FLIWAS: FLOOD INFORMATION AND WARNING SYSTEM

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ABSTRACT

In the Interreg IIIb funded project NOAH project partners from the Netherlands, Germany and Ireland joined forces to improve information transfer during high water events along rivers. Main objectives of the project are development and implementation of an automated high water information system called *FLood Information and WArning System (FLIWAS)* and involving the general public in high water issues.

FLIWAS is a new, advanced information system for flood time management. The objective of FLIWAS is optimal flood preparation. The system provides, to the parties concerned, access to current and relevant information in the event of a flood (threat). FLIWAS is intended for the water column as well as the POS column (public order and safety).

FLIWAS can be used by means of the Internet. For water managers, this is a tool to manage, counteract and monitor floods as best as possible. FLIWAS enables managers and functionaries in disaster management to make timely, well-founded decisions about (emergency) measures in the event of flood (threat).

All key users are given insight into the forecasts, are able to look at the current situation and are able to initiate and monitor the execution of measures.

In addition, FLIWAS supports (crisis) communication with the public and the media in order to provide them with the correct information.

A part of the development of FLIWAS is the implementation of the system, which includes a training programme and a run-through exercise. Initially, FLIWAS will be implemented in a limited number of coastal and river regions in the Netherlands, Germany and Ireland. The system will subsequently become available for general implementation.

The paper presents the concept of FLIWAS including use of measurements, forecasts and emergency plans and how FLIWAS can contribute to the problem of flood and emergency management in the Mekong Delta.

BACKGROUND

Along the North West European rivers many organizations are responsible for water management issues. In general, high water management consists of different stages, with different actions and responsibilities involved. In fact, in all Western European countries, the same type of hierarchic structure towards water management exists, which can be represented in the following graph (Figure 1).

The graph shows that appointed authorities for water management, such as water boards or municipalities, are in charge during times of normal water levels. They are responsible for day-to-day maintenance of water works, for planning and preparation of flood scenarios and measures.

During a period of rising water levels, these authorities remain primarily responsible to protect areas against flooding. Decisions whether or not to implement an action or measure during high water and flooding events are made on the basis of the available information. This means that such information has to be as reliable as possible. Ideally, this is the case up to the calamity level, when a higher authority takes over the responsibility and calamity plans are effectuated.

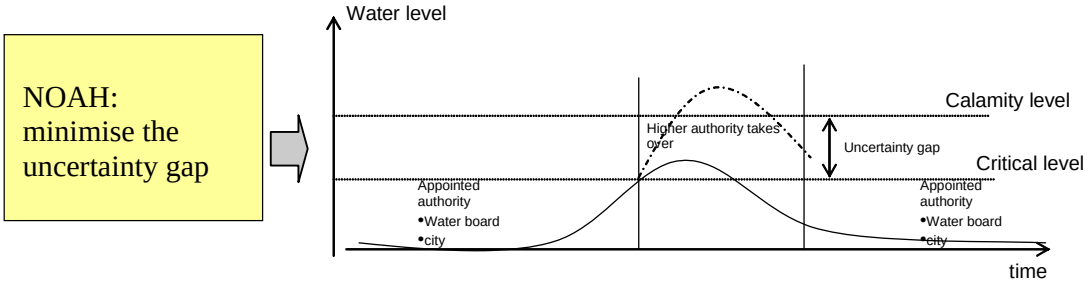

Figure 1. Responsibilities during high water event

Recent flood events and high water periods in different North West European river catchments (e.g. Rhine, Elbe, Scheldt, Maas) have emphasized that it is very important that measures and actions are taken at the right place and at the right moment. The 'von Kirchbach-report' on the floods of the Elbe in 2002 shows that information was available but did not get to the right place, or not in a useful form. We also learned that a large amount of information is exchanged, both within and between organizations and with the general public and media. As a result of stress and complexity during calamity situations, this information flow is often uncontrolled, not in time or unreliable, thus raising feelings of uncertainty at decision maker level and with the threatened population.

As a result, the higher authority often already takes over at the critical level. Because of its nature, the critical level is subjective, and depends on actual or predicted water levels, status of the water works and measures taken and, of utmost importance, the availability and reliability of the right information. This means that measures and actions (e.g. evacuation) could be taken unnecessary, resulting in avoidable risks and damages. Although an actual catastrophe may not occur, the impact and costs can still be considerable, not to mention the responsibility claims between the involved governmental organizations after the event and, very important, the loss of trust of the general public in their water managers.

NOAH

Information transfer is identified as a key factor in modern and dynamic water management. And the human factor in operational flood management constitutes a significant risk regarding effective information transfer. It is acknowledged that the use of automated tools for operational flood management such as prediction and warning, but also for action monitoring, communication and post event evaluation can reduce this risk. By using computers for what they are good at (storing information, handling predefined procedures), humans can focus on what they are better at: dealing with unexpected developments and making decisions based on incomparable criteria and data. Therefore, automation of information management can lead to a significant increase of safety and reduction of damage and personal risks caused by flooding.

Within the EU-Interreg funded project NOAH, partners from the Netherlands, Germany and Ireland (Figure 2) joined forces to develop and implement such an automated tool, calamity and evacuation plans and to increase public awareness of the advantages and dangers of water in the neighbourhood.

The project addresses the information and communication issues encountered in actual high water situations and will bridge the uncertainty gap between early warning systems and calamity plans. Information management will be supported by development and application of a new, innovative and generic information system designed for use in a multi actor environment called FLIWAS (FLood Information and Warning System). FLIWAS will be available and accessible for all key players, focused on short notice dynamic actions and reduction of uncertainties in high water management.

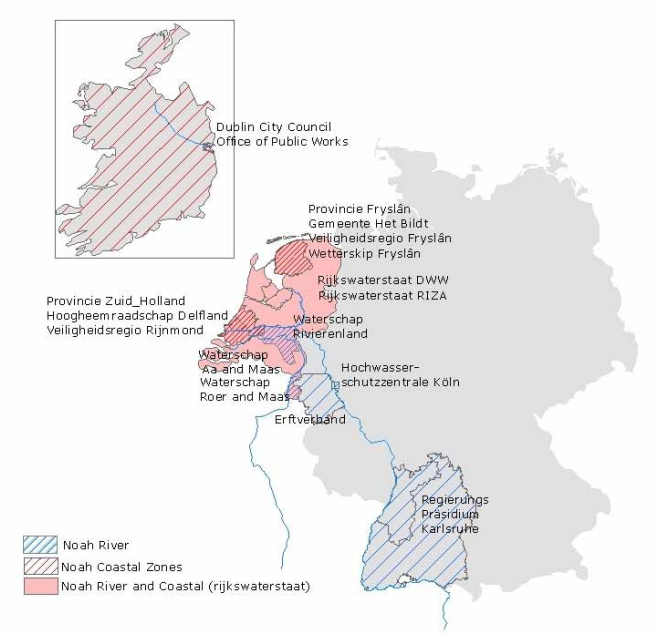

Figure 2. The NOAH project regions

DEVELOPMENT OF FLIWAS

The concept of FLIWAS is developed in close co-operation with end users. Starting point was the knowledge of and experience with local prototypes in Germany 'Hochwasserinformationssystem zur Gefahrenabwehr' (HzG) and 'Hochwasser-Informations und Schutz-System' (HOWISS) and the Netherlands 'Geautomatiseerd Draaiboek Hoogwater' (GDH). During workshop sessions users from the project regions were invited to submit their wishes and demands. This resulted in the overall functional design for FLIWAS.

FLIWAS builds upon existing measurement and flood prediction systems, geo-info, alert plans, flood risk maps and calamity scenarios. All relevant information of these building blocks will be bundled and made available through an internet-oriented Geografic Information System (GIS) based application. This will be structured in such a way that decision makers, water management and calamity professionals as well as private companies and the public will receive all relevant information, optimised for their needs, accessible at their level. The modular design of the information system enables organisations to install only the needed functionality. Authorisation using user profiles provide the users only the functionality and data needed for their role. After an intensive coordination effort with other ongoing projects, NOAH was able to incorporate other initiatives as well, such as the Dutch High Water Information System (HIS), which is being developed by Rijkswaterstaat/DWW (part of the Dutch Ministry of Transport and Public Works). Close co-operation with the program 'Verbetering Informatievoorziening in Nordrhein-Westfalen en Gelderland' (VIKING) (Province of Gelderland and Nord-Rhein Westphalia) ensures that the communication to the calamity management organizations (police, fire-brigades) is optimised. The main functionality of FLIWAS is:

- *monitoring*
  Monitoring the high water situation on the river using available measurement information and forecasts. The information can be in different ways using reference levels. This information will be used to initialise actions to protect areas against flooding (Figure 3);
- *protection against flooding (for structures and embankments)*
  Setting up plans for structures and embankments to protect areas and cities against flooding. Initialising and monitoring measures, predictions and actions based on warning stages and direct communication to all involved staff;
- *dike analysis module*
  Calculate the strength of embankments at specific (critical) circumstances (Figure 4);

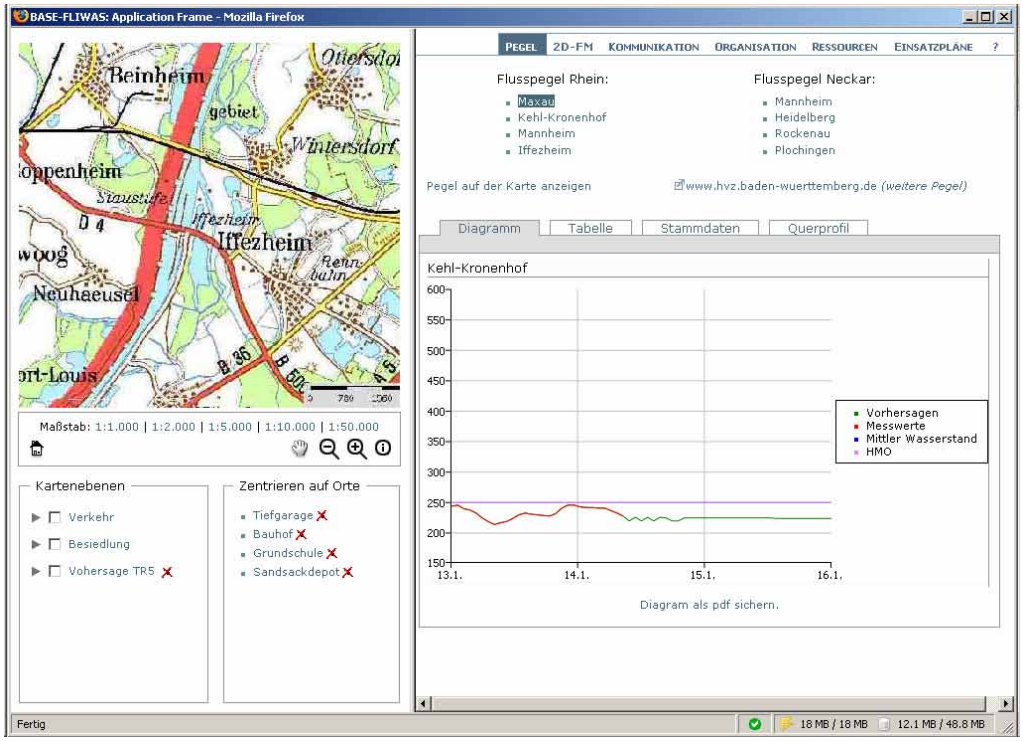

Figure 3. Monitoring measurements and forecasts of gauge Maxau

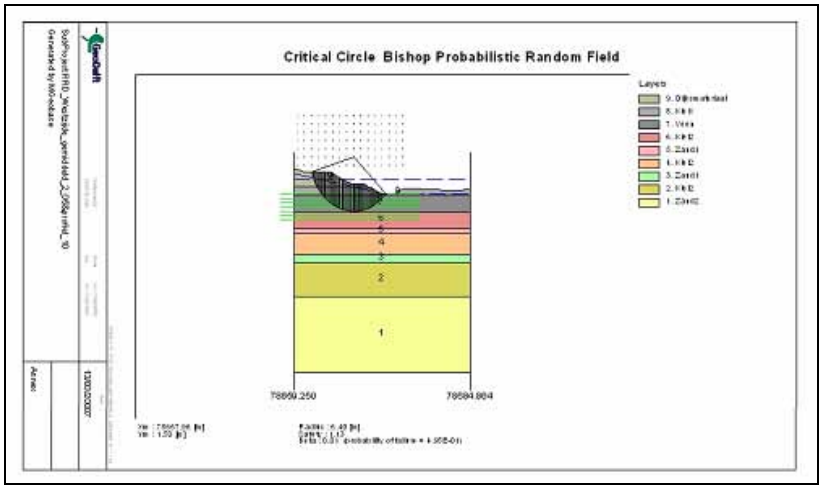

Figure 4. Graphical presentation of the results of a calculation of the Dike Analysis Module

- *evacuation*
  Designing of evacuation plans in advance and assisting during the execution during calamity situations, using results of the 2D-Flooding model and a traffic-model, data of geographic maps, population distribution and infrastructure. A decision about evacuation has to be taken after signals from the High Water Protection-model;
- *evaluation*
  Use FLIWAS for the evaluation of a high water period using logged data to improve calamity and evacuation plans and train users (Figure 5).

Some general features of the system are its ability to communicate automatically with key staff, its workflow function to control execution of actions and its logging module.

FLIWAS will be multi lingual (initially English, Dutch, German) and represent the state-of-the–

art in management and decision support systems for flood management. It will enable water managers in crisis situations to decide on the basis of real-time and reliable data, thus reducing the uncertainty gap. This will help solving the question of responsibilities, which rises during calamity situations.

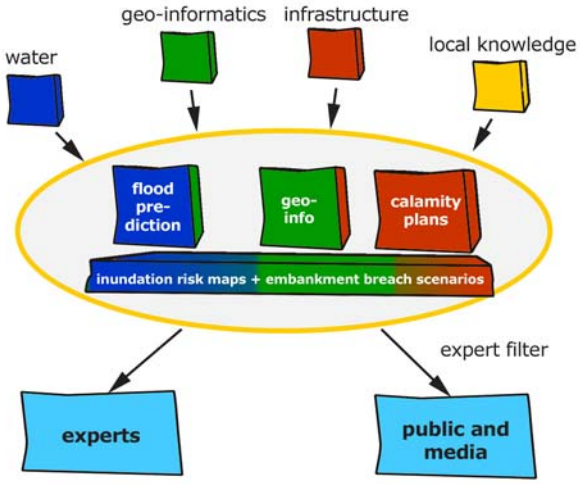

Figure 5. The structure of FLIWAS

The development of FLIWAS has started in autumn 2005. The first modules are ready for implementation at the project partners in summer 2007. According to the actual planning, the building of FLIWAS must be completed by autumn 2007.

USE OF FLIWAS

FLIWAS is a generic system. The input to FLIWAS customizes the system to the organization that uses it. FLIWAS enables organizations to implement their own calamity plans and basic data on one hand and to structure the information and initiate actions during events on the other hand.

FLIWAS will be used to define calamity and evacuation plans, resources and geographical data, to test plans and to evaluate previous events. Appointed users will define high water stages or threshold limits, determine actions needed for those stages and link actions with responsible persons and necessary auxiliaries by a duty roster. The way actions are initiated and communicated (e.g. by phone, fax, e-mail or SMS) is also determined.

During the high water season or during a high water event the system is in an operational mode. Information such as telemetry data, water level forecasts or rainfall predictions are used to determine the phase in which a monitored object is, related to threshold values set by the administrator of the system. If a threshold is exceeded, the system will inform the user and suggest going to the next stage. If the user decides to accept, the system will initialise actions predefined for this stage. The system will then monitor progress and log the actions on completion.

Each user has restricted rights and will have access to the functionality and information that is relevant to him/her. As the system allows data import during high water events, it will always display the latest status of the situation on the ground. Ad hoc actions may be imported too. For decision makers this kind of reliable information is very important; it helps them to decide on the actual safety situation.

FLIWAS runs on one or more web servers. On client PCs, PDAs and palmtops FLIWAS is accessed through a graphical user interface, using a web browser. For the communication between web server and clients the Internet or an intranet is used. If this infrastructure is not available because of the calamity situation, FLIWAS can still be operational. To enable stand-alone operation the data (geo-data, calamity plans and evacuation scenarios and operational data) can be mirrored to a local system. If communication fails, FLIWAS can still be used on the local system. As soon as the network becomes available again the data of the local system and the web server are synchronized and the

system will switch to the central system.

Although FLIWAS is still under construction, the project partners have already started preparations for the implementation. Existing calamity plans have been evaluated and have been strongly improved during the process. Also basic (geo) data is gathered and fed in databases that will be used to feed FLIWAS.

Starting summer 2007, FLIWAS will subsequently be implemented at municipalities and district offices in Baden Württemberg, the Hochwasserschutzzentrale of Cologne in Germany, five water boards and two provinces in the Netherlands, the City Council of Dublin and Office of Public Works (OPW) in Ireland. Users will be instructed and trained in the use of the system. Management, maintenance and support for FLIWAS will be organised.

When the system is operational, a full-scale exercise will be held, starting at the upper Rhine region, then Cologne and ending in Gelderland, the Netherlands. The exercise will involve operational management and full crises staff. International observers will be invited.

PUBLIC AWARENESS AND INVOLVEMENT

Another important issue the project addresses is the increasing demand of the general public for reliable and unambiguous information. From recent high water situations (e.g. the Elbe flood) it is known that the public was informed by several authorities and the media in a diffuse way, leading to uncertainty and unwanted actions like provisional evacuations. Within the project, instruments are developed and implemented to inform and actively involve the general public on high water issues. By a public interface the general public has direct access to approved information in an understandable way on a separate server.

In NOAH, the concept of flood partnerships is applied. In flood partnerships all relevant stakeholders in a community, such as the city council, entrepreneurs, NGOs and inhabitants are brought together. The idea is that in this setting the interests of all parties are identified and looked after and that information transfer is simplified. By providing and using additional information on flood risks the required and desired protection level of inhabitants and companies in high-risk areas can be determined and communicated.

If they receive more information and are more knowledgeable, people living in flood-prone areas can be expected to take on a higher level of responsibility for their situation. For instance, they may change the interior of their house in a way that reduces the impact and costs of flooding (e.g. stone floor covering instead of carpet or wood) or they can take precautions to keep the water out. By establishing flood partnerships in adjoining areas along the Rhine the required and much needed awareness of the risk of high water and flooding will be created or increased. This meets ICPR demands to increase the own responsibility of people living in endangered areas

Flood partnerships will also become important information channels to introduce the information system FLIWAS and make it accessible to a larger public. We expect that flood partnerships and the general public as well as media will be involved in the full-scale exercise in 2007. In Baden Württemberg, the first flood partnership was established in the city of Au am Rhein on 11 November 2004 (Figure 6). The following experience has been gained until so far.

To guarantee a continuous and exhaustive participation, a so called moderator, which will be an acknowledged person of an administrative institution or a mayor within the partnership, will organize and invite to annual local events. He will also act as a regional contact person.

The spatial division of flood partnerships has proved to be one of the most difficult challenges. The participants need to identify with the name of the flood partnership. Naming flood partnerships according to the most important rivers could lead to the result, that basically only the local authorities along those rivers take part at the meeting. Therefore it is recommended to name the partnerships according to the catchment or at least add the word ‘catchment’.

Expanding the flood partnerships to boarders of local districts can resolve in problems, too, as those boarders normally don’t have a relation to the river-catchments and thus no relation to the catchment specific problems and common concernments. This problem seems not to occur in flood partnerships along the main rivers like the rivers Rhein, Neckar and Donau.

Figure 6. Start of the Flood partnership in Au am Rhein

In the scope of the constitution of the flood partnership, general information on current regional and national topics should be given to the participants. In coordination with the local moderator, a discussion should be initiated to get more information about special regional interests.

For succeeding meetings, the suggestions of the participants will be picked up and discussed, as this is another basic requirement for a continuous participation. Furthermore, it is essential to develop a continuous thread within the meetings and to achieve concrete results and materials for the target group.

The approach to FLIWAS within the project NOAH and the flood partnership Nördlicher Oberrhein could be taken as an example for future flood partnerships with the aim, to assist local authorities in working out or revising their alarm- and action plans and prepare them for an uncomplicated migration to FLIWAS.

To achieve the aim, to assist local authorities in an adequate way, specific topics (e.g. alarm- and action plans) will be intensified in cooperation with the local moderator and the participants as well as with support of the local authorities during a number of meetings. The sequence and content of these meetings may vary according to the topic and the progress within the flood partnership. The independent implementation of the discussed topics between the meetings by the municipalities is a basic requirement, to achieve a noticeable progress.

The motivation of the municipalities for an active participation will be achieved by a facilitation of the implementation of obligations (e.g. setting up alarm- and action plans) and necessities (e.g. information for the population) as well as with comprehensive information. Another important factor is to provide a platform for the municipalities to discuss specific regional problems according high water with the participating local authorities. Providing standardised materials such as forms, documentations and informative literature will safe expenditure of human labour within the municipalities and lead to a continuous quality, as the essential part of the work will be centralized. As an example, specific forms, tables and sheets for the preparation of alarm- and action plans could be worked out, to fill in actions, contacts, locations and many more information that can be automatically linked. This will allow an uncomplicated import to FLIWAS at a later date.

The flood partnerships will also lead to a general increased awareness for the necessity of high water precaution within the population. Beside the already mentioned topics that are mainly targeted at municipalities (e.g. risk maps, amendment of the water law), it is also intended, to provide information and materials for the municipalities, to organize and carry out own information events for their population. Appropriate topics are e.g. secure storage of oil in flood prone areas, protection of objects, private prevention and risk insurance.

Therefore posters, flyers, exhibitions and multimedia content could be worked out and provided for the municipalities. These information events could be accompanied by interactive events for the population, e.g. competitions in filling up sand bags or building up mobile defence works together with the local fire-department (Figure 7). This kind of events has proven to be powerful instruments to interest and involve people in the meetings. These also provide a welcome publicity for the municipality itself. It is recommended to involve local and supra regional press.

Figure 7. Competition in filling sand bags