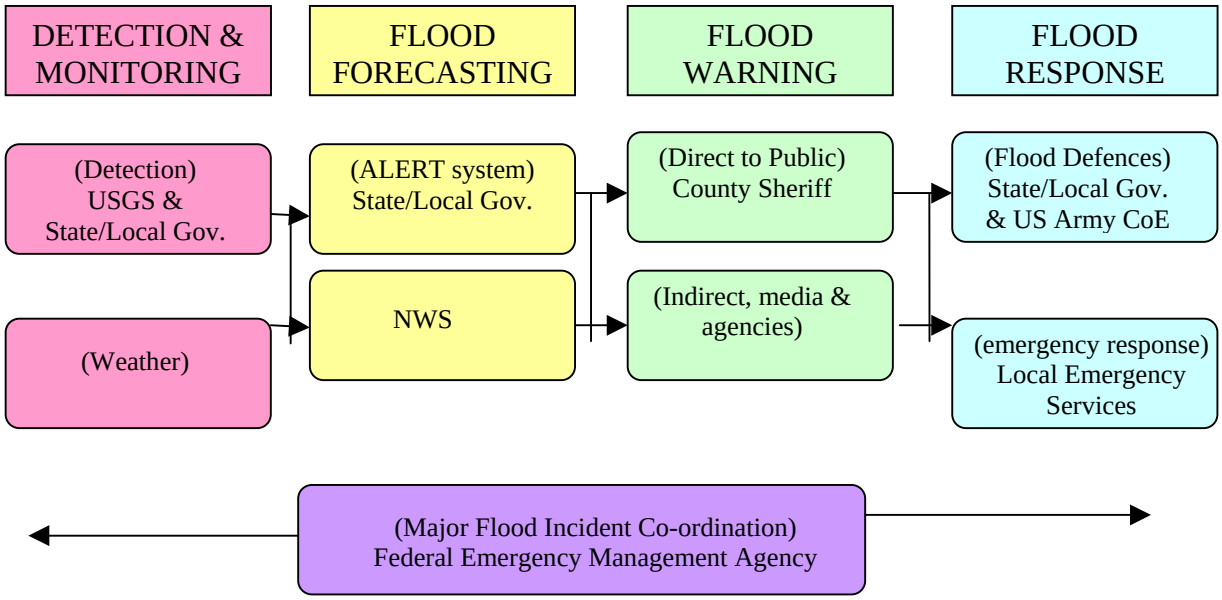
NWS – National Weather Service

USGS – United States Geological Survey

US Army CoE – US Army Corp. of Engineers

FEMA – Federal Emergency Management Agency

ALERT - Automated Local Evaluation in Real Time



4.3.7.2 Communications

The internet is widely used to provide access for local emergency managers to weather and flood information such as radar images, warnings in force and river data. For example, the National Weather Services Hydrologic Information Centre (http://www.nws.noaa.gov/oh/hic/) provides information on the current flooding situation and access to a large archive of historic flood data.

4.3.7.3 Incident Management

OK-FIRST (http://okfirst.ocs.ou.edu/) is an initiative by the OCS to improve access to current weather information and to develop a decision-support system for the state's public safety (fire, police and emergency management) agencies. The system has won an award as an 'innovative program in American government'. ONALERT (http://onalert.ocs.ou.edu/) is a multi-agency effort bringing together the expertise of the National Weather Service (NWS), the Oklahoma Climatological Survey (OCS) and NOAA's Forecast Systems Laboratory (FSL) in the areas of analysis, forecast and warning generation, and adaptation of critical forecast information for efficient and appropriate use by emergency management personnel.

4.3.7.4 Data Collected During a Flood Event

Local emergency management agencies widely use the ALERT system to monitor local flood conditions. ALERT is an acronym for Automated Local Evaluation in Real Time, which is a method of using remote sensors in the field to transmit environmental data to a central computer in real time. (http://www.alertsystems.org/)

4.3.7.5 Post Incident Performance Measurement

The NWS conducts Service Assessments to evaluate performance for catastrophic weather events. Service assessments are performed when one or more of the following criteria are met:

- a major economic impact on a large area or population
- multiple fatalities or numerous serious injuries
- an unusually high level of public or media interest

Assessment teams, composed of experts within and outside the NWS, produce reports that:

- explain what happened
- detail NWS actions before, during, and after the event
- recommend changes in NWS policy, procedures, products, and/or services to improve performance and emulate best practice.

Example Service Assessments are posted on the NWS Office of hydrologic development website (http://www.nws.noaa.gov/oh/).

4.3.7.6 Future Proposals

Because of the number of organisations involved in food incident management at national, state and local levels there are many different and competing products in development. For example, the USGS Centre for Integration of Natural Disaster Information are developing “An integrated Flood Warning and Assessment System to Enhance Decision Making During Hazardous Rainfall and Flood Events”(IFWAS) for use in Puerto Rica. IFWAS is an advanced flood warning system that compiles and evaluates available, near-real-time hydrologic and meteorological data and that makes this information available in a usable format to a number of local and federal organisations responsible for flood emergency preparedness and response.

4.3.7.7 Relevance to the Environment Agency

Examples of relevance to the Agency from the USA include:

- OKFIRST/ONALERT initiative as a project that provides access to weather related information for all emergency response agencies in order to aid decision making. In addition, the resource is used to provide training for the users in interpretation of the data and use of the system. The system is also used as an educational resource for local schools.
- ALERT systems as a cheap and effective system to provide local flood related data and warnings.

NWS services, products and service assessments have many similarities with flood forecasting and warning services provided by the Agency.

4.3.8 Other Relevant Research Results

In the course of undertaking the literature review and web search a wealth of other relevant literature and web pages were discovered. Detailed description of all of these sources of information is not warranted within this report but a listing is provided in Appendix D.

4.4 Comparison with Agency Practice

The proposed functionality of the FWMS is shown in the schematic contained in Appendix E. Table 1 compares, for each of the proposed FWMS function headings, Agency current practice with that found in other organisations and countries.

TABLE 1. COMPARISON OF CURRENT AGENCY CURRENT PRACTICE WITH ALTERNATIVE GOOD PRACTICE EXAMPLES.

FWMS Function	Current Agency Practice	Alternative Good Practice Examples
Issue Warnings	Current AVM - voice, pager, fax and posts warnings in force onto the Agency web site. Proposed Multi-media Dissemination System – as above plus email, SMS text to voice technology and improved functionality.	• OSIRIS Klodzko 2, one system combines displays all the data and issue criteria needed to make a warning decision and issue the warning. • OSIRIS Loire 1, the recipient can customise the warning and use WAP technology to access information. • Australian BoM's proposed FSEP
Maintain Current and Forecast Conditions	Various telemetry and forecasting systems but migrating towards a single national telemetry system and FFMS.	• Australian BoM's tropical cyclone threat map. • Netherlands HIS system linked to data on flood defences.. • Netherlands GDH system displaying the current stage of the flood. • OSIRIS Loire 1, 2 and Klodzko 2 demonstrators • MCA decision support tools (SARIS and OSIS). • OKFIRST/ONALERT integration of data within one system.
Generate reports	Manually intensive Word processed.	• GDH standard reports with some manual input. • MCA preformatted forms and automatic dissemination.
Rostering and Resource Deployment	Duty plan arrangements are decided at the local level and are recorded and disseminated as a word processed document	• GDH resource database, duty planning and automatic deployment. • MCA, resource database and automatic deployment.

TABLE 1. COMPARISON OF CURRENT AGENCY CURRENT PRACTICE WITH ALTERNATIVE GOOD PRACTICE EXAMPLES.		
FWMS Function	**Current Agency Practice**	**Alternative Good Practice Examples**
	in a variety of different formats.	• NSPIS resource database and duty planning.
Operational procedures/ workflow	Local procedures are maintained in document controlled manuals. National procedures and guidelines are published on the Agency Intranet.	• GDH uses stages and contingency plans to trigger automated communications and prompt actions by the user. • NSPIS contingency plans functionality with graphical representation.
Logging and Archiving	The National Incident Recording System (NIRS2) is used to keep a record of incidents rather than a live log of actions during an incident. Actions and decisions are recorded on hand written log sheets.	• GDH • HIS • NSPIS • MCA • CFRS All of the above log automated actions and accept user entry.
Rec./M'tain Field Data	Wipe boards and media. NIRS2 records verbal field reports.	MCA have the ability to view counter pollution video and satellite images in the operations room

4.4.1 Ancillary functions

There are a number of examples found that are relevant to the ancillary functions identified outside the FWMS core functions.

4.4.1.1 Post event Analysis

Post event analysis may be improved by:

- logging and recording functions
- The FSEP's Automatic Verification System to measure performance and set targets is an approach that would be worth further research.
- OSIRIS Klodzko 1's use of interactive web site surveys to gather public opinion data on the performance of the flood warning system (including their own actions).

4.4.1.2 Maps/GIS Information ex NFCDD

The exclusion of NFCDD data on the condition of defences and assets is contrary to the approach adopted by HIS, which primary function is to relate observed and forecast level data

to flood defence condition and height. In addition, the HIS policy planning module may be used to help develop contingency plans for worst case scenarios, such as defence failure by breaching or overtopping. This is an example of how the kind of data to be stored on NFCDD may be used during an incident and in the preparation for major incidents.

4.4.1.3 Control Centres

A common issue raised from UK flood incidents and flood exercise debriefs is that of co-ordination and communication between Agencies. For example, Appendix F contains a summary of the lessons learned from a recent major flood exercise in Derbyshire, including the need to improve co-ordination, liaison and communication. A recurring feature of many of the overseas practices (HIS, all OSIRIS demonstrators, OKFIRST/ONALERT) is to provide a system to share information with partner organisations, either a purpose made system or a web based solution. The OKFIRST project goes as far as to provide training material and exercises.

4.4.1.4 Call Handling and Incident Recording.

The Agencies existing NIRS2 system provides incident recording functionality. Some regions have developed call handling databases including “answers to frequently asked questions” and “call logging” functionality. The Agency’s experience of handling large volumes of calls during major floods has led to the development of such local solutions and is a clear indication that there is a business need for call handling and recording functionality. It is interesting to note that call handling did not feature strongly as a function of the international flood specific systems but is by necessity dominant within the emergency services systems.

4.4.1.5 Personnel/skills Information

Agency incident managers largely rely on their own knowledge of their team’s skills and competencies during incidents. During major incidents however, the system breaks down because of the number of people that get involved. Consequently, some regions have developed formal databases recording staff incident management skills and competencies. The GDH, MCA and NSPIS systems all included information on skills and competencies to aid with deployment.

4.5 Recommendations

The following recommendations arise from this study:

1. An incident management system is required to support Agency incident room staff and aid interaction between the Agency, their professional partners and the public.

2. The examples of good practice recorded within this report are used to inform the specification of the proposed FWMS as well as the design of the new business process to be introduced alongside the FWMS.

3. That consideration be given to the widening of the Business Use Case analysis to consider the needs not only of the Agency but of it's professional partners and the public, as exemplified by the OSIRIS project approach.

4. That links and synergies with the Agency's "Strategy for Managing Incidents in the Future" are explored and identified.

5. That the Project Team seek a demonstration of the Netherlands GDH and HIS systems.

6. That the Project Team seek to learn lessons from the OSIRIS project evaluation results. A free workshop is planned in Berlin during March.

7. That the proposed FWMS is introduced in stages, as exemplified by other projects, and is considered in the context of an overall strategy for flood detection, forecasting, warning and response systems.

4.6 Conclusions

Flood Warning: An Australian Guide (Emergency Management Australia, 1995 3-5) introduces the concept of a "total flood warning system" with the following definition:

> "A total flood warning system integrates flood prediction, the assessment of likely flood effects, the dissemination of warning information, the response of agencies and the public in the threatened community, and review and improvement. These components must operate together for sound flood warning performance to be achieved."

The Agency would benefit from the use of an Agency wide standard Incident Management System. The key advantage, as shown by the examples of good practice identified within this report, will be that such a system will enable the Agency to produce a clear and consistent message to its own staff, the general public, professional partners and the media. Further benefits can be expected in the areas of risk reduction and accelerated post event report production.

The proposed Flood Warning Management System (FWMS) will need to act in harmony with the Agency's Flood Forecasting Modelling System (FFMS) and Multi-media Dissemination System to achieve a "total flood warning system".

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

The following section considers the current overall Environment Agency situation in relation to incident management. It recommends a way forward on the basis of a Flood Warning Incident Management System (FWIMS), the development of which will provide the components of a strategic business system solution.

5.1.1 Generic Business Drivers

The Agency's management of incidents is critical to our reputation and is recognised as one of our key risks, both in terms of our ability to forecast events as well as our ability to manage and respond to them. Mitigation of this risk requires the support of Agency staff during large incidents, particularly within the Incident Management domain.

A number of underlying business drivers necessitate action in this area:

1. The need to meet the Agency's statutory duties, powers, responsibilities and commitments in relation to incident management.

2. A number of Health and Safety factors that must be considered during prolonged incidents, including EU Working Time Directives, Lone Worker Legislation and Employer's liability for foreseeable stress in the workplace.

3. The need to use staff resources more effectively.

4. Raised public expectations. Recent major incidents such as the autumn 2000 floods, foot and mouth disease and the events of September 11th 2001 have raised public expectations of all organisations with a role to play in such events.

5. An increase in litigious behaviour within the UK, and the rise of the "compensation culture". The Agency must be able to demonstrate diligence in areas covered by its statutory duties.

6. Incidents are currently managed using paper-based systems and procedures. This creates inherent difficulties for decision support, provision of information, performance measurement, resource deployment and tracking.

7. The Agency's reputation is at stake. There is a need to show that events can be managed well and professionally.

5.1.2 FWIMS Objectives

To address the overall needs of the business a number of systems options and developments could be considered, including those driven by the needs of specific incident types or regional aspirations. This approach requires duplication of effort and risks the over-emphasis of

support for the exceptional and local as against the standard and national. The objective of FWIMS is to build a single system based on nationally agreed Agency processes.

The Agency has created strategies, policies, processes and procedures that assist staff in the delivery of a professional incident management service. Support systems are sparse however, and this Business Case considers the development of a national solution to support Flood Incident Management processes.

The objective of FWIMS is to develop a standard platform upon which the particular business processes associated with major flood incidents can be integrated with the appropriate IT components and local business information.

5.1.3 FWIMS Scope

Generic business processes have been developed by the Agency for the management of any form of major incident and it is these processes and their further improvement that FWIMS will support. However, due to the size, duration and resource requirements of major Flood Events (as compared to other incident types), benefits will be maximised by provision of support for Flood Events only in the first instance.

It is intended that FWIMS will ultimately be the operational platform for the management of all major flood incidents. Information collected and used during minor incidents will be available to FWIMS users via an interface to NIRS2.

It is envisaged that future developments will build upon FWIMS components to provide other incident-specific components (e.g. incorporation of air dispersion models for airborne pollution and nuclear incidents, “Time of Travel models” for Water pollution incidents etc.). These will be overlaid upon the FWIMS components, will be subject to their own financial justification, and are thus out of scope for FWIMS.

5.2 Flood Incident Business Objectives

The following section considers the specific business objectives and benefits of change in developing an initial solution for flood incident management.

5.2.1 Business Drivers

As stated previously, the Agency’s management of incidents is critical to our reputation and is recognised as one of our key risks, both in terms of our ability to forecast events as well as our ability to manage and respond to them. This was demonstrated during the severe floods of autumn 2000. Although the Agency has subsequently implemented a number of recommendations as a result, there continue to be business drivers that must be considered when planning any further improvements to this area. These can be summarised as:

1. The Agency’s target of extending Flood Warning coverage to 75% of the population living in flood plains (coupled with planned better targeting of Flood Warning Areas), will increase the number of current Flood Warning Areas by a factor of between 3 and 5 by 2007.

2. Current Flood Warning Targets set by DEFRA are not being met – nationally the Agency is 30% below target [0].

3. The number of points where flood forecasts are made is set to treble by 2005 and quadruple by 2012.

4. Improved telemetry systems alone will increase the number of alarms to be dealt with by 20% before the end of 2005, however the factors mentioned above will raise this further by a factor of between 3 and 5 by 2010.

5. Strained and at times inadequate communications continue to be a recurring theme for current major flood incident management and have the potential for tragic consequences during an incident [0].

6. There is overload in incident rooms during large flood events, with attendant stress for Flood Incident Room and Warning staff. Overload has the potential for harming the health and safety of Agency staff and producing occasional serious mistakes.

7. There is a pressing business need for tools and solutions to enable EA staff to manage big flood events more effectively; recent experiences underline this, against a background of flooding becoming more frequent and more intensive [0].

8. The Agency's own publicity endeavours (e.g. recent Flood Awareness Campaigns) have undoubtedly raised public expectation of the Agency further and provoked a general interest in flood related matters.

9. The Agency's stated objectives relating to planning policy for sustainable urban drainage systems and the design of new properties and Government has mainly accepted re-developments in flood risk locations. However, it remains likely that flood risk areas will continue to see new building projects that will potentially require both substantial flood defences and excellent flood incident responses from the Agency.

5.2.2 Management Objectives

Given the business drivers outlined above and the recent experience of major flood events, Flood Incident Management has general objectives and specific requirements that must be taken into account when considering the possible tools and solutions:

1. To ensure that the management of specific flood incidents reflects and is integrated with the Agency's management of river, seashore and flood plain as single systems.

2. To continue to limit risks associated with flooding.

3. To look for and implement efficiency savings in the management of flood incidents and so add to the maximisation of resources available for front line environmental improvements.

4. To operate in an effective and integrated way during flood incidents, whether seen from an Area, Region or National perspective.

5. To effectively disseminate best practice and lessons learned to all flood incident management practitioners to deliver continuous improvement.

6. To get things right first time, essential in some flood incidents with regards to flood forecasts, warnings and responses.

7. To keep flood incident management roles, responsibilities, communications and accountabilities as simple and clear as possible.

8. To develop transferable skills and expertise within flood incident management so as to be in a position to support other forms of incident management when required.

9. To develop national consistency within flood incident management processes, services and management information yet allow for specific local practice and needs where appropriate.

10. To ensure our flood incident management tools and systems are easy to use and reflect the needs of our customers and stakeholders.

5.2.3 Specific Business Requirements

In addition to the objectives described above, management of flood incidents has specific requirements that any proposed tools or solutions must satisfy. These can be stated as:

1. Flood Incident rooms need an integrated and accurate view of current and forecast conditions relevant to the flood incident they are responding to.

2. Available flood forecasts should relate to a range of different time intervals (rated by confidence level) and be linked to agreed and required actions to be taken where appropriate.

3. Differing views of the flood incident should be simultaneously available at an appropriate level of detail at Area, Region and National levels.

4. The impact of flood incident status reporting (e.g. Situation Reports) on those who are actively trying to manage the incident should be minimised. Time currently spent on information exchange would be better spent on active management and task completion.

5. Flood incident processes should provide intelligent decision support based on continuously measured and improved operational procedures.

6. Decision support should have a workflow capability for the efficient and effective communication and allocation of required tasks where needed.

7. Decision support requires access to maps that indicate Flood Warning Areas and their status, indicative flood plains, historical flood information, risk areas and properties, current/forecast meteorological conditions, and information relating to telemetry and alarms.

8. Resource scheduling, tracking, usage and reporting tools should all be available for flood incident management.

9. All communications and communication processes should be as robust and effective as possible. This is especially important for Flood Warning and Forecasting staff who may begin incident related work from home. It is also important when considering the delivery of vital information to Incident Rooms and the dissemination of information from Incident Rooms to EA staff and management, professional partners, stakeholders and the public.

10. Handling calls from the public should ensure that, wherever possible, only vital information necessary to the management of the flood incident is delivered to incident room staff. Requests for information should be handled outside the incident room.

11. Organisation-wide tools should support post-incident information gathering, analysis and dissemination of lessons learned. These tools should reduce current levels of effort, speed up the process and allow high visibility to the on-going effort of measuring and delivering flood incident management process improvements.

12. Agreed actions and plans associated with post-incident reviews should be reflected in changes across the organisation when they relate to issues of flood incident 'best-practice'. Tools that support the management of flood incidents will need to be flexible enough to accommodate a process of continuous improvement.

13. Flood incident management tools must be easy to use and capable of integration into incident training exercises for both internal training and alongside our professional partners.

5.3 Flood Incident Management – Recommendation

Achieving the objectives of flood incident management and meeting specific requirements related to changing current practice is a difficult challenge for all involved. Current trends also indicate that unless additional resources become available, it is unlikely that the Agency will be able to satisfy the demands placed upon it in future whilst ensuring the safety and well-being of its staff during major flood incidents.

This section recommends changes to current practice that will benefit the management of flood incidents and help the Agency meet the needs of its customers, stakeholders and partners.

5.3.1 Implement National Flood Incident Management Processes

Currently, the Generic Incident Management Process Overview provides a National Incident Management Process Framework. This supplies guidance to all levels of the organisation regarding the required general steps, roles, responsibilities, activities, success criteria and supporting documentation involved in the consistent management of incidents.

At a level below this framework are specific flood incident management business processes and business systems that deliver the service to customers, stakeholders, professional partners and the public in any specific Area and Region.

Many of these local processes and systems differ from region to region. Some differences have specific historical reasons (e.g. different telemetry systems), and process convergence may be difficult without large-scale infrastructure investment. Other differences relate to distinct local conditions (e.g. flood warnings automatically issued by sirens in very 'flashy' Flood Areas, which is inapplicable to other Areas).

There are however significant areas where procedural differences could be replaced by national standards. The development of a set of National Flood Incident Management Processes, with business rules and information standards defined, would deliver significant benefits for the Agency:

1. Consistent 'best practice' behaviour and service to our customers, stakeholders, professional partners and the public, will enhance the perception and reputation of the Agency in one of its key roles.

2. National Flood Incident Management processes will allow for national process ownership. One owner instead of many.

3. Consistent processes will allow for ongoing process improvements that can be led and implemented nationally by small teams of business experts.

4. Clearly defined national processes and management information that can be nationally compared and reviewed against desired outcomes can help identify 'best performers', focus resources and training where most needed, and provide quantifiable benchmarks for continued improvement.

5. Consistent national processes will create a single set of related templates for forms and system interfaces where consistency is vital. One set of templates to maintain instead of many.

6. Consistent national processes will reduce resource spent on training design. One set of national training for everyone but with the flexibility to embrace local information and needs.

7. Consistent national processes allow resources to be more mobile. Mobile resources can learn what to deliver for local need without first learning a new set of business processes.

8. Common information requirements and national standards will ease the process of enhancing or migrating existing systems to fit national process needs and supports the Convergence Theme.

The potential scope of National Flood Incident Management processes have been outlined in **Error! Reference source not found.**At this stage the target processes outlined should not be seen as definitive as additional business-led work is required. Any Incident Management System applied to flood incidents will require agreed national processes if it is to be successful in delivering a full range of benefits.

5.3.2 Provide Application Process Support

Many flood incident management processes are not currently supported by business systems. There are a number of opportunities to support flood incident management processes with IT, meet business requirements, drive costs down through efficiency improvements and help deliver general and flood incident management business objectives.

Estimates of the anticipated savings have been provided for each process. A breakdown of each estimate is detailed in Section 1261016.1258440, Detailed Assumptions

1. Situation Monitoring
The current hub of flood incident situation monitoring is the Area Incident Room. From this location much of the required incident management information is collected, reviewed, used to guide decision processes and communicated to all concerned. Much of the information is either not available electronically or when available is not integrated with other tools e.g. telemetry and local maps. Support systems can help collect, collate and present a range of incident information based on what is required to support a specific business process. The same information can be easily communicated and shared by anyone with access to the systems. An up-to-date and consistent view of a flood incident could also be presented to professional partners, stakeholders and, through various Agency delivery channels, the public.

Benefits over a 5 year period are estimated at £345,000 (1261016.1258440, Situation Monitoring). In addition to this tangible benefit, which relates to the efficiency improvements expected to accrue with process support, there are a number of possible business effectiveness improvements related to Situation Monitoring. These can be briefly stated as:

- Shared consistent flood incident data will aid overall flood incident planning, awareness and help deliver an improved service.

- Flood incident data can be disseminated at an early stage to professional partners, other stakeholders and the public.

- FWIMS will rationalise and present alarm data based on agreed local rules and priorities and so add to the effectiveness of flood Incident Room and monitoring staff.

2. Situation Reporting
Formal communication of the current situation during a flood incident to all levels of the Agency is currently a manual and resource intensive process. A major benefit of FWIMS will be the ability to automatically generate and maintain Situation Reports. Such a facility is estimated to generate benefits of £66k over 5 years.

In addition, there are a number of potential business effectiveness improvements related to automated situation reporting:

- Management and staff efforts can be directed towards managing incidents rather than collecting and delivering manual reports.

- A consistent baseline of flood incident information will assist the creation and presentation of a consistent Agency viewpoint.

3. Decision Support

Proposed FWIMS functionality systems can deliver support for incident decision making based on the encoding of suggested best practice against a defined set of conditions. This process captures best practice and 'expert knowledge' that will help deliver consistent and accurate services, especially in respect of Flood Warnings. The intention is to provide checklists of activities required for a task, e.g. the opening and closing of Incident Rooms and staff hand over during incidents. It is intended to provide functionality to alert staff to elements of an incident that they may have 'put aside' for more urgent tasks e.g. 'remind me to check that particular forecast again in one hour', etc.

In resource terms alone, savings of greater than £66K over 5 years are anticipated.

4. Resource Deployment

The Agency plans for and deploys a range of resources during a flood incident, not least of which are the large numbers of staff who take on particular roles and responsibilities. FWIMS will contain a resource planning functionality to:

- Monitor that individuals deployed for specific tasks have the right skills and training
- Track staff availability, and that they have had adequate breaks and rest, etc.
- Maintain required rosters and make these available for staff to review and change.
- Monitor physical resources, their availability (vehicles, pumps etc). and when their deployment.

Savings of greater than £428K over 5 years are anticipated

Non-tangible benefits include:

- Region or national flood incident management will have a far clearer view of on-going resource use and availability and create forward plans accordingly.

- Flood incident management can effectively plan resource and skills needs based on a national understanding of required standards and resource availability.

5. Call Handling

Modern call handling IT solutions can ensure that only important information related to the management of an incident is delivered to Incident Room staff. Requests for accurate information can be delivered by other means. (See Situation Monitoring above).

Savings of greater than £122K over 5 years are anticipated

In addition to the above tangible benefits, which relate to the efficiency improvements expected to accrue with IT support for required processes, there are a number of possible business effectiveness improvements related to Call Handling. These can be briefly stated as:

- Priority calls can be automatically placed at the top of call or task stacks immediately.

- Consistent capture of call information will aid service response and reporting.

- A consistent approach will help improve service perception.

- A significant reduction in Incident Room staff stress levels is anticipated

6. Collection and Maintenance of Field Data

An intention of FWIMS is to deliver field data collected both during and after flood incidents directly into incident management systems. Essential information can be efficiently and effectively integrated and shared during an incident and added to the incident information required important to post-incident analysis.

In addition, data supporting telemetry and subjective 'eye-witness' accounts can help flood incident decision making and service to customers.

Savings in excess of £132K over 5 years are anticipated

7. Post-Incident Analysis

Formal analysis of incident management can be collated and presented within a national framework and in relation to agreed key performance indicators. These elements can be automatically reported and help review flood incidents in terms of on-going national process and systems improvements.

A standard basic set of key performance indicators can be automatically derived from the data of any incident and allow for straightforward initial analysis and incident comparison.

Savings of greater than £60K over 5 years are anticipated

8. Training and Flood Incident Exercises

A national set of integrated solutions will allow for the creation of base training and will support the evolution of local training data to reflect particular local needs. FWIMS will support training to facilitate consistent levels of skill and knowledge for specific flood incident roles and processes.

Additionally, there is the potential to involve professional partners in exercises using computer based training thus improving overall incident management effectiveness and co-operation.

Savings of greater than £60K over 5 years are anticipated.

9. Damage Avoidance

Effective and efficient employment of IT solutions may help prevent some damage that current levels of response cannot. Given that flood incidents will occur and when they are serious they can cause extensive damage to property and the environment, even small levels of damage avoidance can deliver large benefits.

Use of national IT solutions to help damage avoidance will demonstrate to the Agency's stakeholders, professional partners and the public a commitment to consistent improvement and modernisation of flood incident management processes.

5.4 Options and Financial Analysis

The following section considers the main options and financial analysis relating to the delivery of recognised business objectives, requirements and benefits of change for the managing of flood incidents.

A number of options were considered during the preparation of this Business Case that might meet the Agency's flood incident management needs to varying degrees.

The implementation of any one of the options will necessitate changes in the current Flood Warning/Incident Management business processes if the stated benefits of that option are to be delivered. Some of the options will support and facilitate the required changes more readily than the others and this factor is considered in making the recommendations contained within this report.

5.4.1 Summary Analysis

Option 1 - Do Nothing. Is considered to help understand the business impact and cost of continuing as is. Few, if any, of the business requirements will be delivered and many of the current issues in the business will remain and possibly accelerate given known business trends and Agency resources. Although not recommended, the analysis of this option has served to identify the key issues and the hidden costs within the business, which are then considered in the analysis of the other options.

Although Option 1 has no Capital Cost associated with it, the on-going operational costs expended to meet the business objectives (e.g. effort costs to produce reports manually) may prove prohibitive over time and result in other options being reconsidered at a later date.

Option 2 – Enhance Existing Manual Processes. Considers a way forward that is likely to be developed and implemented by one or more of the various regions in its management of flood incident functions. It explores the areas of cost and cost duplication inherent in the historical development of separate regional processes and systems implementation to meet local customer, stakeholder, partner and Agency needs.

Although not recommended, the analysis of this option has helped identify costs that will be incurred by the business if business improvement is driven at the regional and functional levels.

Option 3 – Develop and Implement National Business Processes for Flood Incident Management. This option considers the costs and benefits of developing a National Target Set of flood incident management processes. These processes will be developed and adopted across all the Agency regions. This approach is a solution that addresses the weaknesses of Option 1 and 2 without applying the possible benefit multiplier of Information Technology. As such it is seen as essential to enable low risk National flood incident management systems development

This option is recommended for the successful development of consistent, high-quality National business processes and is a precursor to the implementation of an Agency-wide Flood Incident Management System.

Option 4 – Procure a Third Party Package. Considers whether or not an 'off-the-shelf' package can be procured that satisfies all, or a major part, of the Agency's needs for flood incident management. To date, all enquiries to locate such a package or commercially available system have failed. The time taken to conduct a tendering exercise for such a package (if one can be found) is likely to impose additional costs and unacceptable delays to delivering the business benefits and may diffuse business focus and buy-in.

This option has therefore been rejected at an early stage and a financial analysis could not be performed. However, it may be prudent to allocate additional resources in the future to review the situation prior to any bespoke systems development. There are a number of software initiatives that over time may yield commercial products e.g. EC research.

Option 5 – Develop a Bespoke National System for Flood Incident Management – Low Integration. This option looks at the costs and benefits of developing a bespoke National flood incident management system. However, it considers the implications of developing such a system without full integration to other Agency-wide applications, e.g. Call Handling and Logging.

The duplication of systems functionality and data entry and maintenance led this option to be rejected at an early stage. However, it highlights the areas of Agency-wide system development that can be utilised by more than one set of functional users.

Option 6 – Develop a Bespoke National System for Flood Incident Management – High Integration. This option, along with option 3 above is the recommended way forward. It describes a bespoke National system that is fully integrated with other strategic tools to deliver a multi-functional flood incident management platform.

The system will re-use the functionality of other components already earmarked for development. It will gather and present flood incident management information that supports agreed National flood incident management business processes and standards. As such, it will offer opportunities to efficiently and effectively manage flood incidents and communicate vital flood incident information at all levels of the Agency. Opportunities also exist to disseminate the system's accurate and consistent data beyond the Agency workforce to a number of Government departments, external partners, the media, incident customers and the general public.

However, the maximisation of return on investment inherent in this approach requires careful requirement definition and excellent communication across project boundaries. It also demands a carefully staged development cycle and risk management to ensure benefits realisation. These issues and others are considered in detail below.

This option is also seen as creating the necessary IT components for the process support of a variety of incident management types in future.

5.4.2 Options in Detail

5.4.2.1 Option 1 – Do Nothing

This option assumes that Agency's current flood incident management systems, which are mainly manual[31] and differ in operational detail from region to region, remain as they are and no major enhancement work is performed.[32]

Advantages

1. No new capital costs will be expended.
2. No business effort required to develop and implement change.
3. No additional training effort is required.
4. Possible operational stability for incident management within specific regional boundaries will be gained, given no new externally imposed requirements, e.g. no new government directives.

Disadvantages

1. Existing issues in the business will not be consistently addressed.
2. No fit to overall Agency vision.
3. The stated strategic direction for the managing of incidents will be difficult to realise.[33]
4. Few, if any potential medium to long-term business benefits will be realised.
5. Existing workarounds and duplicated/wasted manual effort will continue or increase. The latter is likely given rising incident occurrences.
6. Regionally focused systems and associated duplicate costs will continue to accrue.
7. Consistent Standards of Service will prove difficult to deliver.

[31] Although NIRS2 can be used to collect incident information during an event, its main business use is for retrospective incident analysis, not 'at-the-time' management.

[32] The Multi-Media Warning Dissemination System project will require the integration of that system (MMWDS) into various regional Flood Incident management approaches. Those issues are not covered by this document.

[33] See 'Strategy for Managing Incidents in the Future', Final Draft, 28th February 2002, R. Logan.

Risks

1. The current regional focus for flood incident management will hinder the evolution of best practice, national standards and the more effective management of flood incidents.

2. Multi-regional approaches will hinder the best use of staff resource skills and experience, requiring several training regimes and limiting staff mobility during multi-region and national flood incidents.

3. Given 1 and 2 above, growing political and public demand and expectations in relation to effective flood incident management will be difficult to satisfy.

4. Current multi-regional approaches risk endangering the perception of the Agency's competency and professionalism in relation to flood incident management and will make growing demands on the relatively small number of experienced staff to be found in any one general location.

Conclusions

1. When considered against the strategic direction required for the Agency and flood incident management, it is unlikely that current practices can deliver cost efficient or effective flood incident management as they currently stand.

2. Flood incident management demand and risks are increasing. Current approaches will have to develop to meet future needs. Standing still will not be an option. That this is currently recognised by the business clearly demonstrated by the many regional initiatives that exist to improve flood incident management processes and service.

3. A nationally consistent approach to flood incident management will be difficult to deliver and monitor under current regional regimes.

5.4.2.2 Cost Estimates

Not calculated as not considered further

5.4.2.3 Option 2 – Enhance Existing Manual Processes

This option assumes that Agency's current flood incident procedures will be enhanced to meet the growing needs of incident management and the strategic direction of the Agency.

Advantages

1. Each region will develop operational flood incident management approaches and solutions that are specific to its particular priorities, circumstances, customers, partners and stakeholders without necessarily referencing the incident management systems of other Agency regions.

2. Operational practice will evolve against locally recognised needs and goals.

3. Some business benefit will be realised by local process improvements.

4. Some fit to Agency vision at the local level.

5. Some local process improvements are likely, however it is difficult to determine the scope of these improvements or the time scales involved.

Disadvantages

1. Business effort across the regions will be required to enhance existing manual processes.

2. Poor fit to overall Agency vision.

3. The stated strategic direction for the managing of incidents may be difficult to realise, given the regional focus of process improvement efforts.

4. Existing workarounds and duplicated/wasted manual effort will continue or increase. The latter is likely given rising incident occurrences.

5. Regionally focused systems and associated duplicate costs of improvements will continue to accrue.

6. Consistent Standards of Service will continue to prove difficult to deliver.

Risks

1. The current regional focus to flood incident management hinders the evolution of best practice, national standards and the more effective management of all types of incident. Local process improvements

2. Multi-regional approaches will hinder the best use of staff resource skills and experience, requiring several training regimes and limiting staff mobility during multi-region and national incidents.

3. Given 1 and 2 above, growing political and public demand and expectations in relation to effective incident management will be difficult to satisfy.

4. Current multi-regional approaches risk endangering the perception of the Agency's competency and professionalism in relation to flood incident management and will make growing demands on the relatively small number of experienced staff to be found in any one general location.

Conclusions

1. When considered against the strategic direction required for flood incident management, it is unlikely that current practices will deliver cost efficient or effective incident management.

2. Flood incident management demand and risks are increasing beyond the capability of any one region to develop and implement a winning approach and tool-set.

3. A nationally consistent approach to incident management will be difficult to deliver and monitor.

5.4.2.4 Cost Estimates

Implementation costs will include procedure development, implementation and training. Resource estimates for procedure enhancement are circa 1.5 man-years (say £70k + training), however much of this effort could be subsumed into day to day operational activities.

5.4.2.5 Option 3 – Develop and Implement National Business Processes for Flood Incident Management

This option assumes that Agency's current flood incident management systems will be subject to an extensive review. This process will develop and implement a set of specific National Flood Incident Management Business Processes. These detailed processes will maximise shared practice across regions and will harmonise incident management regimes and required information and data formats. This option is very much seen a pre-requisite to limiting risks associated with the development of an IT solution to support business incident management processes and needs.

Advantages

1. No new capital costs will occur.

2. The stated strategic direction for the managing of flood incidents may will be easier to realise, given the focus of the development and implementation of National Business Processes.

3. Reasonable fit to overall Agency vision, though lacking alignment with regards to some important areas.

4. Each region will develop detailed operational incident management delivery regimes and solutions that are in alignment with an agreed set of National Business Processes and standard information requirements. Detailed regional operational flood incident management delivery will continue to be specific to regional particular circumstances, customers, partners and stakeholders but will have a common schema of reference to the flood incident management systems of other Agency regions and will form part of a National whole.

5. The development and implementation of detailed National Business Processes for flood incident management will offer opportunities for the national adoption of best practice and will define national information requirements and standards.

6. Operational practice will continue to be able to encompass locally recognised needs and goals whilst meeting nationally approved practice and standards.

7. Some potential business benefits derived from the spread of agreed best practice will be realised by creating a National Business Process framework and set of information standards.

8. National process improvement initiatives will eliminate duplicate costs associated with improving regional processes and systems.

9. Consistent Standards of Service will be easier to deliver.

A number of additional benefits are described in Section 5.3.1 Implement National Flood Incident Management Processes

Disadvantages

1. National business effort will be required to focus on the development and implementation of National Business Processes. However, issues relating to standard information collection, presentation and dissemination will need help from technology before current business process time cycles are much improved, e.g. incident situation reporting.

2. Existing workarounds and duplicated/wasted manual effort will continue or increase where manual systems support incident management National Business Processes. The latter is likely given rising flood incident occurrences.

Risks

1. The development and implementation of detailed National Business Processes for flood incident management cuts across current regional, functional and national organisational structures and responsibilities. Ownership, authority and the ‘clout’ to ‘make it happen’ will be required and may be difficult to facilitate.

2. Unless strict time scales are imposed, the process of development may degenerate into a ‘talking shop’ for regional factionalism.

3. Strict development time scales may lead to the creation of ‘bland’ National Business Processes that do not go far enough in defining process steps, process alternates and exceptions, information needs and required standards. Thus creating the necessity for the continuation of regional variation in those circumstances not defined and the failure to implement national consistency.

Conclusions

1. When considered against the strategic direction required for the Agency and flood incident management, detailed National Business Processes are a required tool to help deliver cost efficient and effective flood incident management.

2. Flood incident management demand and risks are increasing beyond the capability of any one region to develop and implement a winning approach and tool-set. National

Business Processes that embrace the required details to create a recognisable national business system will help pool and focus the efforts and resources of the Agency.

3. A nationally consistent approach to flood incident management will be easier to deliver and monitor from a set of detailed National Business Processes.

4. Detailed National Business Processes for flood incident management will enable the lower-risk development of a national flood incident management IT solution.

5.4.2.6 Cost Estimates

Thirty areas have been identified where National Business Processes would be of benefit. Effort to develop and implement these processes is estimated at circa 5 man-years or £175k + training. It is thought likely that much of this effort could be subsumed within day to day operational activities.

5.4.2.7 Option 4 – Procure a Third Party Package

This option considers the procurement of a third party package that will satisfy the requirements of the Agency in the support of National Business Processes for flood incident management.[34] Initial investigations have revealed that whilst incident management IT solutions have been implemented both in the UK and abroad, none have yet come onto the market as a viable commercial packages.

It may be prudent to carry out some further analysis of the commercial package market at a later date if recommendations to develop a bespoke solution are accepted and funding agreed, however in the absence of a commercially available product this option has not been analysed in any further detail.

Advantages

The advantages of this option are as follows:

1. There may be quicker delivery of a technical solution to support the business changes implemented.

2. If the package is used directly “out of the box”, product support may be straightforward, and may cost less than other options.

3. The disadvantages of this option are considered to be:

4. It is not clear if there is a suitable package currently available within the market place. If not, there may be a case of “forced fit”, thus reducing potential business benefit and increasing Agency cost.

[34] It has not been considered feasible or desirable to consider a third party package with the flexibility to encompass support for current regional variation in incident management processes and information.

5. It is not clear if a package solution could be implemented quickly. Implementation schedules would depend on the package chosen.

6. It is not clear if a package solution would reduce capital and support costs. It would depend on the package and supplier chosen.

7. If the package does not fit "out of the box", it may require adaptation and hence end up as a bespoke system. This would then attract the same drawbacks as option 6, the bespoke build.

8. The procurement process may inhibit any quick wins for the Agency.

9. The Agency would not hold the intellectual property rights for any package solution.

10. Cost of adapting the package to get the required functionality could be high.

11. It does not support the convergence of systems.

12. Unlikely to address the Agency strategy of implementing systems that are based on reusability and extendibility. Common services and data will not exist and therefore true business benefit cannot be achieved.

13. Customisation may not be part of product strategy and may take longer to implement and not be supported so readily

14. There may well be additional issues when it comes to data migration, as the data standard used by the package is likely to be different to the Agency standard.

15. The adaptation of the package may affect the way it was intended to work.

16. Future product strategy may diverge from business need and new requirements may not be supported.

Risks

No specific risks have been considered at this time. For reference, the main risks associated with any package acquisition can be generally summarised as:

1. Poor fit to business process and data requirements, leading to a protracted 'build' phase offsetting potential cost benefits.

2. Technical risks associated with the specific software, its potential for development and its fit to emerging commercial standards and future directions.

3. Vendor risks associated with commercial viability, existing customer base, development and implementation consultancy, support and product maintenance.

Conclusions

A third party package solution must be given serious consideration should a package that met the majority of the Agency's requirements be commercially available. Currently, such a package does not seem to exist. Flood incident management processes continue to be the area of experimental applications or incident specific non-commercial software. This situation may change over time, but these time scales may be too long given the Agency's pressing need to develop its tools to support required flood incident management and general business strategies.

As no third party package was identified, possible implementation costs were not considered.

5.4.2.8 Option 5 – Develop a Bespoke National System – Low Integration

This option considers the development and implementation of a bespoke Flood Incident Management System (FWIMS) for flood incidents that will satisfy the requirements of the Agency in the support of National Business Processes for incident management.[35] However, this option will have a low level of integration into other potential corporate systems, e.g. call handling and personnel system components.

Advantages

1. The primary Agency Incident Management System can be built utilising proven modern technologies and to approved strategic technical standards.

2. The first step can embrace flood incidents as a priority whilst creating potential 'core' IT components and capabilities applicable to other incident types.

3. Reasonable levels of support for National Business Processes can be achieved.

4. Reasonable fit to overall Agency vision though lacking in some areas, especially integration and efficiency.

5. Current business problems can be resolved where they occur within the scope of a 'core' flood incident management system.

6. 'Core' flood incident management requirements can be more easily controlled without reference to other IT solutions and projects.

7. The development and implementation of a 'core' Agency Incident Management System supporting agreed National Business Processes for flood incidents, albeit with low integration across other strategic IT components, will represent an enormous advance in the delivery of effective and consistent flood incident related services.

[35] It has not been considered feasible or desirable to consider a bespoke national system with the flexibility to encompass support for current regional variation in incident management processes and information standards.

Disadvantages

1. High costs are likely to be incurred.

2. Low integration to other corporate IT solutions will require potential 'workarounds' and possible data and functional duplications which could be avoided.

3. Unlikely to address the Agency strategy of implementing systems based on reusability and extendibility. Common services and data will not exist and therefore true business benefit is unlikely. Some business cost efficiencies will not be realised with low integration.

Risks

1. Even with low integration to other corporate IT solutions, the development of a 'core' FWIMS product would represent considerable effort and risks related to requirements definition, change management, overall time scales and budgets.

2. A degree of effort would have to be allotted to creating 'work arounds' for the data and functionality that would logically reside within other corporate IT solutions but would still be needed to support incident management National Business Processes.

3. 'Work arounds' might endanger the effective integration of FWIMS with corporate IT solutions at some later point.

Conclusions

The development of a low-integration bespoke system runs counter to the Agency's strategy of implementing systems that are based on reusability and extendibility. Common services and data would not be developed, and the system would sit outside the Agency's Enterprise Architecture.

Given this strategy, such a development would not be permitted at present.

5.4.2.9 Cost Estimates

Not calculated as not considered further.

5.4.2.10 Option 6 – Develop a Bespoke National System for Flood Incident Management – High Integration

This option considers the development and implementation of a bespoke management system for flood incidents that will satisfy the requirements of the Agency in the support of National Business Processes for flood incident management. This option will have a high level of integration into other corporate systems components, e.g. call handling and personnel system components.

Advantages

1. All requirements fulfilled and business drivers met

2. The Incident Management System for flood incidents can be built using proven modern technologies and to approved strategic technical standards.

3. Optimum levels of support for National Business Processes can be achieved.

4. Good fit to overall Agency vision, although likely to be the most expensive option.

5. Current flood incident management business problems can be addressed across the full range of functional and non-functional business requirements to include the use of other corporate systems.

6. Re-use of key corporate systems eliminates data and functional duplication and represents best use of capital investment.

7. The system will re-use the functionality of other components already earmarked for development.

8. The system can be designed to gather and present flood incident management information that supports agreed National flood incident management business processes and standards.

9. The system will offer opportunities to efficiently and effectively manage flood incidents and communicate vital flood incident information at all levels of the Agency. Opportunities also exist to disseminate the system's accurate and consistent data beyond the Agency workforce to a number of Government departments, external partners, the media, incident customers and the general public.

10. By utilising existing investment in the Agency Enterprise Architecture, a phased approach could be used to facilitate system changes in line with the implementation of business changes.

11. Longevity of the system solution may be greater than other options specified.

12. The option may be delivered by a package of projects, rather than one large project. This will reduce risk and ensure that the business remains engaged. It will also ensure that some wins are delivered quickly.

13. Any data migration issues are reduced, as some data will already exist.

14. Staff costs will decrease through the adoption of an automated process.

15. Promotes remote working, hot-desking and location flexibility.

16. Supports national reporting.

17. Delivers a longer life produce and reduces associated desktop infrastructure costs.

Disadvantages

1. Higher capital costs are likely to be incurred initially, however this option allows their recovery at a faster rate.

2. The communication and acceptance of flood incident management requirements within the scope of existing or planned corporate IT solutions represents a significant organisational challenge.

3. A completely integrated FWIMS flood incident solution will be dependent on the availability of required corporate IT solutions.

4. Potential re-use of functionality for other incident types will need careful consideration during the development of FWIMS.

Risks

1. The development of the FWIMS flood incident product with a high degree of integration to other corporate IT solutions requires cross-project co-ordination associated with requirements definition, change management, overall time scales and budgets which is a significantly higher risk than working in isolation.

2. 'High' integration is dependent on the progress and quality of other corporate IT solutions. It may not be achieved in a reasonable time scale.

Conclusions

After careful consideration, it is believed that this is the only truly viable option, however it is infeasible without also implementing Option 3 – "Develop and Implement National Business Processes for Flood Incident Management" as common procedures will form the basis for subsequent automation. Not only does this option satisfy all current business requirements and drivers, but it is compatible with the Agency's Enterprise Architecture and will also lay the foundation for future development in this area.

5.4.2.11 Cost Estimates

Year	**1**	**2**	**3**	**4**	**5**
1. CIS Staff	50,000	100,000	100,000		
2. Hardware		250,000			
Requirements	250,000				
Design Code Test	250,000	500,000	250,000		
Rollout			200,000		
Project Office	15,000	30,000	30,000		
3. Software Total	565,000	880,000	630,000	0	0
4. Support & Maintenance (15% & 8%)		50,000	150,000	150,000	150,000
CIS Project Budget	**565,000**	**930,000**	**780,000**	**150,000**	**150,000**
5. User Time on Project					
Requirements	60,000				
Design Code Test		60,000	30,000		
Rollout			30,000		
SoD Value	**595,000**	**990,000**	**780,000**	**150,000**	**150,000**
6. User Time After Project				100,000	
Total Cost over 5 Years	**595,000**	**990,000**	**780,000**	**250,000**	**150,000**
Sensitivity (15%)	89,250	148,500	117,000	37,500	22,500
Cumulative Cost	**684,250**	**1,822,750**	**2,719,750**	**3,007,250**	**3,179,750**
7. Benefits Due to Project	**0**	**255,800**	**511,600**	**767,400**	**1,023,200**
Net Cost	**684,250**	**1,566,950**	**2,208,150**	**2,239,850**	**2,156,550**
0.035					
Discount Factor (3.5%) - Green Book Figures	1	0.9662	0.9335	0.9019	0.8714
NPV = 1/(1+r)^n	1	0.96618	0.93351	0.90194	0.87144
Net Present Cost	**684,250**	**1,513,987**	**2,061,308**	**2,020,121**	**1,879,218**
Cumulative NPC					

5.5 Risks and Assumptions

5.5.1 Risks

The following are risks to the successful delivery of FWIMS and will require effective countermeasures if the project is to proceed:

5.5.1.1 Business Buy-In And Commitment

One of the greatest risks to the success of FWIMS is a potential lack of widespread business buy-in. Without backing and involvement when required from all Regions, Areas and levels within the Agency, FWIMS will not deliver all of its benefits. In order to succeed

- Commitment is required at Director level within Operations and Water Management
- The project structure will require Regional Executives to be accountable for delivery
- Strong communications to promote the project and combat the "not invented here" syndrome are required – these are likely to be in the form of roadshows of a system demonstrator to canvass opinion and promote the project's benefits.

5.5.1.2 Benefits Realisation

Current benefits of change assumptions are based on the occurrence of a similar flood incident as that of Autumn 2000 and an equal amount of flood incident activity over a five year period. These assumptions may not occur in reality and so put benefits realisation at risk.

5.5.1.3 Nationally Agreed Procedures

Although National procedures have been developed at a high-level for Incident Management itself, there is extensive variation between Regions at the next level of abstraction. For example, the "Open an Incident Room" procedure is national, but Situation Report formats differ between Regions, and in some cases between Areas within Regions.

To introduce automated national reporting for example (which is a major benefit of the system), it is first necessary to implement standardised Situation reports (SitReps) and Common Procedures for SitRep generation. If the effort required to create, agree and implement Common SitReps is extrapolated across the full set of Target National Procedures, it is clear that considerable commitment and resources are required from the Business to implement FWIMS.

5.5.1.4 System Requirements

Following on from an agreed set of National Procedures will be the need to define in detail the functional requirements of the FWIMS flood incident system. Current levels of systems and process variation across the regions may risk agreement at the level of detail or highlight integration problems that could add to project costs.

Similarly, system non-functional requirements will need careful consideration and agreement from the user community regarding reliability, availability and performance.

Defining, agreeing and testing all system requirements represents a significant area of risk for the project.

5.5.1.5 System Users

Beyond business customer management, the level of commitment among proposed system users is an unknown factor, given the current regional focus of Flood Defence teams. It may be that the project will encounter an unwillingness to embrace change. Even if commitment is strong, the amount of time key users could devote to the FWIMS project has not been determined. Given the current diversity of systems use, it is likely that business key users may need additional training to be able to aid the development of the FWIMS project.

5.5.1.6 Technical Risks

The technical complexities related to the integration and IT systems representation of dynamically evolving flood incidents are a significant technical challenge and represent an area of considerable risk for the project.

Innovation, tools, development techniques, hardware and software will all have to be successfully combined to realise the benefits of change. Risks will have to be managed to ensure all involved have the necessary skills and familiarity to deliver.

Integration and successful testing of possible FWIMS components and incident test simulation could also be a problematic risk area. Phased delivery of components may require re-testing of all system elements.

5.5.2 Assumptions

The assumptions below require verification as they may affect the success of the project:

5.5.2.1 Cost Extrapolation

A number of figures used to calculate benefits are not explicitly maintained by the Agency and have been derived from extrapolation from two Regions during workshop discussions attended by a cross-section of Agency staff.

5.5.2.2 Technical Strategy

The suggested technical direction for FWIMS has been verified against the CIS Technical Strategy Summary (2000-2003) [7].

5.5.2.3 Business Analysis and Workshops

We have relied heavily on the information gathered during the business analysis and workshops, and assume that it has validity across all Agency Areas and Regions.

5.5.3 Financial Assumptions

The following generic assumptions have been made in preparing the cost estimates presented in this Business Case:

1. Costs are calculated on the basis that the proposed solution has a 'life expectancy' of 5 years.

2. Any upgrade required to the bandwidth of the Agency's corporate data network to support a GIS based solution will be addressed prior to NFCDD implementation, therefore no network upgrade costs are included. Due consideration should be given during the project design stages, when the technical paper is produced, to ensure that:

    - The impact on the Agency's existing network and infrastructure is minimised.

    - The network requirements of FWIMS are discussed with the Agency's technical staff.

3. The FWIMS solution will be designed to run on the Agency's standard desktop PC and no specialised desktop computer equipment will be required.

4. Staff cost calculations are based upon the following average rates:

    - Agency IT development staff costs are based on an average rate of £410 per day

    - Agency IT operations staff costs are based on an average rate of £310 per day

    - Agency non-IT staff costs are based on an average of £250 per day

    - IT external contractor costs are based on an average rate of £500 per day. It is probable that these costs will be absorbed into a 'fixed' price contractual agreement.

    - Training package provider costs are based on an average of £750 per day (incl. expenses).

5. A discounting rate of 6% has been applied in all Net Present Value (NPV) calculations.

6. The costs of 'taking-on' existing incident management information currently held within mainly manual systems, e.g. paper procedures, emergency plans, historical incident references, etc, will be borne by the project.

7. The cost of any data 'cleansing' required for information held in the existing manual systems is considered to be an on-going business cost and not specifically attributable to

the FWIMS project. This cost will be incurred by the business whatever solution is adopted and is therefore excluded from this Business Case.

8. Regional cost estimates presented in this document are based upon an 'average' Region. The 'average' region was derived from discussions in workshops, subsequent meetings, and detailed business analysis of two Regions.

9. Training will be staged through the development of the FWIMS system. It is envisaged that users will be involved in both systems training and incident 'simulations'

10. The assumption at this stage is that there will be no cost associated with the provision of a development server and associated licences. A contingency cost per area for possible 'hardware' issues encountered during rollout will be made.

5.5.3.1 Benefit Estimate Approach

The benefit estimate figures quoted in the document have been derived from business reports, current process analysis, current process workshop discussions and follow-up investigations.[36]

Where benefit figures are considered to fall within a range of values, the most conservative figure has been used to calculate the likely benefit of FWIMS.

Not all of the cost benefits are realisable in a way that can be given a cash value. Some, such as improved efficiency of SitRep production can be realised as a cost saving, while other benefits will manifest themselves as improvements in overall business effectiveness, where effectiveness is taken to mean recognisable improvements in meeting the needs of our customers and partners.

In the document, benefits are categorised in 2 main ways, Efficiency Improvements and Effectiveness Improvements. Improvements to business efficiency can be expressed as cost benefits and make reference to improvements in process accuracy and process cycle speed if appropriate.

1. **Efficiency Improvements**. For example, maintaining a consistent current view of an incident within the system will accrue cost savings by replacing the existing mainly manual data collection and dissemination approach. It will also be capable of presenting information both internally and externally that is accurate, consistent and comparable. It will also present users of the information with an up-to-date picture when required, without unnecessary time delays.

2. **Effectiveness Improvements**. Continuing to use the example above, shared data will aid overall incident planning, incident communication, incident decision making and

[36] Flood incident process volumes and resources employed figures have been drawn from various national, regional and area reports, especially those relating to the Autumn 2000 floods. See; 'Lessons Learned – Autumn 2000 Floods' EA, 2001, 'Midlands Region November 2000 Flood Report' EA, 'North East Region Autumn 2000 Floods Review Regional Report' EA, 'Autumn 2000 Floods Performance Review and Action Plan for Ridings Area NE Region' EA and 'Review of February 2002 Floods Severn Basin, EA.

incident awareness. These benefits can be delivered to Agency users, shared by professional partners and passed on to stakeholders and the general public.

5.5.3.2 Benefit Estimate Assumptions

The following assumptions have been used to create the benefit estimates given in Section 4 above.

Base Assumptions

1. In a five-year period one national incident of the magnitude of the autumn 2000 will occur and other incidents will also occur across all regions that equal in total one autumn 2000 event in terms of effort and resources deployed.

2. That an Autumn 2000 event covers three consecutive regions, nine consecutive areas and that all regional incident rooms are open for national reporting purposes.

3. That the duration of the autumn 2000 type incident will be a full 20 man-days.

4. Flood warnings issued in an autumn 2000 type incident will average 600 Flood Warnings and 150 Severe Flood Warnings.

5. Operational tasks relating to flood warnings issued will assumed to be 2 specific tasks per warning which require decisions to be made and documented.

6. 3,500 individual members of staff would be employed at some time for an autumn 2000-type incident. Assume an average constant use of 1,200 staff at any moment over the 20 days.

7. Each region for the autumn 2000 incident will have 100% attendance at 20 Gold and Silver Control Centres.

8. 15,000 telephone calls will be made to each region during an Autumn 2000 type event.

9. Benefits stated relate to a fully implemented system across all regions and areas.

10. Effectiveness improvements will be given a nominal quantification of 10K per element identified at this stage. These benefits may deliver some quantifiable benefit but their real measure will be in the effective delivery of service and organisational objectives.

Detailed Assumptions

Situation Monitoring	
Process	**Assumption Details**
Maintain Forecast Situation	In a 5 year period the assumption is that an Autumn 2000 event will occcur, alongside other incidents that equal in total an Autumn 2000 event. In an Autumn 2000 type incident, an affected region might have to handle 1000 forecasts over a 20 day period. A national incident might cover three regions, making 3000 forecasts. 15 minutes worth of information exchange and documentation x 3000 = 100 man days. The assumption is that all of this time will be saved. Over a 5 year period the assumption for benefit realisation is an additional 100 man days saving will be made equal to the Autumn 2000 type incident.
Maintain Current Situation	For the duration of an Autumn 2000 incident at least 2FTE's will be spent keeping each Area Incident Room, Regional Office and National Emergency Room up-to-date, making 26 people x 20 x2 over five years. = 1040 man days. 50% of their time will be saved by the use of an effective IT system.
Liaise with Control Centres	For the duration of an Autumn 2000 type incident there will be 60 Agency FTE's involved in liaising with Control Centres – 60 x 20 = 1200 man days. 25% of their time will be saved by effective IT = 300man days x2 over a 5 year period. = 600 man days
Create & Deliver EA Viewpoints	2000 requests for information from the media will be received per region for an Autumn 2000 type incident, making 6000 requests. 6,000 x 15 mins saved x 2 for a five year period = 400md

Situation Reporting	
Process	**Assumption Details**
Area Reporting	2 formal reports per day of an Autumn 2000 type incident from every area = 40 reports x 9 x 25% where each report takes 0.25FTE to create and deliver x 2 for similar level of effort over 5 years.
Region Reporting	2 formal reports per day of an Autumn 2000 type incident from every region = 40 reports x 3 x 25% where each report takes 0.25FTE to create and deliver x 2 for similar level of effort over 5 years across all regions.

National Reporting	2 formal reports per day of an Autumn 2000 type incident from the National Emergency Room where each report takes 0,25FTE to create and deliver x2 for similar level of effort over 5 years.

Decision Support	
Process	**Assumption Details**
Issue Flood Warnings	Automatic display of conditions and options for flood warnings without reference to procedure manuals or other checks and automatic decision recording and task start. 10 minutes saved per warning. 10 x 750 = 17md x2 = 34md
Decision Support	Automatic display of operational conditions and options for incident management across a range of tasks and flood areas. Automatic decision recording and whenever possible task allocation. 20 minutes saved per operational task required. 20 x 2 x 750 x 2 = 136md
Checklists, Hand over, etc.	Over the duration of an Autumn 2000 type incident 120 minutes at each site will be saved each day by automating current paper processes and procedures around specific hand over, opening and closing incident rooms and checklist activities. 12 sites x 20 days x 120 minutes x 2 =

Resource Deployment	
Process	**Assumption Details**
Deploy Resources	Automatic task allocation and logging of task requests whenever possible will enable incident resource managers to focus on the actual deployment of resources and their best use. Resource deployment will be visible to many and will not require the checking of manual logs, maps or white boards. For the duration of an Autumn 2000 incident at least 1FTE will be required in each area, region and at national level to deploy, log and make known to incident room managers the resource deployment details when required. 50% of their time will be saved by the use of an effective IT system. 13FTE's x 20day x 2 x 50% = 260 man days.
Track Resources	Regular reporting of task and resource status will enable automatic task and resource tracking. Incident resource managers will be able to co-ordinate at a local, regional and

	national level resource use and future resource needs/plans. Task and resource tracking will be visible to many and will not require the checking of manual logs, maps or white boards. For the duration of an Autumn 2000 incident at least 1FTE will be required in each area, region and at national level to track tasks and resource status, log progress and issues and make known these details to incident room managers when required. 50% of their time will be saved by the use of an effective IT system. 13FTE's x 20day x 2 x 50% = 260 man days.
Monitor Staff Health & Safety	Monitoring the health and safety issues related to all staff engaged in flood incident activities is a priority requirement, especially at area and region levels and currently a mainly manual process. All staff engaged in flood incident activities need to have hours worked, duties performed and rest periods recorded and tracked for possible H&S issues. These need to be raised for management action where necessary. Automatic monitoring of staff resources against business rules and appropriate system alerts will help busy incident managers control this vital area. Assume 15 minutes each day per resource is used to record and monitor staff H&S issues and track staff hours worked and skills/task appropriateness. 10 minutes per day per resource can be saved. 1200 staff x 10 minutes x 20days x 2 = 1081 man days
Monitor Staff Health & Safety	Possibility that at some point in near future the Agency may find itself embroiled in legal action and compensation re duty of care, foresight, breach of duty and causation.
Maintain Rostering	Current mainly manual duty rosters and schedules will form an integral part of the resource scheduling element of a new IT system. Assume 50% of all staff used in an incident will form part of a formal roster. Assume time savings of 5 minutes per rostered resource per day by holding rosters within the system. Assume automatic business rules will aid roster maintenance, which may be overridden when required. 600 staff x 5minutes x 20 x 2 = 270 man days

Receive Rostering Information	Information relating to rosters and roster changes will be automatically sent on and confirmation noted. 600 staff x 5 minutes x 20 x 2 = 270 man days

Collect Call Data	
Process	**Assumption Details**
Collect Call Data	15,000 calls to each region will be logged and routed via an effective incident call handling process supported by IT during an Autumn 2000 type incident. Assume a similar number of calls will also be made in relation to flood incidents over 5 years. Assume electronic logging and priority routing saves on average 3 minutes per call. 15,000 x 3 regions x 3 minutes x 2 = 608 man days.

Collecting and Maintaining Field Data	
Process	**Assumption Details**
Collect Field Data	Current processes use verbal, video, photography and manual forms to collect flood incident data. Assume a number of technologies are employed to deliver data into the Incident Management System in a more timely, efficient and effective way. This information becomes immediately available to other system users. Assume a similar number of instances will occur over a five year period. Assume 200 first instances of field data collection per area for an Autumn 2000 type incident. Assume an effort time saving of 15 minutes per instance to make this information generally available.[37] 200 x 9 x 15 minutes x 2 = 60 man days

[37] The real savings relating to collecting field data are in elapsed time saved in making the evidence generally available. Current processes rely mainly on verbal data with documentary evidence supporting statements arriving some time later.

Maintain Field Data	Assume 25% of all field data collected will need regular maintenance during the life of an incident, at least once per day following the first instance. Assume a similar amount over a five year period for all other flood incidents. 50 x 9 x 15 minutes x 20 days x 2 = 600 man days

Post-Incident Analysis	
Process	**Assumption Details**
Post-Incident Analysis	Current manual processes and paper logs demand intensive review to draw out basic post-incident facts for analysis. Assume all this time and 50% of time needed to present data are saved by IT system reports. For an Autumn 2000 type incident assume 10 man days per area and 20 man days per region to draw out and record basic post-incident facts saved. 5 man days per region re data presentation also saved. Assume a similar amount of time is saved over a five year period for all other flood incidents. 50man days x 3 regions x 2 = 300 man days.

Training	
Process	**Assumption Details**
Training	Assume a single system training outline is built. Assume 8 training representatives will tailor standard process training to meet local data and community needs.. The effort for this is 10 man days per year for the centre and for each region = 90 man days. Assume current effort is the same but there is an additional effort at regional level, i.e. 8 regional centres and 8 training representatives. Centralisation will save 70 man days per year. 70 man days x 5 = 350 man days.

Damage Avoidance	
Process	**Assumption Details**
Damage Avoidance	1,300,000,000 ex ABI figures (Autumn 2000) – Assume that the collective efforts of the implementation of the Agency Incident Management System will have a small qualitative effect on the overall damage that can be avoided in flood incidents.

5.6 Recommendations

The recommended option is Option 6 Develop a Bespoke National System – High Integration to be implemented in conjunction with Option 3 Develop and Implement National Business Processes. Although the capital cost is higher than other options considered, this option will deliver key business benefits, and costs are recovered from operational cost savings more rapidly.

The proposed solution is a National Application that links several existing and proposed systems (for example Multi Media Dissemination, Flow Forecasting Modelling Systems etc). Whilst some system components will be nationally hosted, other modules will be processed locally to minimise dependence upon the Wide Area Network.

APPENDICES

1. REFERENCES

The following documents have been generally referenced. Documents that have been used in relation to the description of a particular business process will be noted against that process:

Flood Forecasting and Warning Good Practice Baseline Review R&D Technical Report W5C-013/2/TR, Mott MacDonald, March 2002.

Information Technology Event Management Concept Study by Parsons Brinkerhoff Ref. No. SCL46025A.

Flood Warning Management System Project Mandate Version 2.

Lessons Learned. Autumn 2000 Floods. Environment Agency, March 2001.

EA North East Region Autumn 2000 Floods Review Regional Report March 2001

EA Midlands Region Flood Report 28th October – 20th November 2000

Autumn 2000 Floods. Performance Review and Action Plan. Ridings Area, North East Region. January 2001.

Environment Agency Midlands Region. Review of February 2002 Floods Severn Basin, April 2002.

EA Midlands Region Flood Emergency Service, Detailed Procedures to Issue a Flood Warning, V4.0, October 2001.

EA Regional Incident Procedures, Version 3.

Field Collection of Flood Event Data, NFWC, EFAG/A1.28, V2.0, October 2000.

Environment Agency North East Region. Flood Warning Manual Volume I. Regional Arrangements for Flooding Incidents. Edition 1. 12th September 2000.

Environment Agency North East Region. Regional Flood Warning Manual Volume E. Regional Base Controller (Flooding) Procedures. Edition 1. 12th September 2000.

Environment Agency North East Region. Flood Warning Manual Volume J. RCC Services for Flood Defence. Edition 1. 12th September 2000.

Environment Agency North East Region. Flood Warning Manual Volume A. Monitoring & Forecasting Procedures. Edition 1. 12th September 2000.

W5C 021 – Flood Warning Management System Project 25th July 2002 Workshop Document.

Crisis Management for Management and Executives. Robert Heath, Financial Times Pitman Publishing (1998)

Managing Software Requirements – A Unified Approach. Leffingwell and Widrig. Addison-Wesley (2000).

During May – July 2002 a number of current business documents have been gathered and used as a guide in describing the Flood Incident/Event Management Process. They do not represent an exhaustive survey of current documents and information used in the processes or all documents that currently support the complete business process.

Examples of the documents listed below can be obtained from Malcolm Bacon - office 725-4079, 0207-091-4079 and mobile 0778-674-7768.

'Flood Event Liaison – The Upper Severn Area Incident Room is now Open' – fax sheet.
'Flood Event Liaison – The Upper Severn Area Incident Room is Closed' – fax sheet.

Midlands Regional Forecasting –
Water Resources Operations Team routine task list.
Flood Watch Procedure.
List of topics covered in training sessions for Regional Monitoring and Forecasting Duty Officers (RMFDO's).
Example of an Upper Severn Area Guageboard Data Sheet for Bridgenorth. (Thermometer Graph).
Duty Roster Sheet for RMFDO's
Examples of completed RMFDO log sheets.

Example of a Midlands Severn Basin RMFDO Flood Report.
Example of a blank Midlands Severn Basin Forecasters Record Sheet.
Example of a blank Regional Flood Defence Emergency Log Sheet

Example of a Midlands Region News Release
Example of a Midlands Region 'Flooding – Lines to Take' document.

Examples of Midlands Regional Situation Reports – October 2000 and February 2002.

Examples of Midlands Regional Post-Flood Event Reports –
Flood Report 28th October – 20th November 2000.
Review of February 2002 Floods Severn Basin – April 2002.

Example of Upper Severn Area – FWDO & AFWDO Roster Sheet.
Example of an Upper Severn Forecast Summary Sheet
Example of a Flood Situation Summary Sheet
Example of an Upper Severn Area Guageboard Data Sheet for Welsh Bridge (Thermometer Graph).
Blank example of an Upper Severn Flow Forecasting Duty Officers Log: Severn Basin Flood Status (Duty Log).

Examples of and commentary on Upper Severn Area –
Incident Room Call Log
Change of Duty Log for Incident Room FWDO's.
Flood Situation Summary Sheet.
Summary of Warnings Issued.

North East Region –
Blank Routine Duty Proforma for Tidal Forecasts
Examples of Met Office Heavy Rain forecast faxes
Blank Tidal Warning Proforma
Blank Alarm List
Blank Event Log
Example of a MDO Log Sheet for River Tyne
Example of Flood Warning Manual Volume A Monitoring & Forecasting Procedures - River Tyne

Examples of North East Region Situation Reports – November 2000

Example of North East Region Autumn 2000 Floods Review Regional Report

Example of North East Region, Ridings Area Autumn 2000 Floods, Performance Review and Action Plan January 2001.

Example of a Don & Aire District Area Situation Report November 2000
Example of a Dales Area Situation Report November 2000
Blank proposed Area Situation Report proformas – May 02.

Blank North East Region Flood Defence Emergency Response Message Logsheet
Blank North East Region Dales Area Emergency Response Procedure Vol. 2D Operational Instructions Sheets

Blank Ridings Area FWDO Event Log

Environment Agency - W5C 021 Flood Warning Management System project Regional and Area Current Business Use Cases. Version Draft 1.3

Parsons Brincherhoff Ltd. – Event Management Concept Study Report for the Environment Agency.

Flood Warning: An Australian Guide (Emergency Management Australia, 1995 3-5)

OSIRIS – Synthesis of Information Needs and OSIRIS Project Policy and Strategy DVB02.

John Handmer, Chas Keys and Jim Elliot – Achieving lasting Change in Multi Organisational tasks: the case of flood warnings in Australia

John Handmer – Making Flood Warning Work in Europe

Edmund Penning-Rowsell and Maureen Fordham – Floods Across Europe.

Incident Management Policy Number: 127_01

W5C 021 – Flood Warning Management System Project - Regional and Area Current Business Use Cases, Version 1.4 August 2002, M. Bacon, S. Key and P. Foxley.

EA Strategy for Managing Incidents in the Future – Final Draft 28 February 2002 – Richard Logan.

EA Policy 127_01 Incident Management – Version 7 – 31st July 2002

EA Generic Incident Management Process Overview – Version 9 – 31st July 2002

High Level Target 2 Provision of Flood Warnings. Agency Report to DEFRA February 2002

DEFRA FD2304 Final report March 2001 (Revised June 2001)

Inland Flood Defence – Report by the Comptroller and Auditor General March 2001

Flood Forecasting and Warning Good Practice Baseline Review R&D Technical Report W5C-013/2/TR, Mott MacDonald, March 2002.

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Managing Software Requirements – A Unified Approach. Leffingwell and Widrig. Addison-Wesley (2000).

2. CONSULTEES

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Matt Smith	EA, North East Flood Defence Improvement Officer
Chris Tidridge	EA, Midlands Senior Water Quality Planner
Karen Whipp	EA, North East Flood Defence Technical Assistant
Steve Wragg	EA, North East Flood Defence Engineer

3. USEFUL WEBSITES

For a list of selected Internet/Web sites dealing with disaster management, see http://www.colorado.edu/hazards/sites/sites.html.]

http://iwin.nws.noaa.gov
Through the Emergency Management Weather Information Network - IWIN - the National Weather Service lists all the areas across the country that are currently under watch or warning for thunderstorms, tornadoes, hurricanes, flash flooding, and other extreme weather. It
also provides local weather updates and outlooks, world weather, and in-depth information about short- and long-term weather conditions.

http://meted.ucar.edu
http://www.comet.ucar.edu
http://www.comet.ucar.edu/resources/cases/
The National Weather Service Training Center and Operations Training Branch, along with the Cooperative Program for Operational Meteorology and Education and Training (COMET) recently established the Meteorology Education and Training (METED) home page as the principal location for all Web-based materials produced by the three training facilities. It includes sections on professional development, instruction on the Web, course materials on-line, tele-training and course schedules, case studies, meteorology and hydrology education links, conferences and education, and instructional design techniques. COMET provides the case studies, which include such recent weather events as the "1993 Storm of the Century,"

Hurricane Erin, several major snow storms, the 1996-97 California floods, and the 1997 Jarrell, Texas, tornado. Information and schedules of other training and education are also posted.

http://www.dir.ucar.edu/esig/socasp/
http://www.dir.ucar.edu/esig/socasp/zine/
http://www.dir.ucar.edu/esig/socasp/nsf_grants.htm
etc.
The National Center for Atmospheric Research, Environmental and Societal Impacts Group (ESIG) Web site includes a section on societal impacts of weather. Although we've mentioned this resource before, it warrants another look, because of its ever-growing content. It continues to provide access to ESIG's bi-monthly Internet newsletter "Weather Zone" for persons interested in research and practice in the societal aspects of weather, as well as the "Weather Impacts Journal"- a virtual journal that lists scholarly publications relevant to the societal aspects of weather.

Beyond this, the site offers sections for user groups (insurance industry, emergency management/hazards planning, agriculture, media, and the general public); pages on various phenomena (El Nino, tornadoes, extreme temperature, flood, tropical cyclone, winter, lightning); indexes of community and research tools (people and organizations, upcoming events, bibliographic resources, Web links, mailing lists and news groups); and economic and casualty data. At http://www.dir.ucar.edu/esig/socasp/nsf_grants.html, the site provides a list of NSF Social, Behavioral, and Economics Research Directorate grants that are focused on the societal aspects of weather.

http://www.nws.noaa.gov/oh
http://www.nws.noaa.gov/oh/hic/
http://www.nws.noaa.gov/oh/hic/flood_stats/index.html
As one might suspect, the National Weather Service's Office of Hydrology (OH) and its Hydrological Information Center offer much information on floods and other aquatic disasters. Besides information about the various components of the office, the OH site offers current and historical data including an archive of past flood summaries, information on current hydrologic conditions, water supply outlooks, as well as an "Automated Local Flood Warning Systems Handbook," Natural Disaster Survey Reports, and other scientific publications on hydrology and flooding. The site also provides information and order forms for the office's video on the dangers of "Low Water Crossing." The Hydrological Information Center subsection describes the mission of the center, provides much additional information on flood impacts, and offers extensive flood impact data (deaths and economic losses) via the third URL above.

http://www.nws.noaa.gov/om
As one might also suspect, the National Weather Service Office of Meteorology Web site is a trove of useful meteorological hazard information. It includes information about the office, notices about the ongoing changes and modernisation of the Weather Service, complete "Disaster Surveys" (evaluations of NWS performance before, during, and following disasters), a list of meetings and conferences, natural hazards statistics, a link to the hurricane watch office, a 1998 disaster map, and a list of the *many* NWS publications and hazard awareness materials available on-line.

http://www.disaster-resource.com
The "Disaster Resource Guide" - both print and Web versions – is a "one-stop catalogue," updated annually, that consolidates and provides indexes to educational, organisational, and vendor resources in the areas of safety, emergency management, and business continuity. The publishers of the guide describe their goal as providing "resources for prevention and mitigation of disaster as well as resources for response, resumption, recovery, and restoration after disaster."

http://www.emergency.cd/
Rick Tobin, author of "Emergency Planning on the Internet, "recently alerted us to a new "game" on the market called "EMERGENCY." Although intended for the general public, this simulation, he states, could be used for training by almost any community or discipline, and he recommends that anyone in the profession take a serious look at this product. A demo version is available at the site above.

http://www.bom.gov.au/hydro/flood/
The Australian Bureau of meteorology web site with links to warnings in force, historic information, river data etc.

http://www.mitch-ec.net/
MITigation of Climate induced natural Hazards, brings together researchers, end users and beneficiaries with a leading involvement in the mitigation and management of floods, droughts and landslides risks. Contains several relevant proceedings and papers.

http://www.hisinfo.nl/index2.htm
HIS system web site, in Dutch but a picture tells a story!

..\..\..\WINDOWS\TEMP\Development of Flood Warning System with a view to Mitigate flood disaster.html

Bangladesh is considered to be a country worstly affected by recurring floods with devastating dimensions exposing the national economy in the hands of nature. Complete flood control in the geographical context, particularly in the deltaic form of Bangladesh is not at all a feasible option. Structural methods of flood protection are neither economically viable nor these are environment friendly. Therefore, non-structural methods are becoming popular in mitigating flood disaster. A good way to prevent/ reduce damages occurred from flood is to develop a Flood Forecasting and Warning System in the affected area. This study aims to fulfil such requirement by the extensive use of GIS, providing spatial information for assessment of flood vulnerability.

4. INTERNATIONAL GOOD PRACTICE STRUCTURED INTERVIEW QUESTIONNAIRE

1 Interviewee details.

1.1 Interviewee name:

1.2 Organisation:

1.3 Job title & description:

2 Flood Warning Roles and Responsibilities.

2.1 Which Agency is responsible for forecasting the weather?

2.2 Which Agency is responsible for monitoring hydrological conditions (flood related e.g. river levels, river flows, tides, surges etc.)?

2.3 Which Agency is responsible for flood forecasting (levels, flows, and impacts)?

2.4 Which Agency is responsible for issuing flood warnings and providing flood information to the following:

- *The public?*
- *Other government Agencies e.g. emergency services, local authorities, military?*
- *The media (TV, Press, Radio etc.)?*

2.5 Which Agencies are involved in responding to a flood by, for example, operating flood defences, providing assistance to flood victims and undertaking evacuation and rescues?

2.6 Does a single Agency take the lead or co-ordinate the activity of all the other Agencies responding to a major flood?

3 Communications.

3.1 What methods are used to issue warnings to the following (e.g. voice messaging, fax, email etc):

- *The public?*
- *Other government Agencies e.g. emergency services, local authorities, military?*
- The media (TV, Press, Radio etc.)?

3.2 How is flood information (e.g. impact and current/forecast flood levels) shared with the:

- Public?
- other Agencies?

- the media?
- within your organisation?

3.3 How are telephone calls from the public managed (e.g. call centres, by operational staff, temporary staff call handlers)?

3.4 How many telephone calls from the public does your organisation receive during a major flood?

- Less than 100
- *100 to 1000*
- *1000 to 5000*
- *more than 5000*

3.5 Do you monitor the number and origin of public calls during a flood?

3.6 How are call handlers provided with the information needed to answer the enquiries from the public?

3.7 How are Public Relations Officers provided with the information needed to answer enquiries from the media?

3.8 How do all the Agencies involved in responding to a flood communicate and share information in order to co-ordinate their response? To what extent does communication technology play a part?

3.9 How are situation reports created and issued?

4 Incident Management

4.1 How are flood warning procedures stored and accessed (e.g. warning trigger levels and criteria)?

4.2 How are actions agreed and recorded, such as the decision to issue a flood warning or operate a flood defence structure?

4.3 How does your organisation manage it's human resources during a major flood, with reference to the following:

- *Identification of competent individuals for specific tasks?*
- *Development of shift working patterns?*
- *Monitoring hours worked during an incident?*
- *Deployment in the field?*

- *Training in systems and procedures in preparation for a flood?*

4.4 How does your organisation know what equipment it has available to respond to a flood (such as loud hailer vehicles and pumps)?

4.5 How is the deployment of equipment tracked and recorded?

5 Data Collected During a Flood Event

5.1 What flood damage information does your organisation collect and report during a flood event? ? For example, flooding of properties and essential infrastructure such as roads, railways, power supplies etc.

5.2 How is flood damage information collected during a flood event, in particular, how is the "number of properties flooded" collected?

5.3 How do you monitor the performance of your flood warning system during a flood event? For example, do you collect the following information during a flood event:

- *The number of people who did not receive a flood warning at all or too late?*
- *The number of people who received a flood warning but did not flood?*

5.4 What information does your organisation display within it's own incident rooms to provide an overview of the flood situation?

5.5 How is this flood overview displayed (wipe boards, computer displays, maps)?

5.6 Does your organisation use technology (video, CCTV, digital photos etc.) to display "live" flood images within incident rooms, to the public or to other Agencies. Please give examples.

6 Post Incident Performance Measurement

6.1 What performance measures do you use to monitor the success of your flood forecasting/warning system (e.g. target warning lead times, number receiving advance warning, number taking effective action?

6.2 What scale of flood would trigger a post flood event report and what is reported?

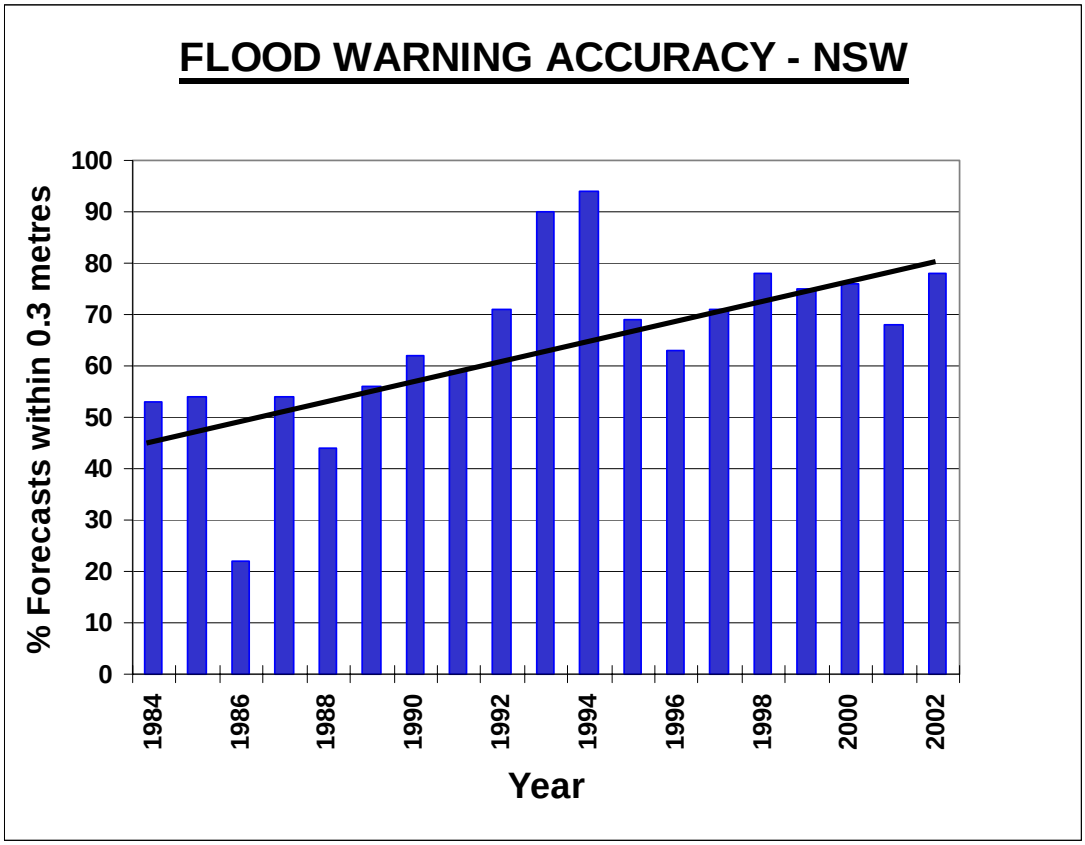
6.3 How is the information contained in post flood event reports gathered and how are the reports created?

6.4 How are the lessons learned from post flood event reports incorporated into your procedures and shared within your organisation?

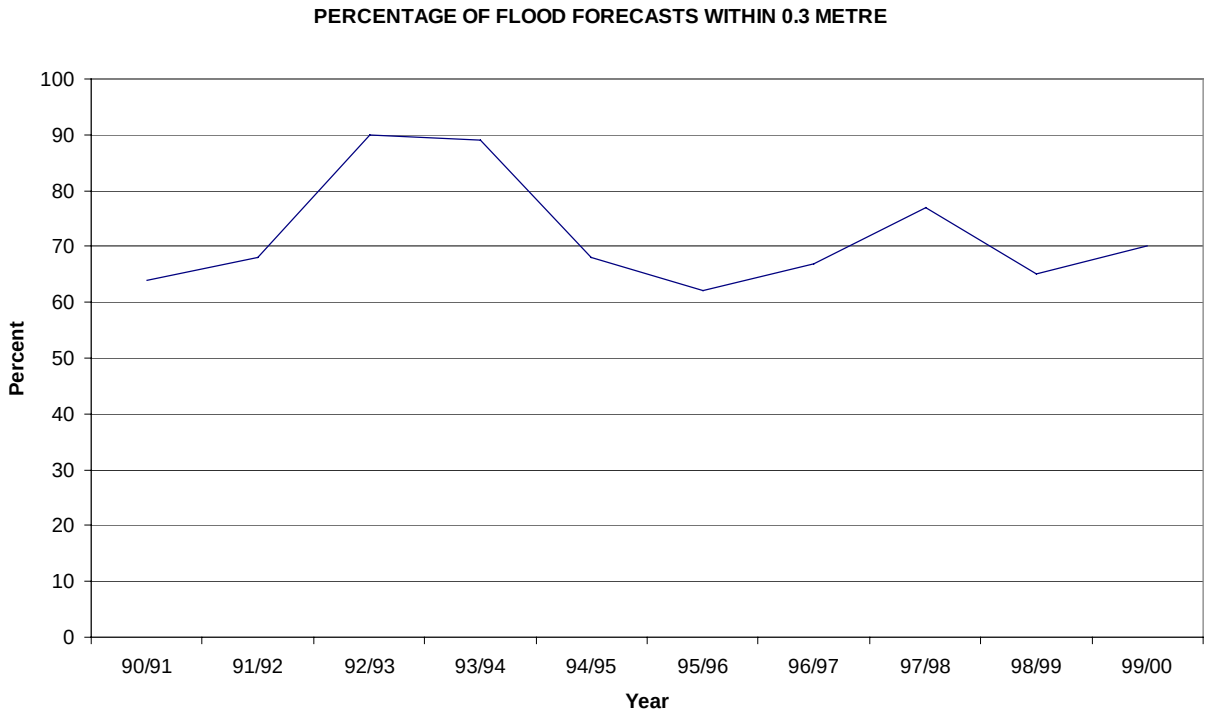
7 Future Proposals

7.1 Does your organisation have proposals to introduce new Flood Management Systems in the future? If so please provide proposed details and timescale.

5. FW ACCURACY NEW SOUTH WALES



Measure of Quality	Target
Percentage of flood forecasts within 0.3m.	75%



The above chart shows the trend in flood warning accuracy over the past 10 years. Apart from the 2 years 1992/93 and 1993/94 when only relatively few floods occurred in the easier to forecast inland rivers, the chart shows a steady trend. This trend needs to be viewed in terms of the natural variability in forecasting accuracy that results from a different set of rivers being in flood during any year and that forecast accuracy varies with the size of the flood. A benchmark for comparison of the current levels of accuracy being achieved can be taken from

a sample of forecast accuracies achieved by the US National Weather Service. Over the period Jan-Sept 1999 the average forecasting accuracy (RMS error) achieved across 5 regions and for a wide range of rivers ranged from 0.4 to 0.8m. Although a different measure to that used by the Bureau, the Bureau data for 1998/99 translates to an RMS error of around 0.4m, comparing favourably with the USNWS benchmark.

6. OSIRIS PROJECT

OSIRIS rationale, motivations and objectives :

Recent catastrophic flood events in Southern and Central Europe (France, Italy, Spain and Poland, Czech's Republic, Germany) have demonstrated the need to change the traditional approach to information dissemination in the critical situations and in particular:

- To increase the ***awareness of the citizens*** concerning inundation risks and to increase citizen's involvment in the prevention and crisis management processes;

- To prepare citizens and crisis managers for ***efficient protection*** and rescue measures during inundation crisis periods;

- To improve the ***quality of information*** made accessible to all flood crisis stakeholders (crisis managers, rescue and civil protection organisations, citizens) before, during and after the crisis period using cutting-edge advances in ICT;

- To increase the rapidity and flexibility of ***access to information*** using emergent information transmission and distribution supports, and to processing information at all levels (central and local) in various locations

OSIRIS Approach

OSIRIS considers all stages of flood risk management:

- preventive measures.

- preparation of action plans.

- river monitoring and overflow forecasting (preparatory stage).

- flood warning.

- measures to attenuate the effects of floods.

- management the crisis situation.

- monitoring the consequences and returning the situation to normal.

OSIRIS will then:

- analyse these stages on different spatial scales, in river basins and associated urban areas,

- use new information technologies to improve the consistency and the efficiency of data flow transmission,

- decision-making and crisis management.

Special attention will be paid to setting up simple but efficient resources for raising awareness of flood risk among residents of flood-prone areas, and building this into their way of thinking

OSIRIS Expected Results

It is hoped to achieve the aims of the project through the following main actions:

Definition and testing of participative educational actions aimed at increasing citizens' awareness of flood risks and the initiatives to take during a crisis period;

Definition and testing of crisis scenarios and emergency action plans aimed at protecting people and property;

Design and development of prototype Information and Communication Management Systems dedicated to :

- basin managers

- operational emergency centres

- citizens and their representatives

These systems will be based on the use of new information and communication technologies (mobile phones, Internet, etc...).

7. ISSUES ARISING FROM "PEAK FLOW"

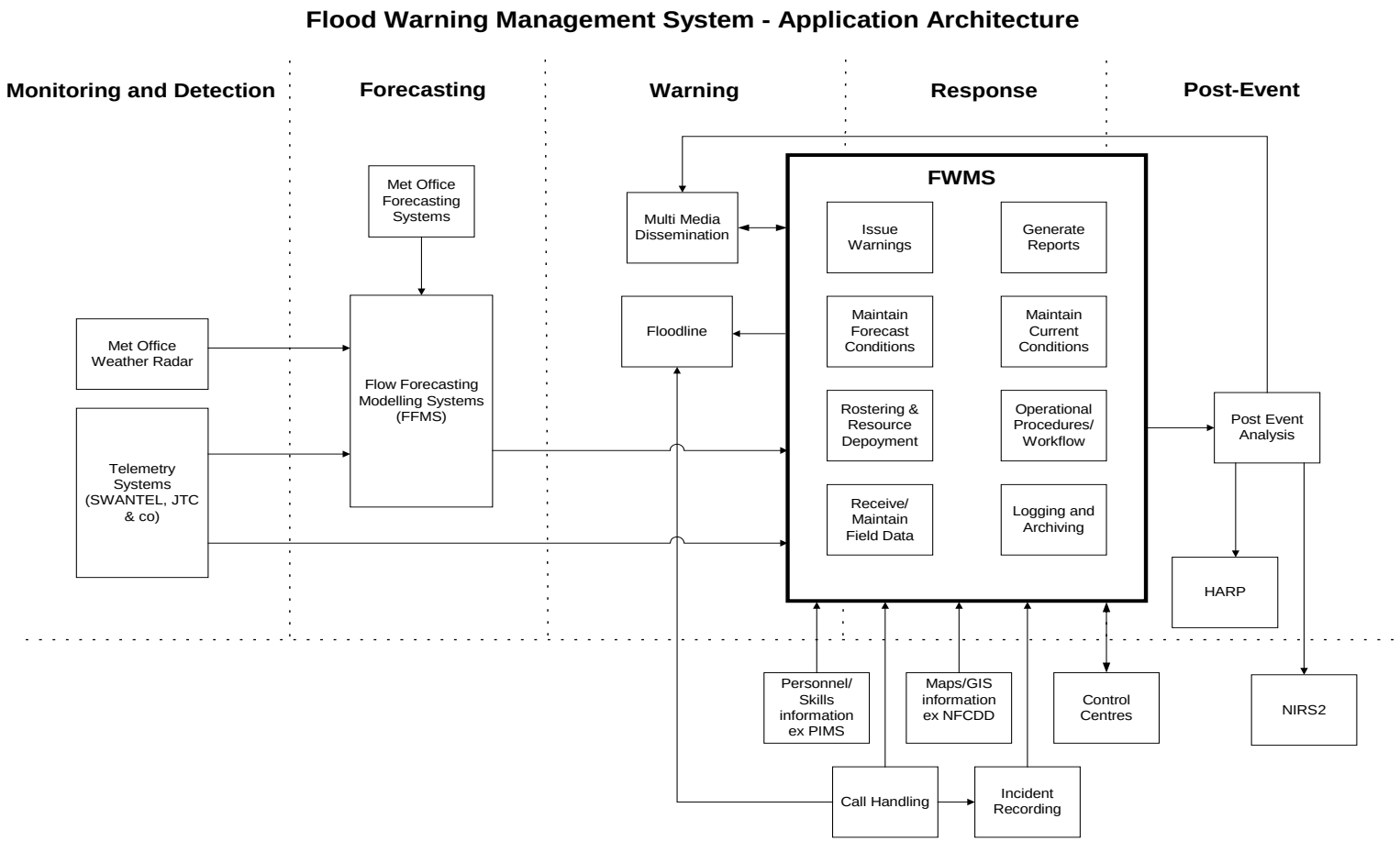
The areas identified by the 74 participants as those in greatest need of improvement are:

- Stand by arrangements - staff shortages.

- Lack of co-ordination during a flooding event.

- Liaison between organisations during an event.
- Lack of resources/equipment.
- Need for updated plans, training and further exercises.
- Public expectations and the need to provide information to the public.
- Lack of funding/finance to prepare and respond.
- Lack of national policy for flooding.
- Poor communications networks.

8. FWMS – APPLICATION ARCHITECTURE



9. INITIAL TARGET NATIONAL BUSINESS PROCESSES

Below is a proposed outline of an initial set of target incident management National Business Processes.

These processes require development and detailed definition to enable the implementation of Option 3. They are also a pre-requisite to the development of a bespoke national system to provide a baseline for business requirements.

It is assumed that the current Incident Management Policy Statement, Generic Incident Management Process Overview and Work Instruction on the management of Major Incidents will form the basis for review and detailed incident management National Business Processes. For now the following general process areas have been used to group potential Target National Business Processes. These general areas are not definitive, but act to logically 'break-up' business processes into potential work packages.

B.1 'Prevention' Processes

Maintain/Upgrade Incident Assets and Equipment – Processes that ensure that assets and equipment central to the management of incidents are kept in a state of good repair and readiness.

Update Incident Asset and Equipment Records – Processes that ensure that asset and equipment records are kept up-to-date regarding descriptions, status, normal location, etc. (These processes might be extended to include possible asset information relating to specialist equipment not owned by the EA but available from another source.)

Track Incident Action Plan Progress and Completion – The process by which recommendations and action plans arising from previous incidents are tracked against agreed time scales and resources to ensure future preparedness.

Maintain Risk Assessments and Reviews– Processes that ensure that Incident Risks are known, accessible and kept under regular review.

Maintain Professional Partner Links and Records – Processes that ensure the communication links and incident organisational roles and responsibilities between the EA and its incident management professional partners remains active and up-to-date.

Maintain Community and Public Links and Records – Processes that ensure the communication links and any agreed incident based roles and responsibilities between the EA and local communities and individuals remains active and up-to-date.

B2 'Preparation' Processes

Conduct Awareness Campaigns – Processes to ensure those who can cause or be affected by incidents have the latest information regarding incident responsibilities and available services.

Train Staff – Processes that ensure the required incident management skills and competencies are transferred to those EA staff who need them.

Maintain Systems and Procedures – Processes that ensure all required incident management systems and procedures reflect agreed best business practice.

Test Systems and Procedures – Processes that ensure that incident management systems and procedures are adequately tested on a regular basis.

Maintain Personnel Records – Processes that ensure staff records accurately reflect up-to-date individual contact information, availability, skills and competencies required or useful during an incident.

Maintain Personnel Duty Rosters and Schedules – Processes that ensure adequate staffing both outside and during the course of an incident.

Maintain Emergency Plans and Contingency Arrangements – Processes that ensure that incident emergency plans and contingency arrangements are up-to-date and effectively disseminated.

Maintain Geographic Information – Processes that ensure that incident management geographic information (maps and map based analysis data) are up-to-date and available to incident management teams.

Maintain Historical Incident Information – Processes that ensure historical information is up-to-date and available to those who need to review it for planning or incident management purposes. These processes will mostly involve the smooth gathering and dissemination of information from 'day-to-day' systems that are relevant to incidents and incident management whilst they occur, thus forming part of the 'current view' of an incident and becoming an important source for any historical analysis, systems and modelling reviews and re-calibration, process reviews, emergency planning, etc.

It will also include the processes by which especially requested incident information, like video clips, aerial photographs or other field data become incorporated into a 'current' view (that is in fact actually 'historical' given inevitable delivery and dissemination time delays) of an incident.

(These are all considered 'preparation' processes, as they ensure the correct information is available to enable incident decisions to be made and responses taken.)

Maintain Incident Condition Rules and Associated Tasks – Procedures that define the framework for the conversion of local potential conditions and advisable tasks into a consistent level of incident management service.

These expert and best practice processes will dictate how actual incident conditions will prompt recommended courses of action and support incident management. Actual incident management will also take into account other factors such as resource availability and task priorities. Where possible, these can also be incorporated into this local view of possible actions.

B.3 'Response' Processes

Open and close an incident – Processes that ensure an incident is recognised by the Agency, is actively owned and managed and is eventually appropriately closed.

Open and close an Incident Room - Processes that ensure the business rules and communications associated with opening and closing of Incident Rooms are defined and adhered to nationally.

Handle Incident Calls – Processes that ensure calls received from the public are handled effectively when related to a new or existing incident.

Disseminate and Agree Incident Forecasts – Processes that ensure that where the Agency is able to create an incident prediction, this information, along with any supporting data like weather forecasts for example, are disseminated to required contacts and where appropriate content, meaning and any agreed actions, are recorded.

Allocate Tasks, Carry Out Tasks and Track Progress – Processes that ensure important incident management required tasks and agreed courses of action are recorded, owned, actioned and that activity progress is consistently tracked. These incident response tasks can vary from incident to incident and from location to location in detail. The challenge will be to determine the generic range that must be defined and managed by incident management National Business Processes.

Request, Transfer and Accept Resources – Processes that define how incident resources can be requested, transferred and accepted between internal or external organisational units.

Track Resource Use – Processes that can track and cost resource use for an incident. When associated with human resources, these processes should make explicit, shift rota, Health and Safety and Lone Worker business rules.

Report Incidents – Processes that define the requirements and cycles of incident reporting at all levels of the organisation, with process flows where necessary to external communication channels and external stakeholders.

Liaison at Incident Control Centres – Processes that ensure consistent practice by Agency staff acting as Liaison Officers at incident control centres.

Create and Disseminate EA Incident Viewpoints – Corporate National Public Relations processes that ensure a consistent approach and standard of dissemination of Agency viewpoints that are considered vital to communicate in the immediate period before, during and after an environmental incident.

B.4 'Clean-Up' Processes

Gather and Record Post-Incident Information – Processes that ensure that information only feasibly gathered after an incident has closed is added to the body of historical information derived during an incident. (See also 'prevention' processes related to updating incident asset and equipment records.)

Analyse Incident Information and Report – The processes by which a national standard of comparable incident information is analysed and any lessons learned, recommendations and action plans are presented and disseminated. These reports should also cover costs incurred and recovery plans if appropriate.

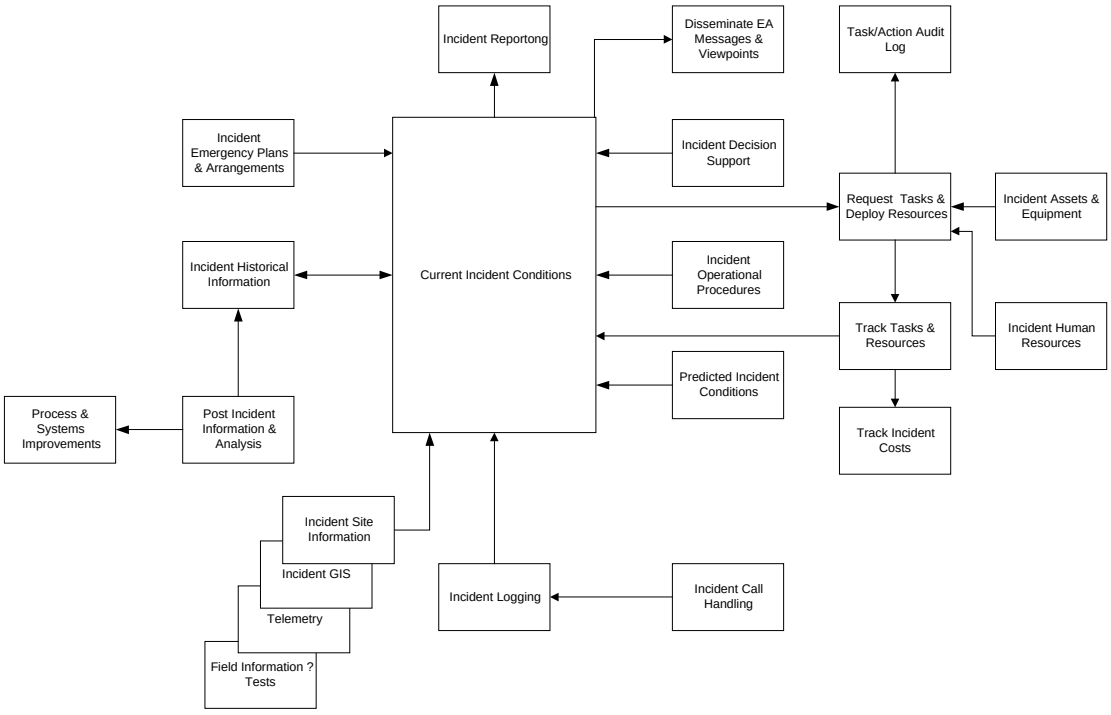
Information Archiving – Processes to ensure information is archived but retrievable, to support operation efficiency.

Work Re-scheduling – Processes that ensure that the effects some incidents can have on the progress of other Agency tasks are identified, agreed, prioritised and re-scheduled to reflect the need to balance outstanding work and targets against resource availability.

10. FWIMS SCOPE AND COMPONENT DESCRIPTIONS

The diagram below is a generic representation of the FWIMS components.

AIMS Components



These components can be generally described as:

9.1.1 Current Incident Conditions

This key component will deliver vital information relating to the current known conditions relating to a potential or actual incident. This will give decision-makers and incident related staff as clear a view as possible of current conditions prevailing in an incident. This component would include:

- The status of any related Incident Room.
- The status of any related emergency Control Centres.
- Current Incident summary and background information.
- Displays of relevant systems data.
- Displays of relevant field data.
- Historical systems and field data as required.
- Specific incident operational procedures.
- Specific incident information received from calls from the public.
- The status of related tasks and resources.
- Information and models relating to predictions of future incident conditions.
- The details of any warnings or messages disseminated by the Agency in relation to the incident.
- Prompts for possible incident related actions and activities.
- Checklists for possible incident related actions and activities.

9.1.2 Incident Site Information

Information relating to the location of an incident and its specific characteristics will form a vital element of incident management. This information could be available from existing Agency systems and sources or will relate to ‘field’ data collected during the incident. This component will ensure that all that is required to help manage an incident ‘site’ will be available to the incident management team.

9.1.3 Incident Historical Information

Where historical information exists that could be of use to the incident management team for reference or modeling purposes, this component will make that information available. It will also serve as the historical archive of the incident as the situation changes over time.

9.1.4 Predicted Incident Conditions

This component will hold the information that relates to the predicted conditions for an incident that have been prepared and disseminated by EA incident forecasters, possibly using incident modeling software. It is envisaged that these predictions will relate to specific incidents, locations, times and will have whenever possible an attendant level of confidence for use in incident decision-making.

9.1.5 Incident Emergency Plans and Arrangements

This component will allow incident managers, staff and systems to access plans, contacts and details of specific incident arrangements to aid the smooth and effective incident management.

9.1.6 Incident Logging

This component will log, prioritise and deliver information that has been received from the public by phone to the relevant incident management team for immediate response or reference.

9.1.7 Incident Call Handling

This component should aim to keep calls directed to Incident Management Teams to a minimum whilst ensuring that useful information relating to an incident is captured for use.

9.1.8 Incident Operational Procedures

This component will allow specific operational procedures relevant to an incident to be both accessed by incident management teams and where appropriate will be embedded in software against a set of incident conditions to act as a parameter for systems decision support and task specification.

9.1.9 Incident Decision Support

This component will relate incident conditions to specified procedures, tasks, checklists etc. to offer incident management teams incident decision support as an active system component.

9.1.10 Request Tasks and Deploy Resources

This component will allow incident management teams to request that tasks be undertaken and that specific resources be deployed from available pools.

9.1.11 Disseminate EA Messages & Viewpoints

Some tasks will relate to the dissemination of incident related messages and the creation and presentation of the Agency's particular viewpoint. This component will ensure that consistent and accurate information of the incident is at the core of those activities.

9.1.12 Task/Action Audit Log

This component will allow agreed tasks and actions taken to be logged against time for analysis and incident audits.

9.1.13 Incident Assets and Equipment

This component will be the ‘pools’ of incident asset and equipment resources that can be called upon by the incident management team.

9.1.14 Incident Human Resources

This component is the ‘pool’ of human resources, with known skills and competencies, availability and schedules for use in an incident.

9.1.15 Track Tasks and Resources

This component will allow incident management teams to track task progress and deployed resources during an incident. Tasks, locations and status will form part of the information that could be requested and displayed in Current Incident Conditions. Health and Safety issues and risks in relation to staff deployed during an incident can be managed by this component.

9.1.16 Track Incident Costs

Where resources have been recorded as deployed during an incident it should be possible to track the associated costs.

9.1.17 Incident Reporting

This component should allow the system to report to standard formats and schedules or allow more ‘ad-hoc’ analysis of incident data. In the case of National incidents, reporting from all levels of the incident management structure can be summarised as required.

9.1.18 Post-Incident Information & Analysis

This component would draw together specific incident measures and allow ‘ad-hoc’ incident analysis of data recorded during an incident or added after an incident is over. Standard analysis should allow incident ‘benchmarking’ and comparative analysis.

9.1.19 Process and Systems Improvement

This component should allow for the on-going business process and systems configuration changes that add improvements to the efficiency and effectiveness of incident management.

11. FLOOD EVENT MANAGEMENT ISSUES AND OPPORTUNITIES

Business Process Ref.	Issue/Opportunity	Requirement	Benefits
Review Weather Forecast	No direct links between Met. Office source and Agency systems	Seamlessly present the current Met. Office weather forecasts in force in an Agency system accessible from home and office.	Costs – current out of hours systems rely on faxes and manual procedures. Accuracy – current process can 'miss' needed facts through manual processes. Speed – So long as an 'alarm' process is in place – needed information can get quickly to the required recipient.
Predict Future Tidal and Fluvial Events	Agency Forecasts during an event are manually delivered and open to misunderstandings.	Record, disseminate and maintain Agency issued forecasts. Log any agreed understandings between Forecasters and Flood Warners. Agency issued forecasts will be time/date specific and will need to be archivable and recoverable.	Costs – current manual systems record forecast details. Accuracy – delivery of forecasts by fax and phone risk missing vital information . Logging of forecast delivery will aid post-incident audit and performance reports. Speed – Required information can be made available to flood warners and others in a timely fashion. Effectiveness – instant availability of Agency forecasts means more time can be spent on the other aspects of decision making the forecast may require, which should help a better delivery of service.
Review Telemetry Based Alarms	Different telemetry systems across Agency regions will make integration into a National Agency Incident Management System more costly and risky.	Standardisation of telemetry system data interfaces and presentation in NFWIMS where needed.	Cost – Users need only be trained in the NFWIMS Telemetry functionality. Speed – Telemetry data can be presented in context with other factors without needing to consult separate systems or have separate IT skills. Accuracy – Telemetry conditions in force can be accurately matched to timings of warnings given. Will aid post-incident analysis and performance reviews. Effectiveness – Telemetry data presented in context can aid decision making.

Business Process Ref.	Issue/Opportunity	Requirement	Benefits
Define Incident Background	An opportunity to standardise 'headline' incident classification.	Formalise incident 'headline' data to aid summary reporting and dissemination of initial incident factors. 'Headline' data will define the basic parameters and background of the incident, e.g. Area Name, Incident Start Time/Date, Conditions At Incident Start, etc, 'Headline' data may be added over time as it becomes known.	Costs – Incident background information forms part of the current manual reporting requirements. Could be automated. Accuracy – standard data will allow for comparison and trend analysis. Speed – 'Headline data can be communicated quickly internally and added to as more data becomes available. Effectiveness – Incident headline data can be disseminated beyond the Agency to meet customer needs and aid decision making.
Maintain Flood Incident Warning Summary	An opportunity exists to record, disseminate and present 100% accurate details of warnings in force and associated details. Current Intranet and Internet attempts to maintain an event warning summary do not seem to meet Agency needs.	Record, disseminate and present 100% accurate details of warnings in force and required associated details. Flood Warnings should be 'time/date' specific and thus archivable and recoverable.	Cost – Current manual systems are employed to collect and present this data in Incident Rooms at all levels, around the Agency and in Situation Reports. Automatic recording, dissemination and user friendly presentation methods will greater reduce current efforts. Accuracy – from data source the dissemination of warning data will enable a 100% accurate summary to be maintained. Speed – Warning summary data can quickly be disseminated and presented to numerous internal and external customers in a variety of ways, including required regular reports. Effectiveness – up-to-date warning summary information and associated details will aid incident management at all levels and will help meet customer information needs.

Business Process Ref.	Issue/Opportunity	Requirement	Benefits
Maintain Current Fluvial and Tidal Information	An opportunity exists to present a shared view of an incident. Current practice expends a good deal of effort on knowing 'what's going on'.	Create, disseminate and present a comprehensive view of an incident that can form the basis of a shared view for both decision making and communication needs. All 'Current' information is best viewed as an instantly 'historical' source i.e. 'time/date specific, that should be archivable and recoverable.	Costs – present current incident information automatically and reduce existing manual systems. Accuracy – information can be presented in a way that will be consistent and comparable. Speed – users can have up-to-date information as available. Effectiveness – Shared data will aid incident planning, decision making and awareness.
Collect Field Data	Opportunities exist to use more electronic means to submit field data, record it within a system and disseminate it to support incident awareness and decision making. Logged field data can support post-event analysis.	Submit and capture field data to a system that can disseminate and present field data to internal and external customers during an incident. Field data must be archivable and recoverable.	Cost – Currently, only field data phoned in is used to aid decision making. This is not easily disseminated. Written data is captured at a later date and only used for post-event analysis. Accuracy – Technology can help to accurately geographically position a data source and thus aid understanding of what is happening during an incident. Speed – 'on-the-spot' data can be quickly disseminated to aid awareness and support decision making. Effectiveness – Data supporting telemetry readings and subjective 'eye-witness' accounts can aid decision making and service to customers. Integrated field data can help in post-event analysis and staff training exercises.

Business Process Ref.	Issue/Opportunity	Requirement	Benefits
Collect Call Based Information	There is an opportunity for an Agency National business process and supporting call technologies to ensure incident information submitted by phone is logged and routed to an appropriate owner.	An National incident call logging and routing process and technologies to ensure incident information reaches an appropriate owner.	Cost – system logging rather than paper logs will cut current manual costs. Accuracy – capture of consistent incident core information and caller data will aid service, response and reporting. Speed – Priority calls can be placed at the top of call or task stacks immediately. Effectiveness – A consistent approach will aid incident management, planning and help improve service and service perceptions.