



**CABRI – COOPERATION ALONG A BIG RIVER:
CABRI-Volga Expert Group Meeting
in Nizhniy Novgorod, Russia, on 28-29 September 2005**

Expert Group 3: Natural Resources & Their Sustainable Use

**Konrad Störk:
Flood Protection and Flood Damage Mitigation
Experiences and Policies of the Water Resources Administration in the Federal State of
Baden-Württemberg, Germany**

1. Introduction Baden-Württemberg

Fig. 1 Germany / Europe

Germany occupies a central location in Europe. It covers an area of 360,000 km² and has a population of 80 million. The average population density is 225 inhabitants per square kilometre.

Although the country is heavily industrialised and densely populated, the area covered by building developments and traffic infrastructure is only some 12% of the total area. 59% of the total area is utilised for agriculture and 30% consists of forest.

Germany is located in a temperate humid climatic zone. The mean annual rainfall is 760 mm. This figure varies between low-rainfall areas with 500 mm only and the Alps with up to 2500 mm.

Fig. 2 16 States of the Federal Republic of Germany

Fig. 3 River Systems in Germany

Germany is a federal country with 16 federal states, one of which is the state of Baden-Württemberg:

Population: 10.5 million = 13% Germany
Area: 35,700 km² = 10% Germany

The state of Baden-Württemberg is subdivided into 4 Regional districts, each of them having a Regional District Authority. The city of Stuttgart is the legal seat of the State Government, the State Departments and one of the Regional District Authorities. District of Stuttgart:

Population: 3.9 million
Area: 10,600 km²



2. Administrative Structure and Collaboration in Water Resources Management (Fig 4)

2.1. Collaboration of the Federal and the State Governments

Germany has a federal structure, which means that governmental tasks are shared between the federal and the state governments. The constitution lays down that concerning water resources the federal government has the right to issue framework regulations. The state governments then have to fulfil these frameworks by passing their own state legislation, and they are also entitled to add supplementary regulations.

Enforcement of all statutory regulations concerning water resources, including federal legislation, is the responsibility of the state governments.

2.2. Administrative Structure and Water Resources Administration in the State of Baden-Württemberg

Only the state governments and local authorities (cities, districts and municipalities) are responsible for the enforcement of water resources regulations. The water resources administration in Baden-Württemberg reflects the three-level structure of the state administration in general.

Highest Level: Environmental Department with a section for Water and soil.

Tasks: Management of water resources administration and general administrative procedures.

In order to reach a consensus on general concerns and for the administration of statutory water resources management instruments, the topmost authorities of all the federal states of Germany have amalgamated to form the joint states working group for water resources (LAWA).

Middle Level: Four Regional District Authorities, each of them with a section for pollution control and water resources management.

Tasks: Water resources management on a regional basis, significant legal procedures in this sphere, administrative procedures, counselling services, funding of water resources measures taken by cities and amalgamations of cities

Functions: Addressing problems, reaching consensus, taking decisions, integration between municipalities, joint consideration of common concerns.

Lowest Level: This level is formed by 35 districts and by those 9 big cities which constitute districts on their own.

Tasks:

- process water resources legislation, provide specialist advisory services, monitor surface waters and affluent run-off into these
- ground water protection, water supply
- sewage/waste water disposal, protection of surface waters
- waste management, waste treatment techniques
- surface waters, hydraulic engineering, flood protection
- land protection, restoration of contaminated sites



Water supply and sewage disposal are part of the **tasks** of the **municipalities**. In order to cover for this costs the users have to pay contributions and fees to the municipal administrations. They are responsible for the preservation of smaller surface waters which they own.

In Germany, **associations** play an important role. Usually voluntary but in part also set up by the Federal State, they are amalgamations of municipalities regulated by contracts. Their task is to manage specific water resources problems exceeding municipal boundaries, e.g. water supply, sewage treatment, preservation of surface waters and flood protection.

3. Objectives and Strategy of Flood Management in Baden-Württemberg

The experiences of several extreme flood events of the past 10 years and the following discussion have led to three important findings:

- Flood events are natural and cannot be avoided.
- Due to settlement and high-class use of flood endangered valleys, natural floods become disastrous events causing high material damages and threatening humans in their living environment.
- There is no absolute flood protection. The protection by technical measures is limited by technical or financial constraints and is only sufficient up to the planned limit, i.e. the design flood¹⁾. There will always be larger run-offs and higher water levels against which technical measures do not provide protection any more.

¹⁾ Design flood: The flood event which is used in order to design the flood protection plant: maximum run-off in a certain recurrence period for which a structure is dimensioned.

From this, also in Baden-Württemberg two important consequences have been drawn:

- It is not primarily important to influence the flood. The most important objective of all flood protection measures is rather to reduce the damaging effects of flood events.
- The task of reducing flood damages is by far more complicated than the former task of hydraulic engineering which was to provide for technical flood protection. To prevent flood damages requires an organised, well-aimed and integrated co-operation of many different partners of administration and society.

Three sub-strategies in order to achieve the objectives

In principle, the largest possible damage mitigation can only be achieved with the combination of the three sub-strategies.

- **Management of flood endangered areas and management of catchment areas** aims at a surface use which is adapted to the flood danger and at increasing the water retention in the catchment area.
- **Technical flood protection** prevents damages up to the design flood.
- **Flood damage prevention** reduces, beyond this, damages also during more extreme events.

Three sub-strategies in order to achieve the objectives

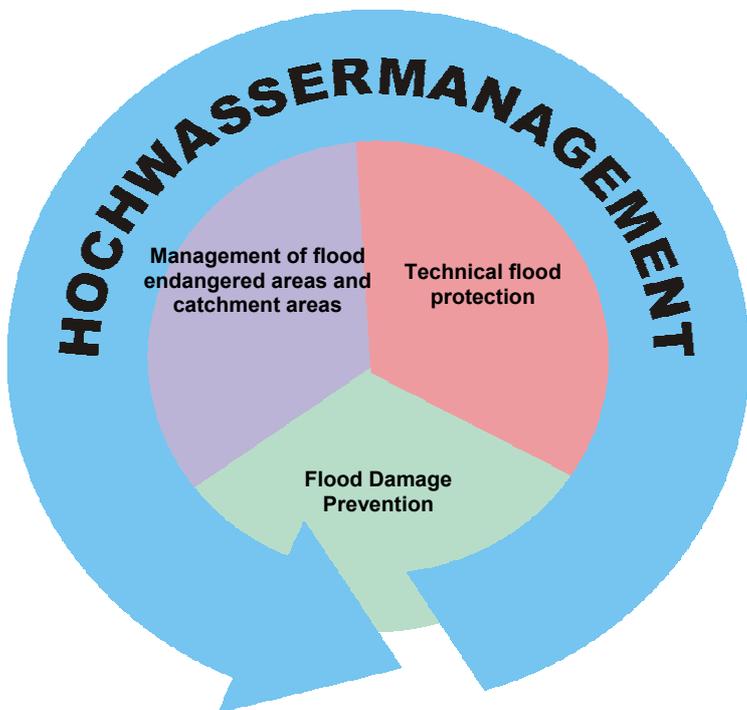


Fig 5 Flood Risk Management in Baden-Württemberg

1. Management of flood endangered areas and catchment areas:

Land use control

- Surface-related information about the flood hazard (Flood hazard maps)
- Planning-related and legal safeguarding of the flood-endangered areas against high-class land use
- Adapted use of flood-endangered areas

Water retention in the surface

Preservation and restoration of retention areas and soils enabling seeping

2. Technical Flood Protection:

Construction of dams, dykes and water retention basins, river improvement and flood-proofing measures according to the present risk potential

3. Flood Damage Prevention:

Flood proofing constructions

Adaptation of construction type and equipment of buildings according to the flood risk – "living with the flood"

Flood preparedness

- Flood alarms in good time and well-planned action before and during flood in order to reduce damages
- Drawing-up alarming- and action plans

Risk Prevention

Financial prevention by means of savings and insurances

Management of Flood endangered areas and Catchment areas - *A river needs space!*

By Management of **Flood endangered Areas and Catchment Areas** we understand the adjustment of the land use which is necessary in order to reduce the damage potential (surface prevention). Furthermore we assign all measures in the catchment area serving to influence the development of flood (water retention) in the surface to this sub-strategy.

The valleys must, as far as possible, be kept free from additional flood-endangered structures. No additional damage potential and no need of additional technical flood protection measures should be caused. This serves also the purpose of keeping the rivers as living spaces and lifelines of the landscape, as far as they still exist, and of recreating valuable biotopes.

The focus within land use control is on regional planning and development planning. These are responsible for classifying priority areas, reservation areas and reference areas for flood-endangered areas.

Technical flood protection – *There is no absolute protection!*

Technical flood protection remains an important task in order to reduce the damages in the already settled flood-endangered areas.

Only technical flood protection measures should be realised which can be justified economically, are sufficiently effective as well as compatible with ecological concerns or minimising interventions. This must be proved by the planning. An appropriate requirement list for the contents of flood protection planning in Baden-Württemberg is being compiled at present.

Flood Damage Prevention (Fig 6)

Technical flood protection must always be accompanied by **Flood Damage Prevention**. Flood Damage Prevention is composed of **flood proofing constructions, flood preparedness and risk prevention**. In the case of flood it helps to mitigate damages considerably.

Warning and action planning of cities and municipalities is an important instrument of **flood preparedness** for risk defence and disaster control. Warning and action planning is supported by two institutions which become active in the case of flood:

4. Initial situation and procedure of the water management administration Baden-Württemberg for co-operation with external partners

Like many administrations in other States, also the water management administration in Baden-Württemberg has been facing, for some years, problems and challenges:

- Rising variety, complexity and dynamics of the tasks;
- Permanent and increasing scarceness of resources;
- Outsourcing, privatisation of tasks;
- Increasing dependence of the administration on their respective external and internal conditions and partners.



In order to implement the integrated strategy for the improvement of flood protection and flood damage prevention, therefore the following is necessary:

- Much more than so far it is necessary to focus on finding, activating and co-ordinating external potentials for performance and support with various partners. A high degree of independence must be accorded to the partners as participating parties.
- For this purpose, specific demands have to be made to the water management administration as well as to the methods and instruments which are used:
 - recognising new, interlaced action conditions (developments, challenges, risks, chances).
 - strengthening of information, objective imparting and stimulation directed to the exterior,
 - conceiving of a functioning action program based upon an understanding of tasks enabling consensus jointly with the partners,
 - permanent optimisation of organisational conditions.

In general strategy, communication, co-ordination, achieving consensus, control and monitoring of the achievement of objectives become more important.

The following section presents a project which has been very successfully run in Baden-Württemberg:

5. Guideline for Flood Hazard and Strategies for Flood Damage Mitigation in Baden-Württemberg (Fig 7)

Given this task, the Ministry for the Environment and Transport formed a multi-disciplinary working group at the end of 2000. Group members include representatives of disaster control, municipalities, municipal associations, spatial planning, regional planning associations, the Chambers of Industry and Commerce, the insurance industry and water management administration. In addition to the Ministry for the Environment and Transport, the Ministry for the Interior and the Ministry for Economics are also represented. This joint venture confirms the need for interdisciplinary co-operation.

The members quickly determined that flood hazard maps for all relevant areas were urgently needed. As a basis for their work, all parties required hazard maps showing the spread of floods and flood depths for various recurrence periods. In addition, information is required on historical extreme events and threats to surfaces of high-grade use located behind protective devices.

Based on the flood hazard maps covering all relevant areas, it is possible to draw up precautionary and flood damage mitigation plans for the protection of humans and property, public facilities and for securing business and industrial locations. Only those who are familiar with the hazards involved are able to take the right prevention and preparation measures.

Stemming from this basic consensus, the working group drew up the “**Guideline for Flood Hazards and Strategies for Damage Mitigation in Baden-Württemberg**“. All group members agreed on an 11 - point program. By acting together at a preliminary stage, targeted



flood management should be used to mitigate flood hazards as much as possible and to reduce or even completely prevent flood damage. All members support each other through close co-operation and through the inclusion of potentially affected residents, municipalities and of the local disaster control administration together with the fire department and police, the State and regional planning authorities, water management authorities, industry and business as well as insurance companies.

The State government plans to pass a resolution in December 2002 on the principles and guideline which were developed. The following section presents several important agreements contained in the “**11 - Point Program for Flood Damage Mitigation**“:

(1) Sustainable interdisciplinary co-operation and State-wide development of flood hazard maps

Flood hazard maps are to be created across the State to show locations threatened by flood. Information about the hazards to flood-prone areas contained in flood hazard maps should appear in an easy-to-understand form and be presented, distributed and maintained for the long term for the general public. Setting the limits and future procedures for flood-threatened areas should involve the participation of all hazard map users:

- risk defence / disaster control
- municipal and community planning
- regional planning
- insurance industry
- water resources management

The maps show flood hazards for different recurrence probabilities and the flood depths for a 100-year flood event. This information forms the basis for flood prevention measures to be taken within the framework of:

- regional and development planning
- warning and action planning
- the insurance industry
- creating awareness among people affected

The development of flood hazard maps is to take place over eight years by way of a comprehensive plan co-ordinated on a State-wide basis under control of the water management administration. Costs are estimated to be approximately EUR 20 million.

(2) Joint regulations and information from the State government

All regulations for flood damage prevention in endangered areas will be combined and introduced in an interdisciplinary manner by a joint decree on flood protection and non structural flood plain management by the Ministry for the Environment and Transport, the Ministry for Economics and the Ministry for the Interior.

(3) Regulations on handling water-endangering substances in flood-prone areas

The regulations will be improved, especially in housing areas.



(4) Determination of area categories concerning regional planning and criteria and methods for their definition

Within the regional plans, the following area categories concerning regional planning are set:

- “Priority areas for preventive flood protection“, for
 - avoiding of new risks of damage,
 - preserving and activating of natural overflow areas,
 - river development and flood plain re-naturalisation
- “Reservation areas for preventive flood protection“ to minimise damage risks
- Reference areas

(5) Adoption of water management information in developing and modifying municipal development plans

Suitable agreements must be met to avoid new risks of damage. Loss of retention areas must be compensated.

(6) Inclusion of hazard maps in municipal planning

Water management information (hazard maps) should be considered during municipal planning (**existing** development plans, sector planning) in order to minimise damage risks.

(7) Integration of essential regionally planning features into the State Development Plan

The new State Development Plan ("Landesentwicklungsplan") of April 2002 underlines the need for preventive flood damage protection within the regional development framework. The plan sets the focus in a compulsory classification of priority and reservation areas within the regional plans and strengthens thereby the possibilities available for regional associations in securing natural flood plains through proper planning.

The regional plans must set out the priority and reservation areas for preventive flood damage protection to serve as a guideline for development planning. Overflow surfaces in open areas can be secured through the use of priority areas. In order to prevent further flood risk, additional housing development should not take place in priority areas.

Non-priority flood plains in open areas should be classified as reservation areas in regional plans. Special importance has to be attached to preventive flood damage protection for reservation areas when considering other important plans and measures which are foreseen for the area.

Open areas located behind and downstream flood protected facilities should be marked as reservation areas for preventive flood protection, so long as these areas are necessary for effective flood damage prevention, or unusual damage could arise which is not preventable through structural measures involving normal expenditures.



(8) Development and maintenance of warning and action plans, regular practice exercises for risk defence

In the event of a flood, the responsible authorities and staff of risk defence and disaster control normally only have a short time to react. Should they not already exist, warning and action plans should be developed immediately and regularly updated and maintained.

Action plans in the event of a flood are to be prepared at the municipal level and at the civil defence authority level. In each case, responsibility lies with the municipality or the district authority in charge of civil defence. In this context, a catalogue of risks is to be prepared depending on the specific flood hazard situation.

To ensure that warning and action plans are effective in an emergency, regular practice exercises should be performed.

(9) Risk Prevention through Insurance

It is important to have various insurance quotes available relating to danger situations and existing flood prevention.

(10) Public Relations – Development of Flood Partnerships

The Ministry for the Environment and Transport together with the Water Management Association of Baden-Württemberg has started in 2003 form “Flood Partnerships”. Its objective is to establish an exchange of experiences between cities, municipalities and water associations on the topic of “Preventive Flood damage Protection”. Core focus lays on creating flood danger awareness among decision-makers and the general public. This sustainable exchange of knowledge should help fulfil the guidelines set out in legislation.

In particular, the following topics are being discussed:

- Flood protected oil storage (experience has shown that spilled fuel oil and its consequential damage to buildings, for instance, is the largest source of damage.)
- Storage and handling of other water-endangering substances (industry)
- Flood-adapted land use and construction
- Flood preparedness
- Flood proofing measures / private provision for actions
- Risk defence / disaster control (flood alarming and action plans etc.)
- Building long-term awareness among citizens, industry and business
- Information about flood hazard maps / endangerment
- Flood predictions
- Risk protection / insurance coverage
- Regional planning / development planning / building permit procedure
- Endangerment from surface water, slope water
- Erosion protection measures
- Information for research and education

(11) Interdisciplinary action plans on flood defence in the catchment areas in Baden-Württemberg



Long-term and sustainable consensus is needed among the responsible authorities and those affected in order to ensure acceptance of comprehensive flood management and the necessary measures and resources used. A **Action Plan on Flood Defence** will combine the goals of all parties involved with flood protection and prevention within a catchment area and describe the measures to be taken by all responsible and affected parties.

The basis of this plan is the LAWA (Joint State Working Group for Water Resources) action instructions of 1999. The action instructions contain points to be observed by decision-makers within affected special administrations, associations, cities and municipalities; points should be equally understandable to citizens affected by flooding. When all points have been worked through and implemented, it should be possible to reach the objectives contained in the action plan on flood defence:

- Reduction of damage risks,
- Reduction of flood water levels,
- Increase flood awareness and
- Improvement of flood information

An action plan has been completed for the Rhine river. Drafts have been completed for the Neckar and Donau rivers.

Action plan on flood defence for the Neckar catchment area

The **Action plan on flood defence for the Neckar catchment area** will contain concrete objectives, strategies and actions for all responsible and affected parties. The plan will define actions to be taken with respect to dates, financial resources, duties and responsibilities, as well as monitoring of performances.

The action plan will aim at a target-oriented implementation of measures, and produce regular written reports about the progress of individual implementation programs. Action plan objectives should be followed and supported by water management authorities, regional planning, nature preservation agencies, agricultural and forestry authorities at the State level, as well as by municipalities in the catchment area. Both the general public and industry are requested to keep these objectives in mind and actively implement them given their own interests in damage reduction.

All powers within the society that are relevant to flood issues should be informed and mobilised. The role of public relations also is to be considered at all levels. The action plan should serve as a framework for objectives and action for the flood partnership between all parties concerned in the catchment area. The objective levels achieved are to be checked and reported on regularly.

6. IkoNE – Integrating Conception of the Catchment area of the Neckar river

Fig 8,9,10,11

IkoNE is a further example of the activity of the water management administration of Baden-Württemberg integrating other partners and of the synoptic technical procedure in a catchment area - not only for flood protection.



The Neckar is the biggest river flowing within the State from its source to its mouth. Its catchment area of almost 14,000 km² is also located almost entirely in the State of Baden-Württemberg, 50% of the population of this State live in this catchment area.

The Minister for Environment of Baden-Württemberg has given the go-ahead for IkoNE in 1999 which consists in a river-basin-related action framework concerning water resources management for the entire catchment area of the Neckar river including its affluents. Thereby planning and acting of water resources management in the catchment area of the Neckar river are provided in a synoptic way, taking into account also the requirements of the European Union framework Directive about water.

Basic Idea of IkoNE

As **action framework concerning water resources management**, IkoNE co-ordinates river-related measures - flood protection, structure and quality of the river - with other local and supra-local plans and integrates other sector plannings. The objective is to preserve and improve the rivers as living spaces and lifelines of the landscape as well as important natural factors for business locations. IkoNE addresses citizens, industry and business, associations and authorities, thus all parties living at the Neckar river and its affluents and feeling responsible for this region. In a joint responsibility for today's and future generations, preservation of nature and use by humans have to be brought into harmony.

In order to achieve a broad acceptance of the action, the objectives of the water management administration must be anchored into the awareness of the general public. This requires to know about and to understand the complexity of water resources management. IkoNE aims at achieving its objectives basing on the following principles:

- acting from a synoptic view
- orientation by joint objectives
- partnership of all participating parties

IkoNE is no construction and investment program, but a tool for preparing the realisation of such programs.

Action programs of IkoNE

IkoNE defines and bundles the multiple tasks of river management into action programs. This includes measure-related action programs and fundamentally-orientated action programs. The latter serve to gather and make available water resources management data.

Within the action programs, the following specialised objectives are formulated:

- **Flood management**
 - Management of Flood endangered Surfaces and Catchment areas
 - Technical flood protection
 - Flood damage prevention
- **Quality of the waterway:**
 - Target Quality Class II – slightly polluted
 - State-of-the-art sewage installations
- **Structure of the waterway:**
 - Eco-morphology



- Minimum run-off
- Permeability

By means of this action programs and the framework conditions which have to be taken into account, **conceptions** are elaborated for the entire catchment area of the Neckar river and its affluents e.g.:

- Conceptions for flood protection
- Conceptions for waterway restoration
- Conceptions for waterway development

On the basis of this conceptions the planning authorities of State and municipalities elaborate **concrete action procedures and construction projects**.

Working methodology of IkoNE:

Within the work of IkoNE, the concept "integrating" means the following:

- The entire catchment area is considered.
- All subjects of water resources management are considered in a synoptic way.
- The interdisciplinary approach ensures that also other subjects are integrated.
- The expectations of the population concerning the living space of the river with its recreation and leisure function
- All partners from within the administration and from outside as well as the task promoters are involved.

Besides the traditional administrative work, communication is of special importance within IkoNE. The communication within IkoNE should

- Present the water resources management with its tasks and objectives in a convincing way.
- Create confidence.
- Influence behaviour.
- Win co-operation partners.

IkoNE provides a guiding tool with agreements upon objectives for the catchment area of the Neckar river from which environmental, technical and financial priorities can be deduced. **IkoNE is an agenda** for politic, administrative, scientific and private action **for the sustainable management and development of the waterways in the catchment area of the Neckar river**.

All responsible and participating parties can use these documents.

The IkoNE handbook 4 describes flood management with all its components with the joint objective of reducing flood damages.

**A tool developed jointly by research and administration within IkoNE which should support the all-encompassing flood management:
GIS-supported flood modelling by the example of the Neckar river**



On request of the Water Management Administration of Baden-Württemberg, the Institute of Water Resources Management, Hydraulic and Rural Engineering (IWK) of the University of Karlsruhe has developed in the context of the program IKoNE a GIS-supported flood model for the Neckar river. The model is transferred to the water management administration of Baden-Württemberg with the goal of supporting the handling of flood-related issues (determination of legally defined flood areas, analysis of flood protection level, risk analysis etc.). GIS-functionalities and user interfaces that are particularly aligned with the needs of the administration have been developed. In addition, training courses are organised.

The project is a positive example of the successful co-operation of the water management administration of the State with research and the waterways and shipping administration of the Federal Government. This network has been substantial for the success of this project. By this means it was possible to create sustainable co-operation relations, a realistic requirement profile for the needs of the water resources administration, an effective data and know-how transfer as well as transparency for all involved parties and users.

The model has proved to be very useful: overflow scenarios have been visualised in such a comprehensible and convincing way that municipalities could be induced to take measures for flood protection and damage prevention before a damaging flood took place and not only after having experienced material flood damages.

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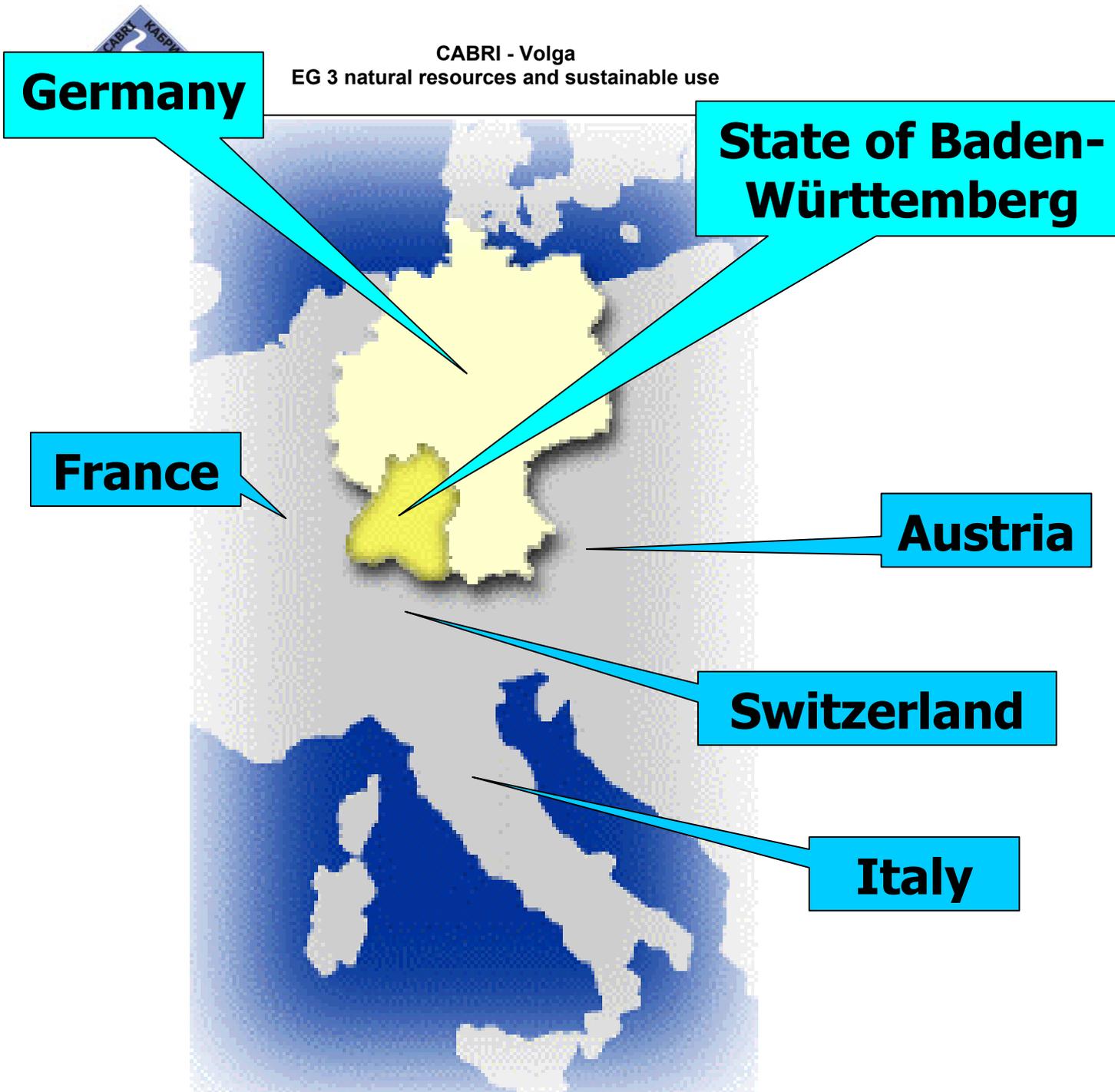


Fig. 1 Germany in Europe

States of the Federal Republic of Germany



Fig. 2

River Systems in Germany

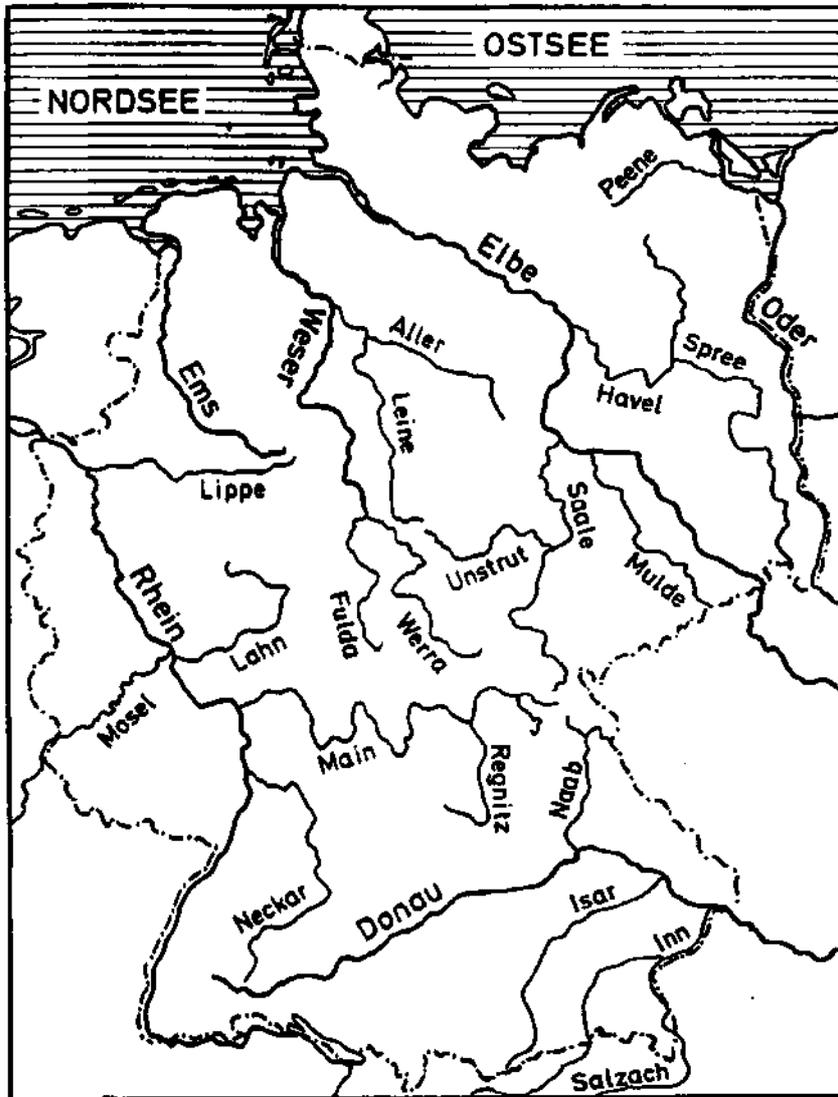


Fig. 3

Fig 4

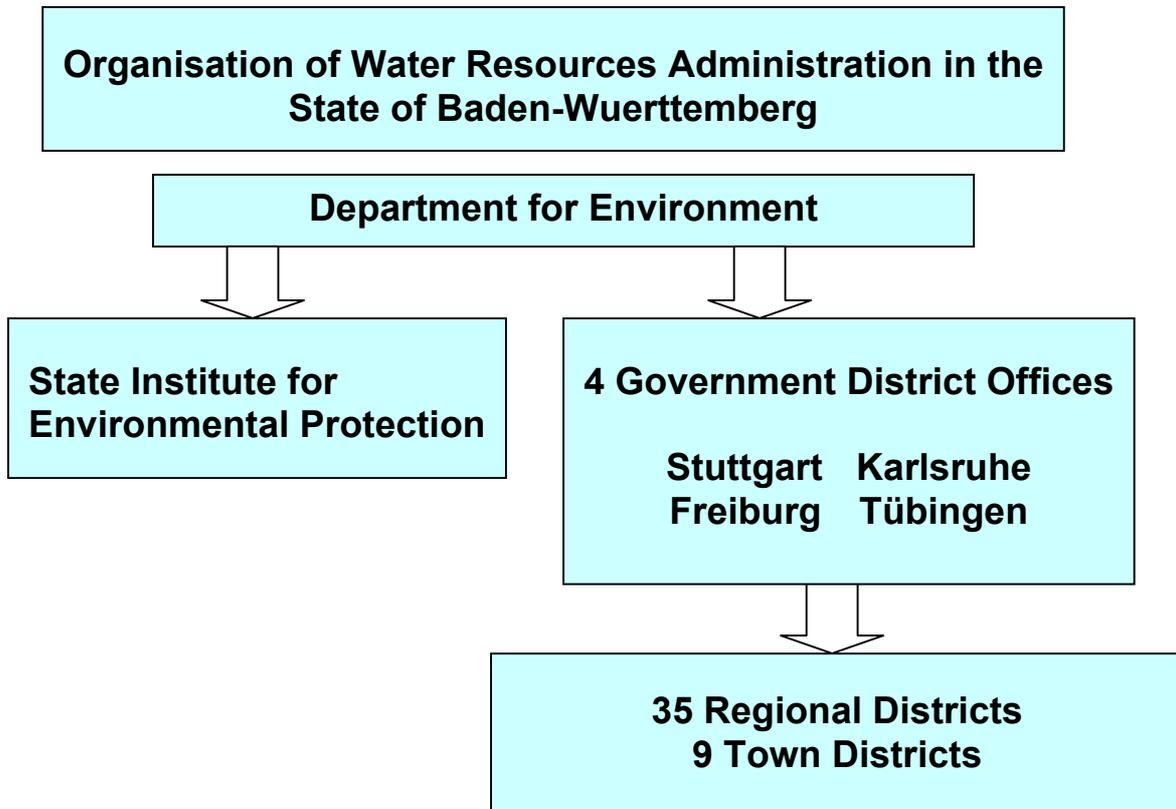


Fig 6

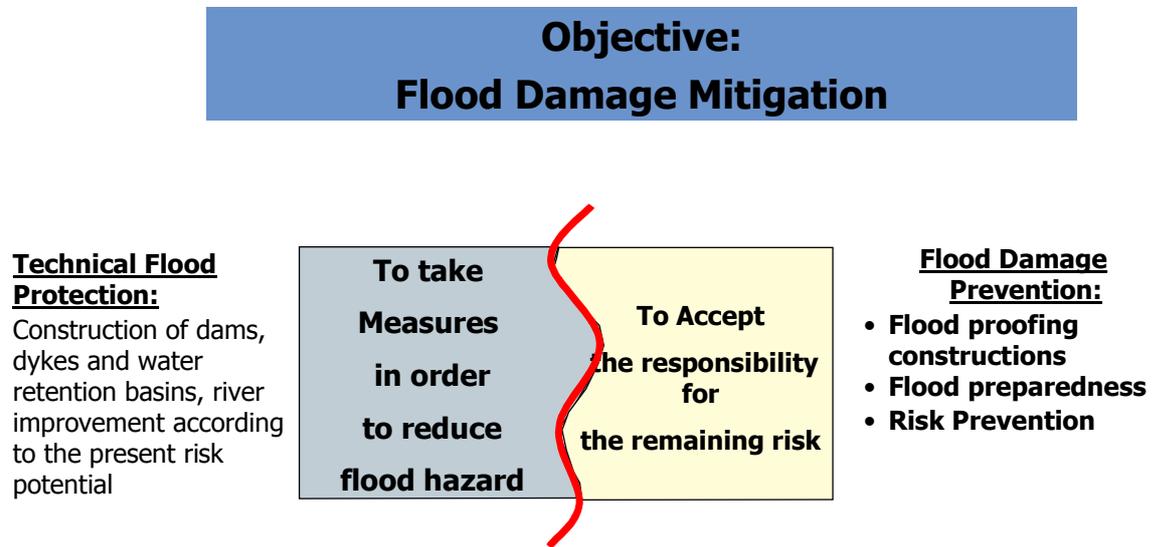


Fig 7

Responsible Parties and Participants: Network against Flood Damage

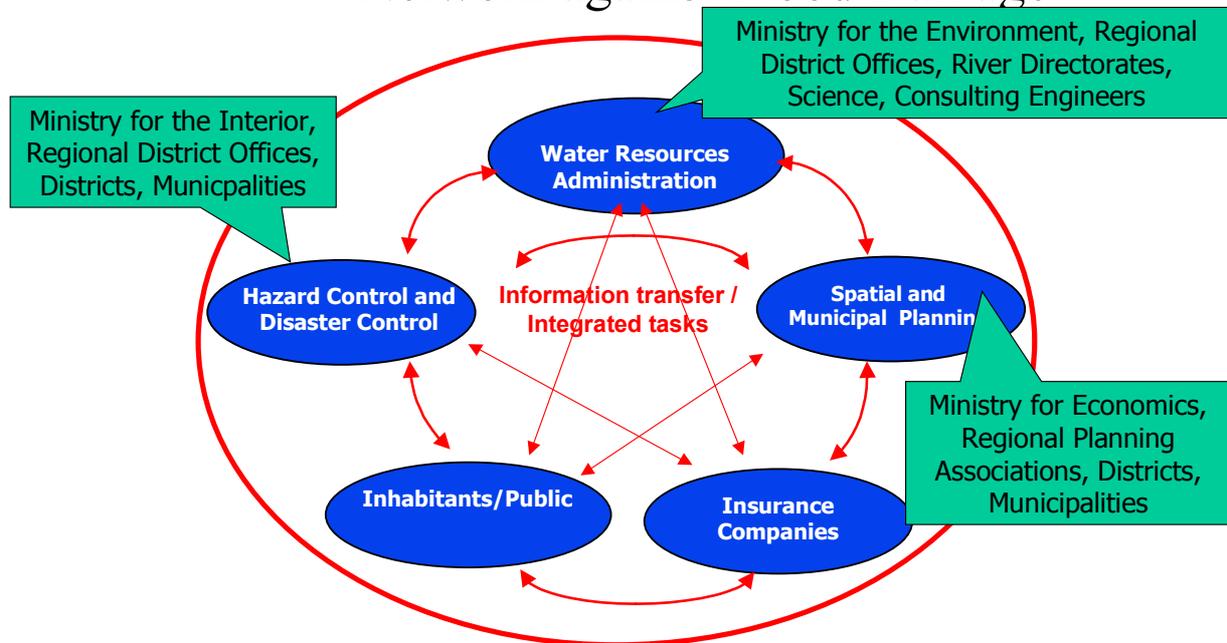


Fig 8, 9, 10, 11 IKoNE Integrating Conception of the Catchment Area of the Neckar River



Integrierende Konzeption
Neckar-Einzugsgebiet





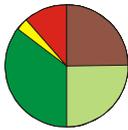
Catchment area of the Neckar

Space for business and nature –
Home for more than 5.2 Million citizens.

*Important basis for the economic prosperity and
the quality of life in the Land.*

Significance:

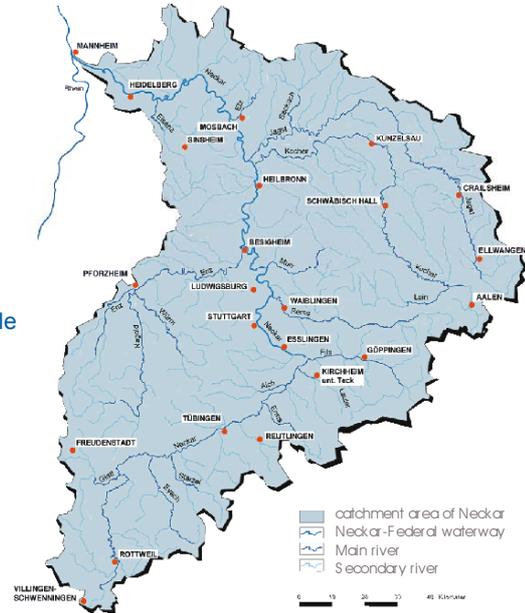
- 50 % of the resident population of Baden-Württemberg
- 40 % of the surface of Baden-Württemberg
- Land use legend at the right and text of map non readable



- Urbane Flächen 15%
- Ackerland 24%
- Grünland 24%
- Wald 36%
- Sonstige 1%

Neckar: thousand sources - one river

IKONE: Respect of the concerns and
needs of man and nature.





What does IKoNE want ?

The catchment area of the Neckar for man and nature –
Long-term environmental protection and safeguarding of industrial locations.

The aims of IKoNE:

- Improvement of flood protection and flood prevention
- Improvement of the ecological state of the waters
- Improvement of the quality of the waters
- Improvement of data basis and instruments

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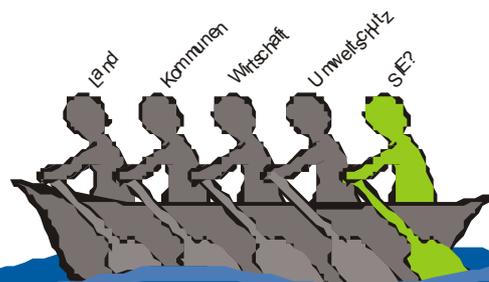
How does IKoNE want to achieve its aims?

The bundling of all forces – for a common objective.

IKoNE is an integrating procedure:

- acting from a total view
- orientation by the common aims
- partnership of all involved parties

IKoNE - together for the living space Neckar,
come on board!



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Fig 12 GIS- supported Flood modelling of the Neckar River

