A quick scan of spatial measures and instruments for flood risk reduction in selected EU countries

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1 Summary

Traditionally, flood risk reduction in the Netherlands relies heavily on technical measures such as dykes and pumps. Due to recent instances of high river levels, events of excess rainfall and the prospect of climate change the Dutch flood prevention policy now places more emphasis on spatial measures. Finding “space for water” is not an easy matter for a densely inhabited country like the Netherlands; therefore there is a keen interest to learn from the experience in other countries. To this aim, a quick scan has been performed on the experience in this aspect in Austria, Belgium, England, France, Germany, Hungary, Italy, Poland and Sweden. The quick scan focusses on spatial measures to reduce flood hazard, measures to reduce the flood damage potential, and on the juridical and economic instruments in support of these measures; measures and instruments for emergency management were not considered. Information was retrieved via Internet and a questionnaire.

Nearly all countries that were included in the quick scan have faced major floods in the last decade. This has put flood risk reduction high on the political agendas. Technical measures still form the backbone of flood prevention in all selected countries, but in most countries there is a strong interest and growing experience in the application of spatial measures to reduce flood hazard and in the reduction of flood damage potential.

In most countries there are definite plans for the realisation of spatial measures, but actual realisation is still on a small scale. Retention measures in the catchment are common in Germany, Italy, Austria and France. Examples of the application of spatial measures in polders or low lying areas were not found outside the Netherlands. Measures for infiltration in urban areas are well developed in Germany. Examples of retention areas and protected floodplains were found along rivers in Germany, Italy, Belgium and Hungary. Generally these areas are situated in sparsely populated regions. Creating new retention areas and regaining floodplains generally requires tailor-made designs that attracts sufficient local support and outside funding.

Restrictive hazard zoning in combination with building regulations are important instruments for limiting the flood damage potential in France, Italy, Austria and Germany. In England and Belgium, central authorities have obliged local authorities to take flood risks seriously in their land use decisions. Instances of private contracts to accept floods have been found in France, Germany. Germany is attempting to decrease urban runoff by imposing a tax on impermeable surface in urban areas.

Countries differ considerably in the arrangement for the compensation of flood damage. Some countries have a state compensation scheme; others rely entirely on private insurance; many countries have a mixed system. Because of the high costs in recent floods that had to be covered by national authorities and the EU, there is an increasing interest in private insurance.
2 Introduction

Floods appear to be becoming a more acute risk in many countries in Europe. This is illustrated by recent floods of large rivers as the Rhine, Elbe, Oder, Tisza and Danube and more local flood events along rivers in England and the Mediterranean. In the Netherlands recent instances of high levels of the rivers Rhine and Meuse and events of excess rainfall, as well as the prospect of climate change have led to a change in water policy. This new policy now aims to find “space for water”, rather than relying on technical measures such as higher dykes and more pumps. Central ideas in the new approach are shown in Figure 2-1, Figure 2-2 and Figure 2-3. The policy has been laid down in the policy document “A Different Approach to Water, Water Management Policy in the 21st Century”. English, French and German versions of the document can be found at http://www.verkeerenwaterstaat.nl/object/?lc=uk&tb=Object&id=1, http://www.verkeerenwaterstaat.nl/object/?lc=fr&tb=Object&id=10 and http://www.verkeerenwaterstaat.nl/object/?lc=de&tb=Object&id=14.

Claiming space for water in a densely inhabited country like the Netherlands is not an easy matter. It requires the careful application of spatial planning procedures and juridical, economic and communicative instruments, and it requires a shift in the traditional perspective that flood problems can be kept under control by technical measures. There is therefore a keen interest to learn from the experience in other countries on topics such as:
- examples of claiming and maintaining space for water
- understanding what instruments were used and what factors determined the success of these instruments
- making contacts with persons and institutes who are working in this field

To this aim, RIZA\(^1\) has commissioned the Dutch consultant DHV to perform a quick scan of the experience in the following countries: Austria, Belgium, England, France, Germany, Hungary, Italy, Poland and Sweden.

This report is the result of this quick scan.

We welcome all questions or comments; please contact the project leader at RIZA at w.oosterberg@riza.rws.minvenw.nl

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\(^1\) RIZA is the Dutch national Institute for Inland Water Management and Waste-Water Treatment. It is the research and advisory institute of the Ministry of Transport, Public Works and Water Management. It has played an important role in the formulation of the new Dutch policy and is closely involved in the implementation of this policy.
Figure 2-1 Three-step strategy to reduce local water excess and floods. Source: “A different approach to water”
Space for water in the main system
In and along the main water system, ambitious measures are required to increase the space for water.

Area around the Rhine, Waal and Meuse
More space for the river can be created by:
A. inland relocation of the winter dykes;
B. lowering the floodplains;
C. removing obstacles in the flood plains; and
D. creating retention areas.

1. More space for water regionally
Both in the high parts and in the low-lying parts of the Netherlands, the water system is being modified to create more space for water and prevent water-related problems.

2. Additional bend in the stream
Remeandering streams proves to be an efficient measure in the high parts of the Netherlands to prevent water-related problems. These measures cut both ways: they decrease water-related problems and the financial benefits exceed the costs. Nature and recreation benefit as well.

Figure 2-2 Examples of spatial measures along main rivers and in catchment areas. Source: "A different approach to water"
Bottlenecks of the river
Growth of towns and cities along rivers in the Netherlands has had as a result that rivers have had to surrender a lot of space. Nowadays, the bottlenecks of the river can only be protected against flooding by means of drastic measures upstream and/or downstream.

Figure 2-3 Some spatial measures under consideration along main rivers. Source: "A different approach to water"
3 Approach

3.1 Scope of the quick scan
In the past years some in-depth studies have been done in the field of spatial planning and water management. A good example is IRMA-SPONGE 2001. This project focuses on the Rhine-bordering countries Switzerland, France, Germany and The Netherlands. It evaluates the inclusion of claims for “space for water” into regional and local spatial plans in these countries as well as the use of supporting (soft) instruments such as transboundary co-operation, economic instruments and information management. Figure 3-1 (taken from ICBR 2002) and Figure 3-2 (taken from the IRMA-SPONGE report) give useful conceptual frameworks for the interplay of spatial planning and flood management.

We have used the following definitions:
- Flood hazard: the probability that a certain area is flooded
- Flood damage potential: the sum of possibly damaged assets in the area at risk.
- Flood risk = flood hazard * flood damage potential

Flood hazard can be reduced via technical measures and spatial measures. Technical measures refer to dykes, sluices, pumps, dams and reservoirs. Spatial measures have their effect due to their areal size.

We made a distinction between measures (which have a physical basis), and instruments (which are designed to influence human behaviour).

The scope of this quick scan is then on the application of spatial measures to reduce flood hazard, on the application of measures to reduce the flood damage potential and on the application of instruments in support of these measures. Measures and instruments for emergency management have not been considered. The quick scan is descriptive and not prescriptive - it asks the question how measures and instruments are applied in practice, and not how they should be applied.

3.2 Choice of countries
Countries were selected on the basis of the following considerations:
- a focus on neighbouring countries with whom we share transboundary rivers (Belgium, France, Germany)
- a focus on European countries because of a similar economic development, a similar climate and shared and shared EU initiatives that have a relation with flood management
- inclusion of some new member states (Hungary, Poland)
- available funding did not allow coverage of all European countries

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2 IRMA-SPONGE 2001 project 5: “Spatial planning and supporting instruments for preventive flood management” The report can be found at http://www.irma-sponge.org/publications.php.
3 The definition is not ideal; reservoirs also have their effect due to their areal size, retention areas which we treat as spatial measures can be highly technical constructions. We chose to avoid the term “structural measures” which in some publications is synonymous with “technical measures” as used in this report, but in other publications is expanded to include all measures that reduce flood hazard.
Figure 3-1 Diagram with chain of damage generation. It shows the concepts of "flood hazard", "flood damage potential" and "damage risk". The scope of this quick scan is shown in green. (from ICPR 2002 "Non structural flood plain management, Measures and their Effectiveness"); in original, the box "flood damage potential" read "vulnerability").

Figure 3-2 Goals, measures and instruments for preventive flood management (from IRMA-SPONGE 2001). The scope of this quick scan is shown in green.
3.3 Retrieval of information
A questionnaire was collated (see Table 3-1), which was put to contact persons – via e-mail and telephone - and formed the basis for searches on Internet. In fact most of the information contained in this report was found on the Internet. Towards the end of the project we did a search for relevant Interreg projects; these are given in Annex 1.

3.4 Presentation of information
The information is presented per country in the chapters 5 to 13, in a format similar to that of the questionnaire. (These chapters can be found in the full report, which is available in PDF and WORD format on the enclosed CD). As the information was provided by various people, differences in emphasis on items emerged. The contributions of various authors have been groomed into a comparable structure, while leaving the original story intact as much as possible. Opportunities for addition and verification were very restricted. For example, information on financial arrangements ("who pays for what") is only available for some countries. Thus the information presented gives no in depth and complete picture of the way in which spatial planning contributes to flood management in the investigated countries, but we think that it offers an overview of interesting solutions and instruments.
### Table 3-1 Questionnaire of quick scan

1. **Type of flood problems**
   - Type of flood problems (coastal flooding; large rivers; small rivers; local rainfall; urban floods)
   - Extent of damage

2. **Political attention for flood problems**
   - Political momentum
     - Is flooding an important policy issue?
     - Is new policy and legislation being prepared?
   - Organisation
     - Who is responsible for flood management?
   - Sense of direction
     - Is a relation made with climatic change?
     - Is there an orientation towards space for water or towards more technical solutions?)

3. **Solutions: what kind of measures, apart from technical measures such as dikes, pumps, reservoirs?**
   - Retention in the catchment (forests, flood meadows, meandering brooks)
   - Retention in urban areas (decreasing impervious areas, decoupling roofs)
   - Retention along rivers (storage areas for flood water)
   - Floodplain restoration (removing obstacles, (re)introducing river channels, dyke setback)
   - Are these measures combined with other objectives, such as nature restoration, recreation, new housing areas, landscape reconstruction

4. **Solutions: what kind of instruments?**
   - Hazard zoning and building regulations
     - Is hazard zoning part of national, regional and local plans?
     - Is it obligatory or not?
     - What categories of zones are used?
   - Role of insurance and compensation schemes
     - Is flood damage compensated by the state?
     - Is commercial insurance against flood damage available?
   - Role of economic and fiscal instruments
     - What incentives are available for preventing flood damage?
     - What incentives are available to increase retention?
   - Role of financial arrangements
     - Are decisions made on the basis of a cost-benefit analyses?
     - Is there a possibility of co-financing with other functions such as nature restoration, recreation?
     - What is the role of external subsidies, such as EU funds?
     - Is there co-financing by private funds?
   - Role of planning procedures
     - What is the status of plans and planning procedures?
     - Who are involved?

5. **Useful institutes, projects and key persons for further contact**
4 Results

In this chapter we aggregate the information that was obtained for the various countries on the basis of the main questions of the questionnaire. Although we did not perform a quick scan of the Netherlands, we did include it in the comparison with other countries.

4.1 Type of flood problems
Table 4-1 gives an overview of the main flood problems in the 10 countries. Nearly all countries have faced major floods in the last decade. The Netherlands faced critical situations in 1993 and 1995 and flooding of some polders in 1998.

Table 4-1 Main flood types in selected EU countries.
Netherlands (NL), Belgium (B), Germany (D), United Kingdom excluding Schotland (UK,) France (F), Hungary (HU), Poland (PL), Italy (I), Austria (A), Sweden (S).

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<th>NL</th>
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<td><strong>Polders, flat and poorly drained areas</strong></td>
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France, Italy and Austria share the problem of steep rivers and flash floods. Nearly all countries share the problem of flooding of lowland rivers – with or without dykes. The problem of flooding of elevated rivers is mainly faced by the Netherlands and to a lesser extent by Hungary. Netherlands and Hungary share the problem of flooding of polders and flat areas; a problem that is also present to a lesser extent in Belgium, Germany, England and France. Netherlands, Belgium, England and Germany share the problem of estuaries and storm surges. Sweden is a country with few flood problems.

In most countries, flood hazard standards are typically 1:100 or 1:200 years. In the Netherlands standards are (much) sharper (Table 4-2).

Table 4-2 Standards for flood hazards in selected EU countries (unit: 1/year)
Notes: Values have not been validated. The figures are flood hazard standards, not actual flood hazards. Protection levels along urban areas in HU, FR, D, I, UK are often higher – typically 1:500. In UK there are no legally established standards. In Belgium the actual flood hazard along the Scheldt is 1:350 years; a project is in progress that will decrease this level to 1:10,000 years.

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<td>NL (B)</td>
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4.2 Political momentum

Recent floods or near-floods have put flood risk prevention high on the political agenda in all countries that we included in the quick scan; with the exception of Sweden. In all these countries policies are being re-evaluated in order to face this risk. There is a strong interest in the application of spatial measures to reduce flood hazard and in the reduction of flood damage potential. Poland may be the exception, as the focus still appears to be on technical measures for the reduction of flood hazard.

An issue that is attracting increasing attention, is the continuous increase in the flood damage potential due to investments in areas with a non-negligible flood hazard, for example in areas behind dykes with a 1:100 year standard. (For the perspective: a 1:100 year flood has a 26% probability of occurring once in 30 years, the duration of a typical mortgage).

In most countries the power for spatial decisions is delegated to local authorities. In many countries such as England, France, Germany and Austria central authorities are taking initiatives to sensitize or influence local authorities to take flood hazard and flood damage potential into account in their spatial decisions.

In England, Germany and the Netherlands climate change is seen as an important factor contributing to an increase in flood risk.

Along international rivers with flood problems, the level of international cooperation is increasing. This is the case along the Rhine, the Elbe and the Oder. The Interreg IIIB programme is a focal point for international cooperation, as it includes many projects in the field of flood risk prevention in the region of North West Europe and to a lesser extent in the North Sea Region, Central and South-Eastern Europe (CADSES) and the Alps.
4.3 Measures
The information on the measures in the 10 countries has been scored on a 4-point scale:
p - tentative plans
P - definite plans
r - realisation on a small scale
R - realisation on a large scale
Results are in Table 4-3. The scoring procedure is subjective, and depends on the completeness of the information per country, which is uncertain. So the table and the discussion based on it may contain errors, as can be expected from a quick scan.

Table 4-3 Main measures applied in selected EU countries.

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<td>Dams, dykes, pumps, reservoirs</td>
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<td>Retention in the catchment</td>
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<td>Restoration of forests, flood meadows and meandering brooks</td>
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<td>Retention in polders and flat areas</td>
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<tr>
<td>Increasing area of surface water, flood meadows</td>
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<td>Infiltration in urban areas</td>
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<td>Decreasing impermeable areas, reducing the area drained by sewers, de-coupling roofs</td>
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<tr>
<td>Retention areas along rivers</td>
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<td>Measures aimed at storing flood water (Figure 4-1)</td>
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<td>Measures aimed at increasing the river flow capacity (see also Figure 4-1)</td>
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<tr>
<td>Reducing flood damage potential</td>
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<td>Flood proofing houses and infrastructure</td>
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<td>Removing houses</td>
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</table>
Figure 4-1 Distinction between retention areas (A) and floodplain restoration (B-D).
A: retention areas; B: dyke setback; C: (re)introducing river channels; D: removing obstacles in the floodplain. Measure A aims solely at storing part of the flood water. Measures B, C and D aim primarily at increasing the river flow capacity during floods.
Note: the term “floodplain restoration” should be read as “restoration of hydraulic functions of the floodplain” and not as “restoration of nature values of the floodplain”.

4.3.1 Technical measures
Technical measures, which are not the focus of this report, still form the backbone of flood prevention in all selected countries.

Small reservoirs
The creation of systems of smaller reservoirs to attenuate floods is popular, especially if this can be combined with water provision in summer. Also water recreation is a motive. Most examples are found in southern France and Italy, in regions that face long dry summers. But there is also renewed interest in using existing, often hydroelectric reservoirs for flood management purposes, for example in Germany and France. There are often conflicting interests, as recreation prefers because constant high water levels. There is a long tradition in multipurpose reservoir management in the US, but not so in Western Europe.
4.3.2 Spatial measures

In all countries considered (except Sweden), recent flood events have placed spatial measures on the political agenda. The table gives some insight in the “leaders” and “followers”, but as a general picture most countries appear to be approximately in the same phase of development, that is between definite plans and realisation on a small scale.

Retention in the catchment

There is much attention for retention in the catchment in Germany, Italy, Austria and France.

- In the catchment areas of the larger German rivers - the Rhine, Oder and Elbe - this is an ongoing activity for many years. Especially in the last 5 years a large number of projects have been implemented.
- Austria attempts to integrate the planning requirements of the WFD and the planning of catchment restoration in order to prevent flash floods and erosion.
- In Italy river basin authorities address the issues of soil erosion, slope stability and flow capacity in their river basin plans; these issues lie within the competence of the river basin authorities.

In steep catchments measures focus on reforestation, slope stability and enhancing stream flow capacity. Nature restoration is often an important additional goal.

In hilly catchments, retention focuses on reduction of agricultural drainage, re-meandering of brooks and restoration of riparian lands. Sometimes the restoration of groundwater levels and upward seepage areas are additional objectives. In Germany there are specific guidelines that demand the restoration of the natural hydrology in order to reach ecological objectives. Most of these approaches are limited in scale and focus upon smaller catchments, but are not seen as an alternative strategy for managing large-scale flood problems. Many of the measures are subsidised by national nature conservation budgets and by EU-money. With the WFD the reduction of diffuse pollution by agriculture will be high on the agenda in all catchment plans. Here lies the challenge to combine the needs of water retention and emission reduction.

Retention in polders and flat areas

In polders in the Netherlands, initiatives are being taken to enlarge the retention capacity of drainage systems (by widening channels and ditches and by designing the lowest grasslands as inundation areas), and applying dynamic forms of water level management. Outside the Netherlands, no examples have been found.

Infiltration in urban areas.

Plans for infiltration in urban areas abound, but implemented plans are still scarce.

- In Germany retention in urban areas receives much attention. Infiltration is mostly combined with new housing areas. Rain water infiltration is often implemented when sewers have to be renewed. A hydrological guideline prescribes that the 1-year maximum runoff (HQ1) should not differ more than 10% from the original HQ1 under near natural conditions. The HQ1 reference is calculated on the basis of a catchment area in which all urban areas have been replaced by a representative combination of forests and agricultural land.
- Austria is in the process of converting combined sewerage system to a separate sewerage system, with infiltration of the non-polluted runoff via soil filters into permeable soils.
- In England measures such as infiltration, retention and buffers are increasingly being considered in urban areas through the use of SUDS (sustainable urban drainage systems). The use of buffer zones within urban areas is a favoured option but it takes time to realise the release of currently developed areas for this purpose.
- In Italy the river basin plans often contain the requirement of hydrologic compensation in case larger surface areas become impermeable due to urbanisation.
Retention areas along rivers and floodplain restoration

Retention areas can be found in most countries. Many examples exist in Germany, Italy, Belgium and Hungary.

- In Germany along the Rhine and the Elbe many retention areas are in operation. An even larger number of retention areas is being planned and constructed. The size of these areas is typically 100 – 600 ha. The Havel Polder is a 2000 – 4000 ha retention area that is in operation along the Elbe.
- Hungary has large retention areas (2000 – 5000 ha) along the Tisza, that have been operational during the recent floods.
- In Italy retention areas (200 – 500 ha) have been constructed since the beginning of the 20th century; many new initiatives are in the planning stage.
- In Belgium the Sigmaplan is an ambitious plan to reduce flood risks along the Scheldt, by means of the creation of a large number of – relatively small – retention areas.

There is a growing interest in floodplain restoration along larger rivers. Examples can be found in Austria, Belgium, Germany, France, Hungary, Italy and England.

- In Germany dyke setbacks are an important element of the recently adopted Flood Action Plan for the Elbe.

The above countries have extensive plans for new retention areas and floodplain restoration. Generally the areas are situated in sparsely populated regions and are combined with the objective of nature conservation, which can give the legal title and funds necessary for land acquisition. Other common functions are forestry and extensive forms of recreation. Combination with agriculture and intensive forms of recreation are less common. We found no examples of combinations with housing.

Creating new retention areas and regaining floodplains is much more difficult than maintaining existing areas. Many new retention areas are still on the drawing board. Creating the necessary local coalition for actual realisation of these plans is generally difficult. There are frequent instances of local resistance, for example in Germany, Belgium, Italy and Hungary. Success stories are characterised by a win-win approach that cater to the wishes and requirements of local stakeholders and involve tailor-made designs that fulfill multiple objectives and open the door to multiple budget lines. Spatial solutions may have the most societal effects with least costs to the local authorities and inhabitants. The reverse side of the medal is, that most success stories appear to be based on very generous external funding from the national level or the EU.

4.3.3 Reducing flood damage potential

Reducing flood damage potential is central to the flood management strategy in Austria, Germany, France, Italy and England.

Reducing flood damage potential is mainly in the sphere of instruments (see 4.4). The most obvious (physical) measure for reducing flood damage potential is flood proofing, which is often prescribed via building regulations (see 4.4.1). Flood proofing is being developed and applied on a considerable scale in Germany, France, England and Italy.

Removal of houses, the ultimate retreat from flood-prone areas, requires juridical and economic instruments such as expropriation and state compensation (see 4.4).
4.4 **Instruments**

Table 4-4 gives an overview of the instruments that we found in the quick scan. We used the same scoring procedure as for the measures. It must be stressed that the table has not been validated, so an empty cell must not be read to mean that the instrument is not used in the country concerned.

We assigned the instruments to one of three categories: juridical, economic and communicative. This is a common distinction but only partly satisfactory. All instruments have indirect effects that could warrant their assignment to one of the other categories. For example a prohibition to build in a flood-prone area is a juridical instrument, but also has economic effects (land prices will drop due to the prohibition) and communicative aspects (people realise that an area is dangerous). In addition, instruments are chosen to implement or facilitate specific measures, thus per measure a classification scheme of instruments could be developed. We tackled this aspect in part, by giving each instrument one of two labels: instruments in support of measures to decrease flood hazard (H) and instruments that have their main effect by decreasing flood damage potential (DP).

**Table 4-4 Instruments applied in EU countries to achieve space for water.**

**NB.: empty cell does not mean that instrument is not used in the country concerned.**

*H: instrument in support of measures to decrease flood hazard*  
*DP: main effect of instrument is the reduction of flood damage potential*

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<td><strong>Juridical instruments</strong></td>
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<tr>
<td>Obligation to consider flood risks in land use decisions</td>
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<td>Building regulations (eg. flood proofing)</td>
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<td>Reservation of floodplains and retention areas in spatial plans</td>
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<td>Expropriation because of flood risks</td>
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<td>Subsidies for the implementation of spatial measures</td>
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<td>Private contracts to accept floods</td>
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<td>Tax on impermeable surface in urban areas</td>
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<td>Private insurance of flood damage</td>
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<td>Land reallocation schemes used to implement spatial measures</td>
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4.4.1 Juridical instruments

Obligation to consider flood risks in land use decisions ("Water Test")
In the Netherlands, Belgium and England the national authority has obliged the local authorities, who take the land use decisions, to explicitly consider flood risks in their decisions, or to ask the advice of central authorities with expertise on flood risk reduction. However, the decision power has been left with the local authorities, and the advice of central authorities does not need to be followed. Thus, this can be regarded as a process instrument, as it obliges that a process should be followed, but does not prohibit decisions that increase flood risks.

Restrictive hazard zoning and building regulations
In many countries restrictive hazard zoning, in conjunction with building regulations, form the core instruments of flood risk reduction.
- In France, Italy and Austria the designation of hazard zones and the regulation of building activities in these zones is required by law.
- In Germany the recent Flood Prevention Law (Hochwasserschutzgesetz) obliges the Länder to apply restrictive hazard zoning.
- In Germany, France and Italy there is a growing attention for hazard zoning of areas with a high capital investment that are protected by dikes.

Restrictive hazard zoning and building regulations are instruments that are generally used in conjunction. The hazard zones delimit the zones with a certain flood hazard (often 1:100 years); the building regulations specify the necessary measures for flood damage reduction in these zones. Common elements are:
- Guarantee human safety (prevent the collapse of buildings and bridges, maintain escape routes operational, prevent buildings with only a ground floor in areas that are deeply flooded).
- Safeguard critical public services (power stations and hospitals to be planned outside flood prone areas).
- Limit flood damage (flood proofing of ground floor, forbid the construction of cellars).
- Limit environmental damage (prohibition of oil tanks, flood proofing of potentially polluting activities such as chemical industries).

In contrast with the "Water Test" described above, these instruments attempt to prohibit decisions that increase flood risks.

Reservation of floodplains and retention areas in spatial plans
In most countries, maintaining "empty space" for water functions is a challenge, as the pressure from other functions is strong. Thus it is necessary to give floodplains and retention areas an explicit protected status in spatial plans.
- Germany has a long tradition of protection of floodplains and retention areas. However, the protection status can differ per Land. With the recent Flood Prevention Law, the federal government attempts to bring the protection status of these areas on a common footing, and to stimulate the designation of new areas.
- In France, retention areas and floodplains can be easily protected in the framework of the restrictive hazard zoning plans (Plans de Prevention de Risques).
- In Italy the retention areas have a clear protected status.
- In the Netherlands the floodplains "outside the dykes" are reserved for water discharge. Also inland lakes and waterways are delimited and protected from land reclamation.

Reserving space for water for the future is an even larger challenge. This requires a change in land use status in the land use plans.
- At present, Belgium is taking this step as part of the Sigma Plan.

Expropriation because of flood risks
Only a few instances of the application of expropriation have been found.
In Belgium the implementation of the first phase of the Sigma Plan led to the expropriation of some isolated houses in future retention areas. The instrument may become more important as the retention areas in the second phase of the Sigma Plan have a more intensive land use. The expropriation can work both ways: inhabitants that live in flood prone areas can also offer their premises to the state, who has the obligation to buy them out.

In France the Barnier Fund finances voluntary expropriation of property when there is an acute flood hazard and the costs for public authorities of preventive measures exceeds the value of the property.

**International treaty**
In 1982, the national governments of France and Germany agreed on a program of restoration of floodplains and realisation of retention areas along the Middle Rhine. As the agreement took the form of an international treaty, it provided powers to the national authorities to impose regulations on the local authorities and owners.

### 4.4.2 Economic instruments

**Subsidies for the implementation of spatial measures**
Considerable subsidies from higher levels (province, national, EU) are widely used and appear to be a pre-requisite for the implementation of spatial measures.

**Private contracts to accept floods**
Nearly always the land that is needed for floodplains or retention areas is privately owned. This land may remain in the hands of individuals if contracts guarantee their proper “blue” use. Examples of compensation payment for a “blue” use of land were found in France, Germany and the Netherlands. Preferably, the regulations that safeguard the water function are not in the form of a contract with a temporary land owner, but are vested in the land, for example in the form of an easement (*erfdienstbaarheid*).

**Tax on impermeable surface in urban areas**
This type of instruments has been found in Germany and is under discussion in France.

- In Germany, many communities (e.g. Berlin) have introduced a stormwater fee for discharging stormwater into the sewer system, while at the same time reducing the sewage fee based on drinking water consumption. The introduction of this system, which is called a “split fee” is a rather complicated task. The sealed area must be surveyed by areal photos, the degree of connection must be estimated and a database with all the information including the address of the owners must be built up. The process is usually accompanied by a lot of information (web, letters, public hearings, etc.) and also legal procedures (changing the local by-laws). Due to the “split fee”, the awareness of private and commercial property owners for stormwater issues is increasing.

- In France, a similar system is now under discussion. It is proposed that *Agences d’Eau* levy a tax for all impervious areas, in order to create a fund that can be used for floodplain restoration.

**Private insurance or state compensation of flood damage**
In nearly all countries there is a system for the compensation of individuals who suffer damage in the case of large floods.

- France is an example of a country with state compensation and a poorly developed system of private insurance. Flood damage is compensated by a Natural Catastrophes Fund that is financed by an automatic deduction on all mandatory household and vehicle insurance policies. This deduction has increased from 9 to 12% in recent years,
and now amounts to approximately 1 billion Euro per year. Local Mayors can apply for compensation in the case of a catastrophic event and increasingly do so. The insurance companies manage the fund. This arrangement is under scrutiny of the European Commission, because it breaches the principle of free choice of insurance.

- In contrast, in England a strong insurance industry provides (voluntary) insurance on a commercial basis. There is no state damage compensation scheme and government explicitly states that it will not compensate flood damage. This is believed to be a pre-requisite for the successful functioning of the private insurance scheme, as individuals will not choose private insurance if they can count on state compensation.

- Mixed situations also occur, where private insurance pays those who are insured, and the state is obliged to – partly – compensate uninsured parties who have suffered losses during large floods.

- In Belgium the discussion between private insurance or state compensation of flood damage is presently on the political agenda.

Because of the high costs in recent floods that had to be covered by national authorities and the EU, there is an increasing interest in private insurance. Private insurance is often combined with restrictive hazard zoning and building regulations.

4.4.3 Communicative instruments

Few cases were found of instruments with a primarily communicative function. This is partly due to the fact that this question was not explicitly asked in the questionnaire. However, as the Internet has been well searched, it appears that this type of instrument is not very popular.

Flood hazard mapping

Flood hazard mapping is the basis of restrictive hazard zoning, and as such countries that use restrictive hazard zoning also have flood hazard maps. In England, where there is no obligation for local authorities to apply restrictive hazard zoning, detailed maps of flood hazard are freely available on the Internet, with the aim to inform the local authorities and the public of the flood hazards that they face.

4.4.4 Complementary instruments

In France and Germany land reallocation is an important complementary instrument especially if one wants to create a win-win solution with agriculture, which is often the most critical stakeholder and landowner in flood plains. A land reallocation scheme puts land ownership on a fluid basis and can increase external finances that facilitates the process.

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4 For the same reason, a scheme for compulsory flood insurance in Baden Wurttemberg – Germany had to be cancelled.
4.5 Specific points of interest per country

In **Austria** a consensus is growing that local spatial planning by municipalities is no longer sufficient to tackle flood risks. There are initiatives to make flood risk reduction plans for whole river basins. As the requirement for river basin planning is also set by the EU Water Framework Directive, there are efforts to integrate both types of planning. In addition, a discussion is going on about the financing of spatial measures for flood hazard reduction. Downstream municipalities take advantage of measures taken by upstream municipalities; how can the costs be shared between upstream and downstream municipalities?

**Flanders** has interesting features in its spatial planning system.
- There is a governmental Right of Pre-emption (*Recht op Voorkoop*) in areas designated as such in its spatial plans, that may be used to realise retention areas.
- There is compensation for planning damage (*planschade*); if due to a change in the spatial plan a location loses its right of destination for housing, 80% of the damage is compensated by the government.

In **England** the market and economic approach towards flood risk reduction is most advanced.
- In contrast with other countries, precise data on the flood damage potential are readily available.
- Real estate developers must provide an assessment of whether any proposed development is likely to be affected by flooding and whether it will increase flood hazard elsewhere.
- The developers must fund the provision and maintenance of flood defences that are required because of the development.
- Grants from the national government budget for flood prevention measures are provided on the basis of an assessment with a detailed benefit/cost analysis. In the benefit/cost analysis the benefit of prevented flood damage and the cost of flood prevention measures are compared at various levels of flood frequency, in order to find the optimum set of measures. There is a requirement to consider the managed retreat as well as abandonment of existing defences in each project. In addition, social factors and environmental acceptability are important in the assessment.

While in Germany there is much attention for spatial measures, in **Poland** the emphasis is still on technical measures. Thus different strategies may be used along the east and west bank of the Oder.

In **Sweden** flood risks are so small that the emphasis is on efficient emergency and rescue procedures if they do occur.
5 Austria

5.1 Type of flood problems.
As recent as in 2002 heavy rains in Central and Eastern Europe have led to some of the worst flooding the region has witnessed in over a century. The 2002 floods along the Danube in Austria have led to three deaths and high costs damage (3-5 billion Euros). During the flooding 60,000 residents were evacuated in Austria.
When looking at river flooding in Austria the landscape must be taken into account. Problems in narrow valleys of the Alps differ from problems in the broad plains of the flat countryside.

Steep rivers
Many flooding problems in Austria are related to the mountainous landscape and the steep gradients of upstream parts of the river systems. Rainwater flows rapidly down from the mountainsides and gathers in the streams and rivers like the Danube. Water levels in these streams and rivers can rise quickly, leading to dangerous situations. Areas adjacent to the rivers will be inundated after prolonged periods of rain.
One of the reasons for the increase of flooding scale and impact is the decrease of forests in the past decades. The decimation of forests in the alpine region has increased the chances of avalanches, erosion, mudslides, or flooding caused by runoff.

High-rainfall urban floods
In Austrian cities local rainfall may lead to water related problems.
In the last decade the number of events in which high local rainfall caused flooding of urban areas has increased. Since the water level in these cases is not rising very much the damage per event is generally not too high. The total damage after a large (and increasing) number of events however is considerable. Water on the street and overflowing sewage systems also causes water quality problems.

Lowland rivers
After prolonged periods of rainfall river beds can no longer contain the flow. These events can cause flooding of large areas, especially in Lower Austria. In the past these floodplain were mostly in agricultural use. Therefore the damage was relatively small. Since more and more urban areas have spread into the floodplains the damage per event has increased considerably.

5.2 Political momentum
The sense of urgency for measures against the large impacts of flooding in Austria has increased considerably since the August 2002 flooding. The Austrian authorities are increasingly aware that an integrated approach towards abatement of flood problems is needed. Therefore the development of integrated management plans is taking place on different locations in Austria.
5.3 Organisation
The Water Act (last large amendment in 1990, with minor adjustments since) aims at an ambitious protection of all waters, surface and groundwater bodies, irrespective of uses. The water management in Austria, including the maintenance of riverbanks and dikes, is divided over different organisations. The competence for decision-making is allocated in the water departments of the Ministry for Agriculture, Forestry, Environment and Water Management, and within the administrations of the nine “Länder” (provinces). Basically the initiative for flood control measures lies in the hand of the federal government and the Länder. So far NGO’s like WWF Austria have initiated some ecologically sound floodplain plans. Within the administrative system expert advice is also available at the Federal Office of Water Management and the Federal Environment Agency (investigations, monitoring, etc.), and in similar institutions at the level of the “Länder”. The involvement of the interested public, of stakeholders as well as of experts and parties concerned is an important part of the decision making process.

5.4 Measures
5.4.1 Infiltration in urban areas
In the past only combined sewerage was accepted (in order to minimize wrong connections). Today the infiltration of "non-polluted" runoff via soil filters into adequately permeable soil is gaining ground. Infiltration was also common practice in the past, when sewerage was not yet applied in villages. Polluted water is sewered in single-pipe systems (separate sewer system). A conversion of the infrastructure built on "old principles" (i.e. combined sewerage with no infiltration of "non-polluted" runoff or its surface storage) to the "new system" is being implemented. More and more municipalities are adopting this approach. In areas with impermeable soils also surface storage will be used, but the number of applied cases is still relatively small.
5.4.2 Technical measures
In the past many ‘technical’ measures have been taken to ‘tame the rivers’ in order to protect
the people from floods. Examples are the dredging and bulldozing of riverbeds to make them
deeper to carry the water away more quickly, and the building of dykes to concentrate the rivers
in narrower channels. Other technical constructions are regulation works and dams.

5.4.3 Floodplain restoration
From an ecological point of view more and more attention is given to floodplains. Existing
floodplains are preserved and new floodplains are created.
A positive example is the restoration of the upper Drava-river valley. In the period 1999–2002
the project partners (WWF Austria, Federal Ministry of Agriculture, Forestry, Environment and
Water Management) worked on a 57 km-long section of the Drava river in Carinthia. Beneficiary
was the Water Management Authority of Carinthia (Budget: 6.3 Mio Euro). The main aims of the
project were to maintain and improve the (natural) flood protection and the river dynamic
processes and to improve natural habitats and the populations of typical species. Measures
taken were widening of the river bed and reconnection of former side-arms to improve the
overall ecological value of the river stretch.
Restoration resulted in a better flood prevention (a 200 hectares natural flood retention area
with a capacity of 10 million cubic meters), a reduced flow velocity (slowing down the flood wave
speed by more than one hour), more space: (50-70 ha more river- and floodplain habitats),
prevention of further river bed deepening and doubling of fish population.
Recent flood control plans, like the ‘Stream Care Scheme Traisen’, are more integrated in their
approach and combine spatial measures (giving more space to the river), dike improvement
measures and ecological measures that ensure the river continuum.
In future years dikes will be more and more designed with respect to overtopping at selected
locations. In such cases when overtopping will occur the damages from runoff in the former
flood plain should be minimised by excluding potential runoff areas from intensive land
development.

5.5 Instruments

5.5.1 The role of planning and planning procedures
In Austria the 2002 floods have given a positive impulse to the realisation that spatial planning
can considerably reduce the hazard and damage of floods. Local spatial planning by
municipalities is no longer sufficient, because the impacts of floods concern complete regions.
Therefore regional thinking, planning and acting is needed. In line with the catchment area
approach of the European Water Framework Directive regional spatial plans will be developed.
The Austrian government is looking into measures to keep flood areas (Vorsorgeflächen) free or
to reclaim these areas.

The Austrian Water Act defines land property adjacent to public rivers specified in the Water Act
as "publicly owned land area". Starting more than 150 years ago until about 30 years ago there
were constraints for acquiring land on the riverside. For this reason these publicly owned land
areas are usually comparatively small. In the present situation much of the land adjacent to
rivers that will be flooded during larger floods is still private property.
5.5.2 Hazard zoning

The Water Act (see its Art. 38) requires the erection of structures to be built in areas prone to flooding by a flood size HQ30 to be subject to a legal permit. Structures built in areas prone to floods bigger than HQ30 are - via the Water Act - not subject to a legal permit.

Acts on Regional Planning (Raumplanungsgesetze) are Acts that fall under the competence of the Länder (Provinces of Austria). Only one out of 9 Länder (Lower Austria) as yet specifies that land areas prone to floods sized HQ100 cannot be allocated for the purposes of living or working places; infrastructures, however, can be erected.

The present spatial planning acts do not oblige municipalities to keep all flooding danger areas free from building and habitation, it merely recommends it. There is definitely a need for harmonization of land development plans with flood hazard maps and the control of its implementation.

5.5.3 Insurance and compensation schemes

In Austria risk financing is based on both national solidarity (disaster relief funds) and – to a small amount - private insurance.

In principle the government provides financial aid to victims of flooding. Federal funds are provided from the "Disaster Relief Fund", which is fed from the tax revenues of the Federal Governments according to a set formula.

The normal 'disaster relief funds' that are allocated at the Federal Ministry of Agriculture, Forestry, Environment and Water Management (Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft) for measures against the impact of floods were insufficient to cover a catastrophe of the 2002 flooding dimensions. Therefore after the 2002 flood a package of measures was considered which includes tax relief to compensate for property losses.

At present, the insurance sector offers but few products for flood-caused damage. Insurance coverage is in most cases severely limited.

5.5.4 Economic and fiscal instruments

Few economic and fiscal instruments for preventing flood damage have been identified. Funding of flood control measures is in most cases provided by the Federal State, the Provinces, communities, and other interested parties (= users) as laid down in the Hydraulic Engineering Assistance Act (Wasserbautenförderungsgesetz).

A lot of discussion is now going on about financial consequences of measures such as the Vorsorgeflächen. Downstream municipalities take advantage of measures, taken by upstream municipalities. How to share the costs between these municipalities?
6  Belgium

Belgium is a federal state that consists of 3 Regions: Flanders, Wallonia and Brussels. The responsibility for water management and spatial planning has been completely delegated to these regions. In the following, most attention is given to the situation in Flanders.

6.1  Type of flood problems.

Coastal flooding
In Flanders the major flood hazard area is the Scheldt area. Floods caused by storms forcing the North Sea water into the Westerschelde and from there into the Zeeschelde have led to large flooding. The largest was probably the ‘Allerheiligenvloed’ in 1570. In the 20th century 1953 – with relatively small damage compared with the Netherlands – and 1976 – with large damage due to flooding of the town of Ruisbroek – are the best examples of flood risks in the Scheldt area. In the 1976 flood 800 houses were flooded and the water level was at some places 4 meters high. Some parties claim that the Dutch Delta plan as increased flood hazard along the Scheldt, because during north-west storms all the North Sea water is now exclusively forced into the Westerscheldt.

River flooding
In Wallonia, the main flood problems are caused by the river Meuse, coming from across the French border. This problem takes place after prolonged periods of high rainfall in upstream areas. The Meuse river is subject to high flood risks as a result of human influence and changing precipitation patterns.

Urban floods during high rainfall
A third type is flooding as a result of high local rainfall. Especially in urban areas rainwater cannot infiltrate easily into the ground. In hilly terrains water streams are formed that run down the streets and sewage system can’t cope with the abundant water supply. In the last decade the number of events in which high local rainfall caused flooding of urban areas has increased. Since the water level in these cases is not rising very much the damage per event is generally not too high. The total damage after a large (and increasing) number of events however is considerable.

6.2  Political momentum

Especially after the Ruisbroek flooding in 1976 the Belgian government felt a strong sense of urgency to attack the problems of flooding. Inspired by the Delta plan in the Netherlands, the Flemish government prepared the Sigma plan.

Recently a new Law was passed in Parliament (2003-07-09) that handles the functional relationship between water en spatial planning to be worked out in spatial implementation plans (ruimtelijke uitvoeringsplannen) (see http://www.aquafin.be/). As part of this Law a water assessment procedure (watertoets) is required for constructions. In addition, inhabitants that live in flood prone areas can offer their premises to the state, who has to buy them out. Also the organisation will be simplified: there will be water boards and catchment committees for a limited number of catchment areas.

Both Flemish and Walloon authorities realise that rivers need more space. The larger part of the public on the other hand is still in favour of more technical solutions like dike elevation and
improvement. The reason for this lies in the NIMBY-syndrome: inundation areas are okay, as long as my property is not influenced.

6.2.1 Sigmaplan

The Sigmaplan is the most important project on flood prevention in Flanders. After the flood in 1976 the authorities in Flanders decided to develop this plan. Inspired by the Deltaplan from the Netherlands, The Sigmaplan is an integrated plan to reduce the flood frequency in the Scheldt catchment.

Figure 6-1 Part of the problem: the catchment area of the river Scheldt and its tributaries was reduced to a narrow strip next to the rivers.

In the first phase, the Sigmaplan (1977) contained three major elements:
- a Storm Surge Barrier at Oosterweel, downstream from Antwerp
- Improved dikes along the Scheldt river and tributaries
- retention areas (“Controlled Inundation Areas”)

Because the cost efficiency of the storm surge barrier was too low this part of the plan was abandoned. More than 400 kilometres of dikes have been improved (this is 80% of the planned 500 kilometres). Twelve retention areas (potpolders) have been realised and a 13th is under preparation.

At the time experts expected the measures would decrease flood hazard considerably. As a result of increasing urbanization and a future increase of rainwater discharge the flood frequency at present is 1 in 70 years and will decrease to 1 in 350 after realisation of the last retention area.

Therefore a second phase to the Sigmaplan is being prepared. In this context the authorities in Flanders are now looking for more locations for retention areas, not only in the Zeescheldt area but more and more in the upstream part of the Scheldt catchment. A three dimensional model has been made of the landscape and rivers and 182 potential retention areas have been identified. The whole area is being modelled and different potential measures are being studied. The flood frequency should drop to 1:10,000 years.
The following criteria are used: low lying land, no industrial developments present. Beside the realisation of new retention areas, also Controlled Tidal Areas (CTA’s, in which more frequent inundation is to be expected) and depoldered areas (present polders that will be given back to the (tidal) river) may provide a part of the solution. The idea of a storm surge barrier, improvement of dikes and construction of a channel between Wester Scheldt and Easter Scheldt are also (re)considered.

At present a Strategic Environmental Impact Assessment (SEIA) is under preparation. The abovementioned measures will make part of the study. The preferred alternative that follows from the SEIA will be put to parliament for approval in 2005. After approval focused studies on retention areas and their impacts on the hydrology will be conducted. Specific Project Environment Assessments will be executed afterwards. Realisation of the first retention areas in the second phase is not expected before 2010.

The Sigmaplan has been drawn up by the Administration of Waterways and Marine Affairs, which falls under the Flemish Ministry of Finance, Spatial planning, Science and Technological Innovation.

If a specific location is determined to serve as Controlled Inundation Area (CIA), not all the present uses of the area can be maintained. The area is no longer suitable for housing, and other uses may be limited. The change of uses must be laid down in the Spatial Execution Plan (see 6.5.1). For instance, for the CIA Kruibeke-Bazel-Rupelmonde all the underlying uses were changed to nature area, building-free agricultural land, area for water management and area for communal amenity and public benefit.
6.3 Organisation

**Flanders**

In the Flemish region, final responsibility for water management and spatial planning is with the Ministry of Finance, Spatial Planning, Science and Technological Innovation. This Ministry is divided in the following Departments:

- Common Affairs and Finance
- Science, Innovation and Media
- Education
- Welfare, Public Health and Culture
- Economy, Labour, Home Affairs and Agriculture
- Environment and Infrastructure

The Department of Environment consists of the following Administrations:

- Environment, Nature, Land and Water Management (A-MNLW)
- Spatial Planning, Housing, Monuments and Landscapes
- Roads and Traffic
- Waterways and Marine Affairs (A-WZ)

Responsibility for water management is attributed on the basis of the importance of the water body.

- Waterways of the 1st category are managed by the Department of Environment of the Ministry
- Waterways of the 2nd category are managed by the Provinces
- Waterways of the 3rd category are managed by the Municipalities
- Water within polder areas is managed by polder administrations

All actors in the field of integrated water management are represented in the Flemisch Committee for Integrated Water Management (Vlaams Integraal Wateroverleg Comité). In addition, different authorities are currently working together in catchment committees (Bekkencomités), with the aim to prepare Integrated Water Management Plans.

**Wallonia**

In Wallonia the situation is as follows:

- The Ministry of Public Works and Transport (Ministère wallon de l’Equipement et des Transports) is responsible for management and maintenance of the navigable waters (460 km) and waterways that are not classified as navigable (280 km).
- Non-navigable waterways of the 1st category (1650 km) are managed by the Ministère de la Région wallonne.
- Non-navigable waterways of the 2nd category (6000 km) are managed by the provinces.
- Non-navigable waterways of the 3rd category (5750 km) are managed by the municipalities.

6.4 Measures

6.4.1 Technical measures

The construction and improvement of dikes remains important in prevention of flooding. For reduction of the storm surge on the Zeescheldt, the Belgian authorities are very interested in the construction of a connecting channel between Westerschelde and Oosterschelde. This would cause a considerable decrease of the water level in the Scheldt river and its tributaries. Since the proposed channel is within Dutch borders an agreement on this project will probably be far from easy (as soon as the Dutch are involved, complications start). In the Walloon part of the catchment area of the Meuse eight storage reservoirs are situated. Beside generation of electricity, drinking water supply and use for recreation these reservoirs
have important hydrological impacts. Both a continuous minimal discharge, to make year round shipping possible and to combat drought, and a maximum discharge, to prevent downstream flooding, can be reached by intelligent operation of the discharge facility. The largest reservoir, Eau d’Heure/Plate Taille, is owned by the Ministère Wallon de Equipements et des Transports, that rents out the hydro-electric power station to a private organisation. A lot of attention is given to the management of the weirs in extreme discharge conditions and to deepening the river bed of the Meuse river.

![The Zeescheldt near Tielrode](http://www.sigmaplan.be/)

6.4.2 Retention in the catchment

At present measures to increase the retention capacity in upland areas of the Meuse (Amblève, Ourthe, Semois, Sambre, Vesdre) are under discussion. It is expected that these measures will reduce the flood hazards downstream, by maintaining and increasing a natural upstream sponge.

6.4.3 Retention areas along rivers

Retention areas have been created and are being planned along the Scheldt, as part of the Sigmaplan (see paragraph 6.2.1). In retention areas close to the North Sea no agricultural use is profitable, because of high salt concentrations in the inundation water. These areas usually have a nature function. Upstream retention areas however can still be used for agriculture, as only fresh water is inundating the area in frequencies of once in three or four years. Less and less uninhabited areas are available and the resistance of people whose lives and properties are influenced is increasing. For many citizens the danger of floods is hardly existent because they have never been confronted with floods. In their opinion realisation of retention areas is not necessary. Local communities often are completely surprised when their region is selected as a potential retention area. Besides, to change the main function of an area, usually from agricultural use to water retention, a long official and legal process has to be followed. It took the authorities a long time to realise the last retention area in the first phase of the Sigmaplan, in the municipality of Kruibeke. The main reason was the opposition from the mayor of Kruibeke. He was in the position to delay the
process by turning to court and using every legal opportunity available to try to stop the realisation.

At present an INTERREG (IIIB) project has been formulated that will involve the local communities in Durmevallei and Prosperpolder in the planning process by informing them and using their knowledge and experience for drawing up the plan. The aim is a broadly accepted plan that will not face heavy opposition. In preparation of this project a number of studies has been executed. One of them is an actor analysis. Four kinds of actor have been identified:

1. Actors that will experience the consequences of the CIA;
2. Actors that have competences in relation to the issue;
3. Actors that represent social interests;
4. Actors that have knowledge of the issue or related issues.

Thirteen actors have been identified and interviewed: four Flemish governmental organisations: one provincial authority, one local authority (water management), four municipalities and three interest groups (one nature conservationist group, one hunters’ interest group and one farmers’ interest group).

All actors were invited to bring forward problems they fear, chances they see, demands they have and wishes they would like to see realised. On top of that the actors were invited to express their views on the role they can play in realising the retention area, and afterwards in managing the area.

![Figure 3.6 The retention area at Tielrode after inundation at storm tide](image)

6.4.4 Floodplain restoration

In the region where the Meuse river borders Belgium and the Netherlands both countries are working together in combining flood reduction measures with nature development. In Flanders (on the Belgian side) part of the land has dropped as a result of mining, and has become increasingly vulnerable to flooding. Floods in this area would cause high damage to buildings and landed property.
6.5 Instruments

6.5.1 Spatial planning in Flanders
Spatial planning in Flanders occurs at 3 levels (region, province, municipality), with at each level a Spatial Structure Plan (Ruimtelijk Structuur Plan) setting out the desired spatial structure on a long term, and a binding Spatial Execution Plan (SEP; Ruimtelijk Uitvoerings Plan). These plans will slowly replace the older Provincial Plans (Gewestplannen, Bijzondere Plannen van Aanleg). At this point it is not clear if the full matrix (6 plans) will be fully filled.


A new instrument is a governmental Right of Pre-emption (Recht op Voorkoop) in areas designated in the SEPs, in order to realise social housing, nature areas or restructuring of industrial zones. For various reasons, a backlog has occurred in the prosecution of developers and owners of houses that have been built without the proper permits; in the near future all cases – also the older ones – will be prosecuted, in order to achieve a change in mentality. The government has the possibility of expropriation if the acquiring of property is needed for implementation of the SEP. An expropriation plan must be drawn up that parallels the SEP and follows the given procedure regulations. If due to a change in the spatial plan a location loses its right of destination for housing, 80% of the damage is compensated (planschade).

A new element is the introduction of the reverse; if a location increases in value due to a change in plan (planbaten), the owner must pay a part (approximately 20%) of the extra value, when he sells the property.

Recently a new Law was passed in Parliament (2003-07-09) that handles the functional relationship between water en spatial planning to be worked out in spatial implementation plans. As part of this Law a water assessment procedure (watertoets) is required for constructions.

6.5.2 Hazard zoning and building regulations
In former decades the possibility of flooding has not received a lot of attention in spatial planning. Large potentially floodable areas are filled with houses and other buildings. Only in recent years the high costs of floods are increasing the pressure to secure areas with a high flood hazard from settlement or even to clear those areas of existing habitation. This is especially relevant for areas along the Meuse river.

6.5.3 Insurance
At present plans are under discussion for a facultative insurance against ‘natural disasters’ including flooding. Some parties argue that people in low-risk areas should contribute to a national fund. Others don’t agree with this solidarity principle and say people in high-risk areas should take additional insurance. Insurance companies may refuse to insure people in areas that are frequently flooded. Decisions will be made at the highest political level.

6.5.4 Compensation schemes in retention areas
The first retention areas that were implemented in the Sigmaplan were mostly uninhabited areas. Buildings that were present, were expropriated and removed. The expropriation price was market driven and held no relation to the fact that the building is in a retention area. So far a compensation fee for the land has not been necessary. The retention areas are usually only inundated in winter time, when no crop is on the land. Only once, when sheep drowned in a retention area, the farmer was given a compensation fee. Every farmer that feels he is no longer able to make a living in a retention area, is given the opportunity to sell his land for a market-based price.
7 England

This quick scan describes the situation in England (including Wales). Since 1995 Scotland has obtained autonomy in matters relating to flood management. The system in Scotland is different from the system in England. An introduction to the situation in Scotland can be found at http://www.sepa.org.uk/flooding/scotland/.

7.1 Type of flood problems

All types of flooding occur in England and these are widely distributed around the country, including:

- Coastal flooding – widely distributed but mainly on the East and South Coasts.
- River flooding – country wide
- Groundwater flooding – mainly in the South and East of England.
- Urban drainage flooding – countrywide.

A major flood concern for the South East of England is the ‘storm surge’ in the North Sea, of the type which occurred in 1953. Protection against such an event is ensured through extensive coastal defences including the Thames Barrier, which is increasingly used to protect London from such floods.

One should note that most catchments in England are small and that the largest river, the Trent, has an average mean flow of only 100 m3/s. So most rivers show fast rising levels in the case of regional or even local torrential rains.

Approximately 8% of the total area of land in England is at risk from river flooding, including tidal rivers and estuaries, this equal circa 10,000 km2. Approximately 30% of the coastline is developed and some 2,500km² of land (1.5% of the total area) is at risk of direct flooding by the sea. About 1.7 million homes and 130,000 commercial properties worth over £200 billion and 1.3M ha of agricultural land worth about £7 billion are at risk from flooding. This equates to about 10% of the population and 12% of the agricultural land, including 61% of Grade 1 agricultural land. There have been flood events in 1998 and 2000 that led to reviews, policies and change in insurance policies. The Easter 1998 floods caused 5 deaths, £400M damage and resulted in 1,500 people being evacuated. At the autumn/winter 2000 floods about 10,000 properties were flooded.

Flood situations could be typified as fast rising floods on small to medium sized rivers leading to small to medium sized inundations. Defence works are often constructed for 50-100 year probability. As an example one may cite the River Severn at Bewdley at Worcestershire, England. Here rainfall in the upper catchment led within 2-3 days of rain to a 1% flood of 694m³/s that affected houses and businesses along the banks of the river.
Figure 7-1 Indicative flood hazard map of England. Areas in **blue** have a 1:100 year chance of fluvial flooding; areas in **green** have a 1:200 year chance of tidal and sea flooding


Detailed maps can be found at

http://216.31.193.171/asp/1_map.asp?name=1_ea&cmd=map&left=485700&right=553700&top=331860&bottom=263860&maptool=showlayer&cboScale=step3&showlayer=if
7.2 Politics and stakeholders

7.2.1 Political momentum
Due to the floods of Easter 1998 and Autumn 2000, flooding is treated as a serious policy issue. There is a National Strategy for Flooding that is currently being revised and planned to be launched in Oct. 2004. A new Policy Guidance document (PPG 25) gives specific guidance on land use planning and flood prevention (see http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_606931-08.hcsp).

7.2.2 Organisation
The Department for the Environment, Food and Rural Affairs (DEFRA www.defra.gov.uk) is responsible for flood policy and funding of most flood related issues. Responsibility for flood management varies per source of flood water.
- Along the coast, the responsible party can be the Environment Agency, the Local Authority, the port authority or another body, including the land owner.
- Along the main rivers (of which there are 34,000 km with 16,800 with fixed defences) the Environment Agency (EA) is the Operating Authority that undertakes works and maintenance. The Environment Agency is a non-departmental public body (NDPB) (see http://www.environment-agency.gov.uk/)
- Along non-main rivers local district or county authorities (LA) are responsible
- Internal Drainage Boards (a total of 235) operate in some 1.2 million hectares of low-lying designated areas.
- Along the coast various authorities (EA, LA) and even the land owners can be the designated authority.

7.2.3 General strategy
Land use planning and water management have long been separate activities. The recently adopted planning guidance PPG25 requires however that the local planning authority consults with the Agency regarding areas with flood risks. The PPG 25 states the following principles/assumptions:
- the susceptibility of land to flooding is a material planning consideration;
- the Environment Agency has the lead role in providing advice on flood issues, at a strategic level and in relation to planning applications;
- policies in development plans should outline the consideration which will be given to flood issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood hazard is expected to increase as a result of climate change;
- planning authorities should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid such risk where possible and managing it elsewhere;
- planning authorities should recognise the importance of functional flood plains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended flood plains
- developers should fund the provision and maintenance of flood defences that are required because of the development; and
- planning policies and decisions should recognise that the consideration of flood risk and its management needs to be applied on a whole-catchment basis and not be restricted to flood plains.
Climate change is taken into account in all activities. Sea level rise and rainfall increases are taken into account for all new works on a 50-100 year horizon, depending on the expected life of the works. On rivers such as the Thames a maximum 20% increase in peak flow is taken into account. All development should assess flood risks taking into account climatic change.

7.2.4 Who takes the initiative and who makes the decisions

There is no statutory duty on the Government to protect land or property against flooding. Operating authorities have permissive powers but not a duty to carry out flood defence works in the public interest. Individual property owners are also responsible for managing the drainage of their land in such a way as to prevent, as far as is reasonably practicable, adverse impacts on neighbouring land.

The Operating Authorities (Environment Agency, local authorities or Internal Drainage Boards) identify and promote schemes on the basis of need at a local level. Regional Flood Defence Committees (typically consisting of representatives of Local Authorities and the Environment Agency) decide which schemes should be promoted. Schemes are appraised and justified on the basis of benefit/cost, technical feasibility, social factors and environmental acceptability. DEFRA covers 35 to 75% of the capital costs; about 20% is raised by local taxes (e.g. by way of property tax on dwellings). DEFRA assesses schemes on technical feasibility, environmental effects and economic justification. Especially the economic appraisal is very detailed. National Flood Risk assessments will be used increasingly in the future to identify priority areas for investment.

Those proposing particular developments, such as developers are responsible for:
- Providing an assessment of whether any proposed development is likely to be affected by flooding and whether it will increase flood risk elsewhere and of the measures proposed to deal with these effects and risks; and
- Satisfying the local planning authority that any flood risk to the development or additional risk arising from the proposal will be successfully managed with the minimum environmental effect, to ensure that the site can be developed and occupied safely.

Since flood risks affect the value of land and property it is not only the responsibility but also in the interest of developers to deal with these matters. It is then for the local planning authority, advised as necessary by the Environment Agency, to decide.

There is limited public participation in decision-making. Local governments invest mainly on the basis of national funding lines as they have limited possibilities to generate local finance. Water boards are controlled by the central government.

7.3 Measures

A wide range of measures are in use in England and Wales:
- structural measures such as bypass channels (Jubilee River) and demountable flood defences (e.g. at Bewdley)
- retention areas (washlands, wetlands, detention/retention basins) and multi-form channels including river restoration;
- flood proofing, including resilient reconstruction

Table 7-1 summarises, for each option, the powers to adopt each form of flood management and the source of funding.

The priority for decreasing flood damage is in urban areas as these are the areas of greatest risk. Flood damage risk is a combination of flood hazard and flood damage potential. The aspect of flood hazard is tackled primarily through built defences, but there is a move to try to also control runoff at source through land management measures in the urban and rural environments. This is unlikely to remove the need for built defences but may reduce their extent and increase their ability to adapt to climate change. Measures such as infiltration, retention and buffers are increasingly being considered in urban areas through the use of SUDS (sustainable urban drainage systems).
urban drainage systems). The use of buffer zones within urban areas is a favoured option but it takes time to realise the release of currently developed areas for this purpose. The PPG 25 clearly represents the ongoing shift in flood management approaches. Reduction of flood damage potential via flood proofing and control of inappropriate development in areas at risk from flooding are becoming more important even behind dikes and floodwalls. There is a requirement to consider the managed retreat as well as abandonment of existing defences in each project. In addition, decisions that were priorly mainly based on economic aspects are now taken on the basis of a more integrated assessment.

Table 7-1 Flood management options for riparian flooding (adapted from [http://www.ecologic-events.de/floods2003/de/documents/ColinGreen.PDF](http://www.ecologic-events.de/floods2003/de/documents/ColinGreen.PDF))

<table>
<thead>
<tr>
<th>Option</th>
<th>Body with power to provide/requirement</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source control in agriculture</td>
<td>DEFRA</td>
<td>Programmes under the Common Agricultural Policy</td>
</tr>
<tr>
<td>Source control</td>
<td>The local authority with planning responsibility, with agreement of sewerage company</td>
<td>Land owner</td>
</tr>
<tr>
<td>Land use controls</td>
<td>The local authority with planning responsibility</td>
<td>Land owner</td>
</tr>
<tr>
<td>Dikes, flood walls</td>
<td>EA or LA depending upon whether main or non-main river</td>
<td>Flood defence funds</td>
</tr>
<tr>
<td>Retention areas – construction</td>
<td>EA or LA depending upon whether main or non-main river</td>
<td>Flood defence funds</td>
</tr>
<tr>
<td>Retention areas - use of naturally available storage</td>
<td>No legal powers to compensate land owners for any use in this way, nor any requirement to compensate land owners for flooding. Some scope to use programmes under Common Agricultural Policy for these purposes</td>
<td></td>
</tr>
<tr>
<td>Bypass channels</td>
<td>EA or LA depending upon whether main or non-main river</td>
<td>Flood defence funds</td>
</tr>
<tr>
<td>Land acquisition and removal of buildings that are at risk of flooding</td>
<td>No organisation has legal powers to undertake for flood defence purposes i.e. legally, would have to be undertaken in pursuit of other objectives</td>
<td></td>
</tr>
<tr>
<td>Managed retreat</td>
<td>Environment Agency (EA) or Local Authority (LA) depending upon whether main or non-main river</td>
<td>No legal requirement to compensate for flooding and hence no power to compensate land owners who will be exposed to flooding or loss through erosion as a consequence of managed retreat</td>
</tr>
<tr>
<td>Flood proofing properties - new buildings</td>
<td>LA with planning responsibility</td>
<td>Land owner</td>
</tr>
<tr>
<td>Flood proofing properties - existing buildings</td>
<td>EA or LA depending upon whether main or non-main river</td>
<td>Flood defence funds; or land owner</td>
</tr>
<tr>
<td>Resilient reconstruction</td>
<td>This is becoming a requirement of insurance companies as a condition of continued provision of insurance cover</td>
<td>Land owner</td>
</tr>
<tr>
<td>Compensation for losses</td>
<td>Insurance and charitable appeals (note: rate of take up of insurance is income related)</td>
<td>Those who buy insurance or those who contribute to disaster appeal</td>
</tr>
</tbody>
</table>

7.4 Instruments

7.4.1 Role of planning and planning procedures

Local Authorities are the spatial planning authorities. Historically, there has been a weak linkage between water and land management. While there is detailed land use planning, there has been little consideration in that process either of the implications for the water environment or of the water related constraints to land usage. Water Management plans (Catchment Flood Management Plans and Shoreline Management Plans) may include spatial measures but these have no legal basis at present.
New planning guidance (PPG 25) describes the appropriate planning response as a function of flood risk (see Table 7-2). PPG 25 places a new emphasis upon the risks of development in flood plains, and consultation of the Environment Agency by the local planning authority where appropriate. However, advice given by the Environmental Agency does not have to be followed. Compliance with PPG 25 is evaluated and reported on every year (see http://www.environmentagency.gov.uk/commondata/105385/hlt12august_571722.pdf).

In 2002 the Agency was consulted by the local planning authorities on 90,000 planning applications, of which 20,000 required consideration on flood risk grounds; in 4,500 of these cases the Agency made objections on flood risk grounds. In 220 cases, the local planning authorities proceeded with the plans contrary to the Agency’s advice (due to long time delays, there is no 1 on 1 relationship between consultations and final decisions).

Table 7-2 Zones and planning responses (source: PPG25)

<table>
<thead>
<tr>
<th>Flood Zone</th>
<th>Appropriate Planning Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Little or no risk</td>
<td>No constraints due to river, tidal or coastal flooding.</td>
</tr>
<tr>
<td>Annual probability of flooding:</td>
<td></td>
</tr>
<tr>
<td>River, tidal &amp; coastal &lt;0.1%</td>
<td></td>
</tr>
<tr>
<td>2. Low to medium risk</td>
<td>Suitable for most development. For this and higher-risk zones, flood risk assessment appropriate to the scale and nature of the development and the risk should be provided with applications or at time of local plan allocation. Flood-resistant construction and suitable warning/evacuation procedures may be required depending on the flood risk assessment. Subject to operational requirements in terms of response times, these and the higher-risk zones below are generally not suitable for essential civil infrastructure, such as hospitals, fire stations, emergency depots etc. Where such infrastructure has to be, or is already, located in these areas, access must be guaranteed and they must be capable of remaining operational in times of emergency due to extreme flooding.</td>
</tr>
<tr>
<td>Annual probability of flooding:</td>
<td></td>
</tr>
<tr>
<td>River 0.1-1.0%</td>
<td></td>
</tr>
<tr>
<td>Tidal &amp; coastal 0.1-0.5%</td>
<td></td>
</tr>
<tr>
<td>3. High risk</td>
<td></td>
</tr>
<tr>
<td>Annual probability of flooding, with defences where they exist:</td>
<td></td>
</tr>
<tr>
<td>River 1.0% or greater</td>
<td></td>
</tr>
<tr>
<td>Tidal &amp; coastal 0.5% or greater</td>
<td></td>
</tr>
<tr>
<td>a. Developed areas</td>
<td>These areas may be suitable for residential, commercial and industrial development provided the appropriate minimum standard of flood defence (including suitable warning and evacuation procedures) can be maintained for the lifetime of the development, with preference being given to those areas already defended to that standard. In allocating or permitting sites for development, authorities should seek to avoid areas that will be needed, or have significant potential, for coastal managed realignment or washland creation as part of the overall flood defence strategy for coastal cells and river catchments.</td>
</tr>
<tr>
<td>b. Undeveloped &amp; sparsely developed areas</td>
<td>These areas are generally not suitable for residential, commercial and industrial development unless a particular location is essential, eg for navigation and water-based recreation uses, agriculture and essential transport and utilities infrastructure, and an alternative lower-risk location is not available. General-purpose housing or other development comprising residential or institutional accommodation should not normally be permitted. Residential uses should be limited to job-related accommodation (eg caretakers and operational staff). Caravan and camping sites should generally not be located in these areas. Where, exceptionally, development is permitted, it should be provided with the appropriate minimum standard of flood defence and should not impede flood flows or result in a net loss of floodplain storage.</td>
</tr>
<tr>
<td>c. Functional flood plains</td>
<td>These areas may be suitable for some recreation, sport, amenity and conservation uses (provided adequate warning and evacuation procedures are in place). Built development should be wholly exceptional and limited to essential transport and utilities infrastructure that has to be there. Such infrastructure should be designed and constructed so as to remain operational even at times of flood, to result in no net loss of floodplain storage, not to impede water flows and not to increase flood risk elsewhere. There should be a presumption against the provision of camping and caravan sites.</td>
</tr>
</tbody>
</table>

Flood hazard maps are used to inform local plans and discourage development in flood risk areas. Flood hazard maps are based on the approximate extent of floods with a 1% annual probability of occurrence for rivers and a 0.5% annual probability of occurrence for coastal areas.
under present expectations or, where this is greater, the extent of the highest known flood. Flood hazard maps are available for the larger part of the country even by internet. One should note that a 1% flood has a 26% probability of being equalled or exceeded at least once in 30 years (the duration of a typical mortgage) and a 49% probability of being equalled or exceeded at least once in 70 years (a typical human lifetime).

For development behind river flood defences, consideration should be given to the need for the risks to be minimised by incorporation of appropriate flood protection measures in the design and construction of buildings (i.e. flood proofing). Details of such measures can be found in http://www.odpm.gov.uk/stellent/groups/odpm_buildreg/documents/page/odpm_breg_600451.pdf.

The Government places emphasis on the need for urban regeneration and the redevelopment of previously developed land (“brownfield sites”) to minimise the need for development of green-field land. Because much past industrial development took place alongside rivers on suitable flat land, these sites are often vulnerable to flooding. In making proposals for redevelopment of such sites or the re-use of existing buildings and structures, local authorities should take account of flood hazard. Any such redevelopment should avoid interference with flood plain flows or compromising future shoreline or river management options. Developers and local planning authorities should consider what types of new development would be appropriate to these circumstances.

7.4.2 Insurance and compensation schemes
Governments do not compensate victims of natural disasters. There is no damage compensation scheme. A strong insurance industry provides (voluntary) insurance on a commercial basis. Insurance is likely to be increasingly related to zoning in the future. Insurance companies have posed more restrictions lately. The premium was so far divided over all insurance policies but may be differentiated in future to specific zones. Some insurance companies are believed to be considering incentives for flood proofing.

7.4.3 Economic instruments
The provision of grants from the national government budget is determined by DEFRA on the basis of a benefit/cost economic justification. Decisions are made on the basis of benefit/cost from UK government funds. A combination of flood damage and probability is used to determine the most effective prevention measure – if any (see http://www.defra.gov.uk/environ/fcd/pubs/pagn/fcfdpag3/)

Multi-objective or joint finance with other functions is being investigated.
8 France

8.1 Type of flood problems

Figure 8-1 Marseille, December 2003

Less than 4% of France is liable to flooding but 20-25% of the French communes is built on flood plains, a number totalling 2 million inhabitants especially near larger metropolitan areas. Also a large part of the gross national product is generated in flood prone areas. The last 20 years have seen a rise in flood events and flood damage. Consequently, legal action was taken in a number of laws.

Many rivers in the mountainous parts of France flow in confined valleys and experience flash floods. Other rivers like the Rhone, Seine, Loire and Garonne flow part of their length through river plains and have levees and dike systems. The downstream part of the Loire and Rhone face the hazard of coastal surges.

Most levees and dikes along the major rivers are designed on a 1 in 100-flood event basis. Floods exceeding that height can give rise to large flood damage. As an example the Loire may be taken (see http://www.ecologic-events.de/floods2003/de/documents/NicolasGerardCamphuis2.PDF). This river has a system of levees and dikes that are mainly set on 1 in 50 and 1 in 100 design levels, with up to 1 in 500 year floods for the major urban areas. However, the present protection system does not protect significant parts of urban areas that have been built in flood prone zones. A 1 in 50 year flood would results in the flooding of over 20,000 people and cause over 110 million Euro damage; a 1 in 100-flood would lead to a damage of 1 billion Euro (see Figure 8-2). Presently a flood protection scheme for the Loire is being developed that entails 0,5 billion Euro of investments in the coming 15-20 years.
Figure 8-2 Loire river basin and estimate of 1 in 100 year flood damage (from http://www.ecologic-events.de/floods2003/de/documents/NicolasGerardCamphuis2.PDF)
8.2 Political momentum

Flood problems have been on the political agenda for many decades now. Recently a national debate has started on the water management for this century, the “debat national sur la politique de l’eau”. The debate has three phases, the last one being a public consultation. There are three major themes: water and man (“l’eaux et l’homme”), the aquatic environment (“les milieux aquatiques”) and management and finance (“le gouvernance et les moyens”). Issues are the protection and restoration of floodplains, the reduction of flood hazard and flood damage potential, the management of urban areas and the premium differentiation of the flood insurance system.

The debate marks a shift from flood hazard reduction towards flood damage reduction. The state is considering to develop a policy for the management of areas located behind flood protection dikes. This is a difficult but relevant issue since many citizens and capital investments are made on flood plains behind 1 in 100 dikes and levee systems. A ministerial memo from 2002 restricts the authorisation of constructions for sectors located behind dikes and insists on the fact that the area under consideration must not pose a threat to human life.

A special fund (called the Barnier fund) was established with the purpose to acquire threatened property on a voluntary basis when rehabilitation and required protection exceeds the value of the property. One could say that France has taken the last step in flood management, the gradual retreat out of flood prone areas that are too difficult and costly to manage. However the number of buildings so far bought out with the help of the Barnier fund is very small. There will be a complete coverage of France with flood hazard maps 1:25.000 by 2005.

Currently the Risk Law is being drafted (or Law on the Prevention of Technological and Natural risks and Damage Control); of which Titre II chapitre IV Prevision des Crues is relevant (see http://www.environnement.gouv.fr/telch/rapports-ig/2003/Annexes-rapport-champs-expansion.pdf). In this draft law, State and regional authorities are responsible for risk prevention; the mayors are made responsible for informing the public. In each Departement there will be a Commission departementale des risques naturels majeurs with the responsibility of risk prevention. The Prefect can designate hazard zones, floodplains and retention areas after a public consultation. There are special provisions for the restoration of river stretches upstream of urban areas.

8.3 Organisation and strategy

France has over 280,000 km of waterways, only 14,000 km of which are owned by the State, the rest is privately owned.

The 36,000 French communes are the primary authorities responsible for local maintenance of order and safety and exposure to flood risks. The inhabitants should inform themselves and protect themselves and their property from flooding.

The state is responsible for flood forecasting and alert systems.

France has 6 river basin authorities (Agences de l’eau). These Agences have a committee (Comité de Basin) with representatives from local, regional and state authorities and local stakeholders. The Advisory board (Conseille d’Administration) consists of representatives of the regional authority, users and state in equal numbers.

The flood management strategy for the river Loire is based upon the so-called 3P strategy of Prediction, Prevention and Protection. Protection focuses on: restrictions to urbanisation, restoration of the river channel and of its tributaries, the creation of a retention area along the river and additional protection works. This is more or less the general strategy followed for all rivers in France at present.

8.4 Measures
8.4.1 Floodplain restoration and retention areas along rivers
Retention is sought increasingly in former natural floodplains and less in upstream artificial reservoirs. However, for several French rivers storage in reservoirs is still an important flood alleviation measure. As an example, Figure 8-3 shows a plan for the Vidourle which focuses on retention upstream with a number of artificial reservoirs that have the combined objective of flood management and drought management. In addition the plan proposes the restoration of 2 former floodplains over more than 1000 ha.

Bassin versant du Vidourle - Objectif de rétention par sous bassin

Figure 8-3 Map showing the planned reservoirs on the Vidourle as part of a flood management and drought management strategy.

8.4.2 Floodplain restoration and retention areas along rivers
The restoration of floodplains and retention areas (champs d’inondation or champs d’expansion), is widely debated in France. Many river basin authorities have large-scale plans. However, so far these measures have been mainly implemented along the Upper Rhine, within the framework of the French-German Treaty. In other parts of France only smaller areas have been realized.
**Example Oise et Aisne**

Along the Oise et Aisne, a river basin of 17,000 km² draining into the Seine, over 81-million m³ of retention capacity in over 100 sites has been identified in a feasibility study, following floods in 1993 and 1995 (see [http://www.proxines.com/asp/article.asp?idrub=2&idarticle=2087](http://www.proxines.com/asp/article.asp?idrub=2&idarticle=2087)). Half of these sites are to be implemented urgently.

A previous plan to construct storage reservoirs was cancelled due to local opposition. One major retention area is planned at Longueuil for 10 million M3, which is presently negotiated with the farmers. It will consist of different hydrological units. Another is planned near Proisy (2 million-m3), also on agricultural land within the same river basin. In the project, the Prefects of the 9 Departements involved cooperate with the communities, the Agence d’Eau of Seine-Normandie and the shipping authority (*Voies Navigables de France*). The costs are divided between the state (1/3), the regions (1/3) and the department (1/3).

**French-German Treaty; example Polder Erstein**

A special case forms the French-German Treaty for the river Rhine of 1982. Its major goal is to gain flood protection against a 200 year flood event. A 200-year flood event would endanger 1000 square kilometres along the Upper Rhine, mainly in Germany between Iffeshem and Bingen; It would cause a flood damage of 12 billion Euro and affect 95 communes with 700,000 inhabitants in an area with an annual economic production of 35 billion Euro. Because Germany is the main beneficiary, it also contributes to the measures being taken in France. The plan envisages the creation of 280-million m³ flood storage capacity in both countries. In Germany this storage capacity will be implemented mainly in retention areas (see paragraph 9.4.4.1). In France the following measures are taken:

- 45 Million m³ storage capacity is created by adapting the hydro-electric reservoirs upstream of Strasbourg.
- 5,6 Million-m³ storage capacity has been realised in 1992 in polder la Moder near Fort-Louis. This polder is 240 hectares, with 100 hectares of gravel pits. It has so far never been used.
- 7,8 Mio m³ has been realised in polder d’Erstein, which has been recently completed. It comprises 540 hectares of mainly forested areas.

The polders have the double objective of nature conservation and of flood management. It is for this reason that the Polder Erstein will be flooded every 10 years with about 0,5 m. An old river arm within the polder, the Giessen, will be flooded about 60 days every year. A similar regime has been proposed for Polder Moder.

*Figure 8-4 Construction and intake of Polder Erstein*
- Proposed retention areas along the Seine

A large-scale study is presently being conducted along the upper reaches of the Seine (Etude Globale d'Aménagement de la Bassée) to look for possibilities to use existing and create new recreation and retention lakes in order to reduce the peak flow of the Seine (http://www.labassee.com/). The project has two major objectives: flood peak retention and socio-economical sustainable rural development. It focuses on 2,500 hectares between the communes of Marolles-sur-Seine et l’aval de Bray-sur-Seine. The study focuses not only on hydraulic aspects but also on the compatibility between land use and periodic inundation. In consideration is a system of compartments with large pumping stations able to lower water level prior to retaining the peak flood. The study also involves planning and public consultation in 2004. Decisions will be taken in 2005. Communes are involved and there is much attention for public information.

Figure 8-5 The canal a grand gabarit and older water reservoirs in La Bassee

8.5 Instruments

8.5.1 Role of planning

Water management plans

The Law of 1992 introduced integrated water management planning by way of SDAGE and SAGE. (SDAGE Schema Directeur d’Amenagement et de Gestion des Eaux) are the strategic plans that cover all water management issues (waterquality, waterquantity and water use); the plans are made by the Agences d’Eau on the level of the river basins; they are set for a 15-year period and need the approval of the Prefects of the Departements that share the river basin. The first set of SDAGE’s stem from the 1996. Presently there is a shift towards a more open planning process and incorporating also human issues. The six SDAGE plans form the basis of the national water management programme. On a more local level (500 to 2000 km2) water management plans (SAGE, Schema d’Amenagement et de Gestion des Eaux) are made that deal with the concrete implementation in projects of the targets in the respective SDAGE. Local water commissions - consisting of representatives of the Communes, the Departement and local
stakeholders - define the SAGE, with technical and financial assistance of the Agence d’Eau. After approval by the Prefect, the SAGE have regulatory status. It is expected that in the future SDAGE and SAGE will increasingly include aspects of rural planning aspects. The role of the Agences d’Eau is under discussion, since they can only handle flood protection and not flood damage prevention, which is within the jurisdiction of the communes via the application of hazard zoning and building regulations.

8.5.2 Hazard zoning and building regulations
In France there is a long tradition of legally enforced hazard zoning. A law of 1935 introduced the first flood hazard mapping and urban zoning and construction regulations. In spite of the law, many floodplains were built up in the 1950s. After serious floods, the law of 1982 introduced the mandatory Zoning Hazard Exposure Maps (PER, Plan d’Exposition au Risque d’Inondation), in conjunction with a national insurance against flood damage. The PER should ensure that all construction is banned from areas with a high flood hazard (“red zones”) and subject to building regulations in areas with a moderate flood hazard (“blue zones”). In addition is was expected that people in flood prone areas invest in flood prevention up to at least 10% of their property value in a period of 10 years. This has not been the case. Local authorities underestimate the size of the blue en red zones, since there is national insurance to back up any flood damage. PERs were made on the local level and were the responsibility of the majors; in some 10 years fewer than 100 PER were published.
In observing that the introduction of the PERs had done little to limit the constantly increasing growth of housing and business space on flood-prone areas, and following large flood events in 1993 and 1995, the State decided in 1995 to replace the PERs by PPRs ("preventive plans for foreseeable natural risks" Plan de Prevention des Risques Naturels). All flood-prone communes are required to draft a PPR. By late 2002, 3,700 communes had an approved PPR and 5,700 others a PPR in development.

As with the PERs, the local communes are responsible for formulating the PPRs. The Agences de l'eau gives technical support and advice in the formulation of these plans. In contrast with PERs, PPRs must be approved by the Prefects; failure to comply with the provisions of a PPR is subject to prosecution and criminal sanctions.

As it is up to the local communes to stipulate regulations and to zone flood hazards, the PPRs are similar in structure but may differ considerably in the type of hazard maps and zoning regulations.

The PPR has proven a useful tool in limiting the extension of urban development and imposing simple protective measures on new constructions. However, it has considerable difficulty in prescribing preventive measures on existing buildings. In addition, it generates conflicts with local officials who fear being restricted in urban development plans. The procedure foresees the necessity of expropriation of lands if grave risks demand this.

The PPR limits urbanisation considerably and is the topic of much public debate. However momentum is strong, especially since recent floods have led to the loss of human lives. Certain communes have already accepted the PPR before they are put up for public consultation, in order to prevent construction in areas that are off limits. This is in fact a logical course of action, as new constructions in floodprone areas would face huge capital losses once the PPR is adopted. In discussion is for example a 700 house large project in a commune that so far did not accept the PPR, although it is clear from the flood hazard maps, that the properties lie in a flood hazard zone. (see for further comments http://decil.lautre.net/IMG/ZAC.pdf).

It appears that hazard zoning plans will be more effective if the objectives of risk prevention are combined with other objectives, such as floodplain restoration, improvement of the water quality, creating recreational areas and in general the sustainable development of catchment areas.

The following gives an evaluation of a PER along the Saone, and 2 examples of recent PPRs.

o Evaluation of a PER along the Saone

The long-term effects of the PER on land use have been studied in the valley of the Saone. The study focused on the effect of the Plan d'Exposition au Risque d'Inondation (PERi) in the valley of the Saone on land use changes and flood proofing measures (http://www.h2o.net/magazine/dossiers/infrastructures/gestion/inondations/francais/mesures.htm).

The conclusions were that in general the effects of PER were limited. The PER has had limited effects upon withholding new construction from floodprone areas, although intensive urban use did not spread into the floodplain. The major reasons for urban sprawl has been local politics and economics. The city of Villefrance approved the building of a large industrial area in the floodplain in spite of the PERi. This is the general picture that in spite of plans and zoning a large proportion of the natural retention areas along the Saone has been lost to more intensive agriculture and to a lesser degree to urban activities, among them recreational grounds.

Furthermore implementing the plan requires finance and administrative capacity which is often lacking. Also lack of information and communication is mentioned as one of the reasons for the limited success of the PERi.

Most inhabitants of the inundated zone were interviewed. More than half of them had met with a flood in the past years. Only a third of the interviewed indicated that their building is fully flood proof, over 2/3 had taken measures mainly to reduce flood damage, but only a small part had taken flood prevention measures. Over 2/3 still favour a building site in the floodplain, for various reasons, among them the natural appeal of being close to a river, the proximity to family and commodities, and financial aspects. Most of the interviewed agreed with the regulations as laid down in the PER and the preservation of still open retention area, but expropriation of buildings in these zones was opposed by most.
- **PPR Iton** (Source: [http://www.eure.equipement.gouv.fr/amenagement/PPRiton](http://www.eure.equipement.gouv.fr/amenagement/PPRiton))

The river Iton – a tributary of the Seine – has a confined river valley. A large part of the valley floor has been urbanised. Historic flood lines have been used to draw flood contour lines. Four different zones are distinguished:

- **Green zone**, reserved for the floods of the river, meant to guarantee its flow and to prevent an increase of flood hazard in adjacent communes. The zone harbours agricultural lands, gardens, and recreational areas. No new constructions are allowed. Allowed are agricultural activities and leisure zones that match with hydrological functioning.

- **Red zone**, comprising urban areas located in area of high flood hazard and in zones of moderate to high flow momentum. Further urbanisation is prohibited. Extensions to existing building are subject to an assessment.

- **Blue zone**, urban areas subject to a weak to moderate flow momentum that play no significant role in retention. Constructions need to be 20 centimetres above reference flood lines.

- **Yellow zone** corresponds to the remaining valley floor with no to almost no flood hazard. Constructions need to be 20 centimetres above reference flood lines.

<table>
<thead>
<tr>
<th>Flood momentum (alea) (1)</th>
<th>Moderate to strong</th>
<th>Weak to moderate</th>
<th>Weak to none</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Centre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other urban areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas that can be urbanised on the short-term</td>
<td>Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas that can be urbanised on the long-term</td>
<td>Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural areas</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 8-7 Definition of flood hazard zones.*

*Note (1): Flood momentum (alea) takes into account the combined effects of flow depth and flow velocity.*
The PPR for the Paris is interesting because of its potential impact on planning. Ile de France faced large flood events in 1993 and 1995, which have led also to the Risk prevention law, that requires the formulation of a PPR. At present a 1 in 100 flood event (the 1910 flood forms the reference) would inundate an area with over 860,000 inhabitants on 59,000 hectares leading to an estimated 8 billion Euro's flood damage. In addition to the flood hazard maps, also maps are produced that show important objects, such as monuments, medical services, schools etceteras. These maps play an important role in the zoning of regulations, since specific measures are related to them (see Figure 8-9.)
Figure 8-9  Map of flood depths on the basis of the January 1910 reference flood (left) and important buildings and activities (right).

Figure 8-10  Hazard zones and their regulations.

Three major zones have been distinguished for the purpose of policy making:

- **Red zone.** This zone is meant to safeguard river flow. Only activities directly related to the river or its shores are allowed.
- **Green zone.** This zone is meant as an inundation area. Safeguarding the retention capacity is important.
- **Blue zone.** This is the urban area that lies within the 1910 flood contour. The dark blue areas have a flooding depth of more than 1 metre, and the light blue less than one metre. In this area all activities that pose environmental risks to surface and groundwater will be reduced. It is prohibited to store vulnerable and capital-intensive goods in the area without appropriate flood proofing measures. The number of lodgings will be limited. For all new construction in the light and dark blue zones appropriate measures have to be taken to reduce flood risk and damage in case of flooding.
8.5.3  Juridical instruments for safeguarding floodplains and retention areas

Apart from the hazard zoning, there are a number of additional juridical instruments available to acquire land or to contract floodplain or retention services. These instruments are evaluated in http://www.environnement.gouv.fr/telch/rapports-ig/2003/Rapport-champs-expansion.pdf and summarized below.

**Forced land acquisition**

Expropriation of real estate ownership is only possible under the title of a *déclaration d'utilité publique* (at L.11-1 CECUP), which is subject to a decision by the Minister or Prefect. This instrument is in practice only used for public works, such as dikes, sluices and roads. It cannot be used to maintain floodplains or enlarge retention areas with the exception of cases of known risks to human lives.

**Voluntary land acquisition in the public interest**

All authorities can buy land on a voluntary basis. However they need a title, that is a clear objective to do so in the public interest (*déclaration d'utilité publique*). Along the upper Rhine the syndicats de rivieres, a type of waterboard, buy whatever land becomes available. In contrast, the syndicat of the river Vistre refrains from buying riparian lands in order to prevent that riparian citizen no longer feel responsible.

**Voluntary land acquisition by public designation as a nature reserve**

The counties (departments) can buy land, which has been designated as a sensitive natural area, under condition that it is open to the public. This would only be of interest in the case of zones of great natural, recreational or educational value which does not combine easily with for example a use as agricultural grasslands. There are many examples, because nature conservation is an important driving force in the restoration of floodplains. An example is the restoration of the old polder of Musette situated in the floodplain of the Vistre. Here a 130-hectare retention area has been created with as primary objectives nature restoration and floodplain management. It alleviates flood problems downstream. Within the project also wetland agriculture has a place. The project is operational since 1995.

**Land re-allotment**

Land re-allotment (*remembrement agricole, “ruilverkaveling/ landinrichting”) is important in the rural areas of France and an important instrument in the restoration of floodplains and maintaining and creating retention areas. Land reallotment has as a major objective to improve farming conditions and forestry operations, but it can also realign with urban plans and should take nature into consideration. Authorities can create possibilities if they are able to take land positions by acquiring land preferably prior to the start of a land reallocation scheme. So far agricultural interests dominate land reallocation schemes.

The SAFER (Societe d'aménagement foncier et établissement rural, (cf. “Dienst Beheer Landbouwgronden”) administers and coordinates the land-reallotments schemes in France. It can buy land with the objective to facilitate the land-reallotment; and regularly buys land in order to facilitate the establishment of public works, among them water infrastructure. SAFER can only hold on to the land for 10 years, after which it is obliged to sell or let the land. In certain regions the SAFER has sold or let land with limitations that match with floodplain restoration objectives.

**Private contracts with land owners**

Public bodies can make individual contracts with landowners agreeing specific requirements regarding the use of the land. This is common practice in nature protection projects. The main goal is to extensify agriculture in order to improve conditions for breeding meadow birds or special vegetation types. The contracts form the basis for compensation payments. The contracts are between an authority and individual landowners. There are no contracts known that deal exclusively with flood retention functions. However compensation is paid in case flood retention is combined with nature conservation interests as in the case of wet meadows.
Contracts are coordinated by SAFER. The contracts are on a voluntary basis and have a 12-year limit. This poses considerable problems when not all landowners within a single hydrological unit, e.g. a floodplain agree on its terms. An additional disadvantage is that these contracts are related to persons and not to the land. This implies that as soon as land changes ownership and/or the contract duration end, contracts need to be renegotiated.

The contracts have a learning effect, in the sense that they clearly show where flood prone areas lie. It is for this reason that Alsace has created a special programme on the privately owned retention areas near Ill on the floodplains of the river Ill in order to maintain 2000 hectares of grasslands and to further the restoration of an additional 1500 hectares of grassland. It requires the designation of the area as grasslands or meadows as a major nature/public interest.

**Decret specifique**

For the implementation of the French-German Treaty a special legal construction was made (un decret specifique). Within the framework of the treaty the state has additional power to impose regulations on retention areas. The regulations are plain and simple: periodical inundation and free passage of floods must be accepted; all activities that hinder or limit this are not allowed. The regulations are vested in a land registry (livre foncier) and thus related to the land and not to individual contractants. All damages related to the inundation are compensated under the code for land acquisition in the public interest.

**Easement (servitudes conventionelles)**

In the Gard a pilot is being conducted that focusses on the possibilities of easement ("erfdienstbaarheidsstelling"). In the area a number of retention areas have been planned after recent large flood events. One of the problematic rivers is the Vistre, a small river (580 km2 and 45 kilometres long), but heavily urbanized (14%, largely on valley floors). The authority of the catchment of the Vistre want to negotiate on the basis of free inundation of the land, free passage of water, and free development of river shores (so no protection allowed). These services are made part of the land title. So far most landowners have agreed. For compensation payments a fund is created, owned by the contractants. There has been an application for a land-reallotment to facilitate the restoration of floodplains and creation of retention areas. However, the Chambre d’Agriculture has indicated that this is not possible with the sole motivation of creating retention areas. The Departement is buying part of the terrain by assigning it the title of a nature sensitive area.

### 8.5.4 Insurance and compensation schemes

The Law of 1807 stated the principle of non flood insurance protection, implying that the state holds no responsibility for flood damage. However, following a period with a high incidence of natural disasters, state compensation in the form of a Natural Catastrophes Fund was introduced in 1982, in combination with the obligation to make hazard zone plans (PERs). In order to finance the National catastrophe Fund, an automatic deduction on all mandatory household and vehicle insurance policies was imposed. The premium rates to finance the fund have increased from 9 to 12% in recent years amounting to 1 billion Euro per year. Local Mayors can apply for compensation in the case of a catastrophic event and increasingly do so. The insurance companies manage the fund. The arrangement is under scrutiny of the European Commission, because it breaches the principle of free choice of insurance. Private insurance of flood damage in France is practically absent.

### 8.5.5 Other financial arrangements

The Agences de l’Eau levy their own financial sources via two taxes. One tax is related to waste water treatment. The second tax is related to water extraction and alteration of watercourses.
Under discussion is a tax for all impervious areas, to be levied by the Agences, which would create a fund that could also be used for floodplain restoration.

The Barnier fund, which was introduced in 1995 has the aim to acquire property, on a voluntary basis, that is threatened or has suffered flood damage when rehabilitation and protection work exceeds the value of the property. The aim is to set up a procedure that is faster than expropriation. The fund only deals with individual cases, and only when there is imminent danger.
9 Germany

![Map of Germany showing Lander and watersheds of Rhine and Elbe](image)

*Figure 9-1  Lander and watersheds of Rhine and Elbe*
9.1 Type of flood problems
Germany has a history of river floods, the most recent ones occurring in 1993 and 1995 (Rhine), 1997 (Oder) and 2002 (Elbe).
The Rhine floods of 1993 and 1995 caused a damage of 1.8 and 0.7 billion Euro respectively. The extreme floods on the Oder in 1997 led to many dike collapses and the inundation of vast areas, also far away from the river. Most damage was sustained in Poland and Tsjechia; the damage in Germany was over 320 million Euro.
As a result of the Elbe flood in 2002, in Germany more than 20 people lost their lives; the direct damage to property amounted to almost € 10 billion (0.5% of GDP). Over 12% of Germany has been sealed with buildings and roads, and locally this percentage can be much higher as for example in the Ruhrgebiet. In heavily urbanised watersheds this gives rise to increased local and even regional peak flows with much problems and damage.

9.2 Political momentum
Because of the recent flood events flood management has gained considerable political attention lately. Sense of urgency was very much increased by the flood of the Elbe.
In response to these floods, the responsible ministers at the federal and Bundesland level agreed on a joint Federal Government/Länder flood defence programme in September 2002. The main points in this programme are: (see http://www.bmu.de/de/1024/jp/sachthemen/gewaesser/5_punkte_programm/ and http://www.ecologic-events.de/floods2003/de/documents/JurgenTrittinenglish.PDF)

- Give space back to the rivers. Flood alleviation must become an important objective in regional planning, agriculture and nature conservation. This includes measures such as restoring flood channels, free inundation of floodplains, passive inundation of summer polders and active inundation of designated polder areas
- Retain precipitation in a decentralised way
  This includes retention in urban areas, increasing the infiltration capacity and reducing the area of impermeable surfaces, but also changes in land use management and drainage systems and reservoirs
- Control urban development more effectively so as to minimise the damage inflicted in the event of flooding. This includes measures such as land use zoning, flood proofing, flood prediction and public information and local technical flood protection works

In the programme, the Länder are urged to take their obligations seriously, and it is announced that the basic powers of the federal government will be strengthened in order to establish uniform standards relating to flood defenses and to ensure that the interests of upstream and downstream users are balanced fairly.
Presently, a federal bill of law (ontwerp) on Improvement of Preventive Flood Protection (Gesetz zur Verbesserung des vorbeugenden Hochwasserschutzes or Hochwasserschutzgesetz) is under consideration (see paragraph 9.5.1).
In addition to this legislation, direction is given by various important policy documents such as the flood action plan for the Rhine (Aktionplan Hochwasser, 1998) of the IKSR (International Rhine Commission). and guidance documents by LAWA (Länderarbeitsgemeinschaft Wasser).
A new flood action plan for the Elbe has been completed in October 2003 (Aktionplan Hochwasser Elbe) by the IKSE (International Elbe Commission).
A flood action plan for the River Oder is now close to acceptance.

The emphasis in river basins varies. For the Rhine emphasis is upon reducing flood damage potential, because of the larger flood damage potential and the difficulties in restoring retention areas. Along the Elbe the emphasis is upon safeguarding and restoring floodplains, since they are less urbanised.
The frequency of extreme weather conditions is explicitly linked to climate change. There is increasing interest in the effects of climatic change, such as studies by the project KLIWA (Klimaveraenderung und Wasserwirtschaft, see http://www.klima.de/). One should note that the major flood events did not trigger more fundamental structural solutions to flood risks. The communes, who have other interests, heavily debate nearly all flood plain restoration projects (see Figure 9-2). Also after major flood events infrastructure and houses are quickly restored in the same flood prone areas. (Tagesseminar “Bevor die Flut kommt; Hochwasservorsorge an Neckar und Rhein” 10th of May 2002 Heidelberg http://www.boell-ba-wue.de/download/03-14.doc).

Figure 9-2 Protest against a planned Retention polder. Source: Burgerinitiative “Hochwasser- und Naturschutz” Altrip http://www.bihn-altrip.de/OLD/index-old.htm

9.3 Organisation
The responsibility for flood protection and spatial planning lies with the Bundesländer. These are highly autonomous and partly follow different courses of action regarding flood management. In these fields, the federal government is not allowed to draft competing laws (konkurrierende Gesetzgebung), but only framework laws (Rahmenvorschriften), unless a federal law is necessary “to achieve equivalent living conditions or to guarantee the unity in justice or welfare in the interest of all Bundeslander”. As a consequence, flood protection is vested in the federal Water Management Law (Wasserhaushaltsgesetz) and the Water Laws of the Bundeslander (Landeswassergesetze). With the new Hochwasserschutzgesetz (see paragraph 9.5.1), the federal government is expanding its authority in the field of competence of the Lander.

9.4 Measures
9.4.1 Retention in the catchment
The restoration of retention capacity is already an ongoing activity for many years in the catchment areas of the larger German rivers, especially the Rhine, Oder and Elbe. Especially in the last 5 years a large number of projects have been implemented, among which over 60 small retention areas (Rueckhaltebecken) along the Upper Rhine.
In Rheinland-Pfalz an integrated approach has started under the name of *Aktion Blau*, which forms part of a federal programme. This programme aims at the restoration of the natural hydrology of a catchment area by addressing the ecological restoration of rivers and the hydrological restoration of the retention capacity of the land. The programme so far in Rheinland-Pfalz comprises over 1,000 water courses with a total combined length of 3,500 km. 250 restoration project have so far addressed the restoration of 235 kilometres, of which more than 2/3 have already been completed. Over 740 hectares of land were bought in order to allow decentral retention measures alongside the waters. Since 1993 over 130,000 hectares (ca 15% of the agricultural land in Rheinland Pfalz) have been the subject of more environmentally benign forms of land use and for reforestation purposes and the objective to increase infiltration and retention. About 1500 hectare have been reforested and rainwater infiltration was introduced on 650 ha of urban areas. Since 1995 about 60 small to medium scale retention basins with in total 0.7 million-m³ capacity have been created and a further 15 (total capacity of 4 million m³) are being planned. The Land Rheinland Pfalz finances up to 80% of the costs of planning and creation of green buffer zones (*Gewasserrandstreifen*). The planning takes place on a local level in the form of *Gewaesserpflegeplaenen*. Buffer zones that have a retention function are subject to green fiscal conditions. Management is sometimes arranged in the form of *Bachpartnerschaften*, in which local authorities and firms adopt a brook.

9.4.2 *Infiltration in urban areas*

Retention in urban areas receives much attention in Germany. Infiltration is mostly combined with new housing areas. In addition, rainwater infiltration is often implemented when sewers have to be renewed. The emphasis upon urban infiltration projects is increased by the following factors:

- all rainwater infiltrated means less water treated in the case of combined sewer systems. It is for this reason that many water boards subsidize about half the costs of urban infiltration projects. In Hessen, incentives for urban infiltration were widely offered by municipalities; however in recent years these incentives were reduced due to financial problems of municipalities.

- there is also an economic incentive, because households and companies pay sewer levees depending on the sealed surface area that is drained by the sewer system

- a hydrological guideline (*BWK Merkblatt M3*) prescribes that the 1-year maximum runoff (HQ1) should not differ more than 10% from the original HQ1 under near natural conditions. The HQ1 reference is calculated on the basis of a catchment area in which all urban areas have been replaced by a representative combination of forests and agricultural land. Consequently reducing the run-off from urban areas is the key-factor in complying with this guideline.

Many communities (e.g. Berlin) have introduced a separate fee (a stormwater fee) for discharging stormwater into the sewer system. This fee is usually based on the sealed area connected to the sewer system. With the introduction of this stormwater fee, the sewage fee based on drinking water consumption has been reduced. That's why we call it "splitted fee". The fact that people have to pay for discharging stormwater can change a lot. The awareness of private and commercial property owners for stormwater issues is increasing. The introduction of this "splitted fee" is a rather complicated task. The sealed area must be surveyed by areal photos, the degree of connection must be estimated and a database with all the information including the address of the owners has to be built up. The process usually is accompanied by a lot of information (web, letters, public hearings, etc.) and also legal procedures (changing the local by-laws).
9.4.3 Technical measures
Flood protection measures have decreased the flood plain area considerably. Along the Upper Rhine the flood plain was reduced from 1000 km² to 140 km². Along the Lower Rhine, downstream from Karlsruhe the floodplain area was reduced from 1500 km² to 300 km². A similar picture emerges along the Elbe, where the area of floodplains was reduced from 6.200 km to 840 km².
Locally artificial reservoirs play an important role as in the river basin of the Saale, a tributary of the Elbe River which flows through Thuringen and Sachsen Anhalt. Here part of the stored volume has been designated for flood peak attenuation ranging from 44 million m³ in winter to 28 million m³ in summer. The system of reservoirs enables a 50% reduction in design flood levels.
Conflicts may arise over the use of reservoirs. For instance in the Ertsgebirge the combined reservoirs have a great potential in reducing peak flows, but are maintained on constantly high levels because of tourist interests of the local communes.

9.4.4 Floodplain restoration and retention areas along rivers
Maintenance and creation of retention areas and floodplain restoration play an important role in the flood action plans for the rivers Rhine and Elbe.

9.4.4.1 Rhine
For the German part of the Rhine 4 Lander are relevant: Baden-Wurttemberg, Rheinland Pfaltz, Hessen and Nordrhein-Westphalen. In all of these Lander retention areas are presently in operation and floodplains have recently been restored. A large number of projects is currently being planned or at the start of implementation. Many of the planned retention areas are a consequence of the treaty with France. Financing by IRMA plays a role in some of the planned retention areas.

- Treaty with France
France and Germany agreed in 1982 to create 226 million m³ buffer areas along the Oberrhein in Baden-Wurttemberg and Rheinland-Pfalz (see also paragraph 8.4.2). Most structural measures as well as dike reallocations have been implemented; however the construction of retention areas (often called "polders" in Germany) are mostly still in the planning stage.

- Initiatives in Baden-Wurttemberg
Some characteristics of the retention areas in Baden-Wurttemberg – most of them still in the planning stage - are shown in Figure 9-3 and Table 9-1.
Table 9-1 Planned and realised retention areas in Baden Wurttemberg

<table>
<thead>
<tr>
<th>Area</th>
<th>Status</th>
<th>land use</th>
<th>IRMA co-financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheinschanzinsel</td>
<td>definite plan</td>
<td>intensive agriculture</td>
<td></td>
</tr>
<tr>
<td>Elisabethenwört</td>
<td>preliminary plan</td>
<td>intensive agriculture and forestry</td>
<td></td>
</tr>
<tr>
<td>Bellenkopf/Rappenwört</td>
<td>preliminary plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polder Söllingen/Greﬀern</td>
<td>under construction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freistett</td>
<td>preliminary plan</td>
<td>forestry, gravel</td>
<td></td>
</tr>
<tr>
<td>Polder Altenheim</td>
<td>operational</td>
<td>forestry and agriculture with ecological flooding</td>
<td></td>
</tr>
<tr>
<td>Ichenheim/Meißenheim</td>
<td>preliminary plan</td>
<td>forestry</td>
<td></td>
</tr>
<tr>
<td>Eizmündung</td>
<td>definite plan</td>
<td>forestry</td>
<td>+</td>
</tr>
<tr>
<td>Wyhl-Weisweil</td>
<td>definite plan</td>
<td>forestry</td>
<td>+</td>
</tr>
<tr>
<td>Breisach-Burkheim</td>
<td>definite plan</td>
<td>forestry</td>
<td></td>
</tr>
<tr>
<td>Weil-Breisach</td>
<td>definite plan</td>
<td>nature</td>
<td></td>
</tr>
</tbody>
</table>

- Example Polder Sollingen

The retention polder Sollingen - 12 million m3 on 580 hectares – was created as part of the German-French treaty. The construction of the retention polder Rheinschanzinsel starts in 2003, about two decades after the contract with France.
Figure 9-4 Polder Sollingen, under construction, consists of a complex of retention polders. http://www.4gwd.de/karlsruhe/projekte/projgrup/soellingen/polder_monate/qwd_polder_laggro.htm

- **Initiatives in Rheinland-Pfalz**

Figure 9-5, with table, gives information of retention areas in Rheinland Pfalz. The total area of the retention areas is approximately 2500 ha (this is on the assumption that 1 ha can store 25,000 m³, which is the case for the retention areas in Baden Württemberg). Daxlander Au and Flotzgrun are operational; Kollerinsel is under construction. All areas should be realised by 2008, at an estimated costs of 150 million Euro.

<table>
<thead>
<tr>
<th>Rückhalteraum</th>
<th>Art der Rückhaltung</th>
<th>Nach derzeitigem Konzept [Mio. m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daxlander Au</td>
<td>gesteuert</td>
<td>5,1</td>
</tr>
<tr>
<td>Wörth/Jockgrim</td>
<td>ungesteuert</td>
<td>4,2 gesteuert</td>
</tr>
<tr>
<td>Mechtersheim</td>
<td>gesteuert</td>
<td>7,4</td>
</tr>
<tr>
<td>Flotzgrün</td>
<td>gesteuert</td>
<td>6,1</td>
</tr>
<tr>
<td>Kollerinsel</td>
<td>gesteuert</td>
<td>5,0</td>
</tr>
<tr>
<td>Waldsee/Ntripf/Nauhofen</td>
<td>ungesteuert</td>
<td>1,2 gesteuert</td>
</tr>
<tr>
<td>Petersau/Bannen</td>
<td>ungesteuert</td>
<td>3,8 gesteuert</td>
</tr>
<tr>
<td>Worms-Mittlar Busch</td>
<td>ungesteuert</td>
<td>2,1</td>
</tr>
<tr>
<td>Bodenheim/Laubenheim</td>
<td>gesteuert</td>
<td>6,4</td>
</tr>
<tr>
<td>Ingelheim</td>
<td>gesteuert</td>
<td>3,8</td>
</tr>
<tr>
<td><strong>Summe</strong></td>
<td></td>
<td><strong>62,6</strong></td>
</tr>
</tbody>
</table>

Figure 9-5 Retention areas in Rheinland Pfalz. Source: Wasserwirtschaftsverwaltung Rheinland Pfalz. “Gesteuerte Rückhalteraum” probably qualifies as a retention area; “ungesteuerte Rückhalteraum” probably qualifies as floodplain restoration. http://www.wasser.rlp.de/download/5_1_2hochwasserschutz.pdf
Example polder Altrip
Polder Altrip is heavily debated by a local action group because the village of Altrip will be surrounded by water on three sides when the polder is flooded. Alternatives could be found in two other areas. One a nature reserve, but this was considered unacceptable by the nature conservation authorities because of potential damage to the existing flood plain forest. The other alternative location harboured the largest camping of Germany. Reallocation it was unacceptable for the local communes.

Example Kollerinsel
Along the Rhine, between Ludwigshafen and Speyer, a large retention polder has been established in recent years, the Kollerinsel. The Kollerinsel, now under construction, comprises 232 hectares of former floodplains that will hold 6.1 million m3 with a planned frequency of 1 in 20 years. Inundation will be controlled via sluices (gesteuert). The area has been designed as an integrated nature project with as major objectives nature conservation, flood management and recreation. The Koller-insel has always been an important nature area, and its new function will further this objective. The mainly intensive agriculture will be largely extensified in the lower more flood prone parts of the area. Only the higher parts will retain their intensive agriculture. A larger farm will be demolished and rebuild on a 1.6 hectare large mound as a horse-riding center. Several recreational facilities, now spread in a larger area, will be concentrated in the polder.

Figure 9-6 Koller Insel, plan and inflow/outflow construction
9.4.4.2 Elbe

The city of Dresden has managed to keep the floodplains of the River Elbe free from development over the centuries (from ICBR 2002).

For the German part of the Elbe, 4 Lander are relevant: Sachsen, Sachsen-Anhalt, Brandenburg, Schleswig Holstein as well as the city-state of Hamburg.

The flood action plan for the Elbe (Actionsplan Hochwasser Elbe, http://elise.bafg.de/servlet/is/5130/) has been completed in October 2003. The main points in the plan are:

- Improvement of water retention and buffer capacity
  - Rainfall must be stored in the catchments as much as possible. This entails measures in the field of agriculture, forestry and water management and infrastructure. The measures also include the creation of retention areas
- Delineation and use of floodplains
  - Floodplains along the Elbe and its tributaries must be maintained, and incorporated in spatial plans. Former floodplains must be marked as flood hazard areas (Uberschwemmungsgefahr; it should be assessed if former floodplains can be returned to the status of flood areas (Uberschwemmungsgebiete) by means of dyke setbacks.
  - Regulations regarding the use of water pollutants in technical installations
- Improvement of the dykes along the Elbe by 2015
- Improvement of precautionary measures by citizens and private companies
- Improvement of the high water information system

Figure 9-8 and Figure 9-9 show the proposed retention areas and dyke setback areas.

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ICBR (Internationale Commissie voor Bescherming van de Rijn) 2002, “Non structural flood plain management”, Measures and their Effectiveness
Figure 9-8 Possible locations for retention areas along the Elbe, according to the Flood Action Plan Elbe. All these areas are situated in Sachsen and Sachsen-Anhalt.

http://www.bmu.de/files/hochwasser_aktionsplan_grafik03.pdf

Figure 9-9 Possible locations for dyke setbacks along the Elbe, according to the Flood Action Plan Elbe. Locations are mainly in Sachsen-Anhalt and Sachsen; some in Brandenburg and Nieder Sachsen.

http://www.bmu.de/files/hochwasser_aktionsplan_grafik04.pdf
Example retention areas of the Havel

At the confluence of Elbe and Havel, a tributary of the middle Elbe, polders have been created that function as active (by controlled breaching of the dikes) retention area, in order to prevent backflow of the Havel at high levels of the Elbe, as well as capture part of the Elbe floodwave. The polders are designed only to be used at extremely high water levels, and were used in the 2002 flood event. The present capacity of the system is 110 Million m³.
Retention areas are often combined with nature restoration. A good example is the Biosphärenreservat Flusslandschaft Elbe. Here a national park and several nature reserves are combined with flood management objectives. Nature restoration is the leading objective but it needs natural flood dynamics to achieve its goals. Not all areas have been designated as nature reserves. In these areas existing agriculture needs to extensify, and it is planned that they do so voluntarily on the basis of compensation schemes and contracts (Instrument des Vertragsnaturschutzes). Paragraph 9.6 describes in detail the setback of a dyke in the Brandenburgischen Elbtal.

9.5 Instruments

9.5.1 Spatial planning

Spatial planning in Germany has three levels: the federal level, the Bundeslander and the municipalities (http://www.umweltbundesamt.de/rup/).

The federal Planning Law (Raumordnungsgesetz des Bundes) gives three basic competences to the federal level: it is responsible for planning on a geographical scale that exceeds those of the Bundeslander; it can create a legal framework for planning and assessment; it has a responsibility to define the set-up of framework planning by the Bunderslander. However, the federal level can not define concrete objectives for spatial planning, which is considered a task of the Lander.

The Planning Law incorporates three area categories that can be used by the Lander. A distinction is made between:

- **Vorranggebiete**: Priority areas where a specific function should be guaranteed
- **Vorbehaltgebiete**: Reserved areas in which a specific function is dominant
- **Eignungsgebiet**: Suitable areas suitable for specific functions

The Lander define criteria, assessment procedures and by-laws. So a large part of the planning is on this level. Some Lander have used their competence to regulate flood protection areas in terms of objectives and priority areas.

Regional plans (Landesraumordnungsplane, Regionalplane) can in fact guarantee retention areas if designated as Vorranggebiete. Regional plans are legally binding only when all relevant stakeholders have been involved in the formulation of the objectives, requiring that these plans are sufficiently concrete in detail to allow stakeholders to assess the consequences. This often creates a dilemma, since regional plans are foremost strategic policy documents.

Due to the high level of autonomy of the Lander, the application of spatial planning in flood prevention differs considerably between Lander. The status of retention areas along the Elbe can serve as an example:

- **Sachsen** has no regulation on retention areas, so no areas are designated; however most floodplains are still part of the river system.
- **Sachsen-Anhalt** has designated retention areas on the basis of the highest known flood level, or at least the 1 in 100 year level.
- **Brandenburg** has designated retention areas since the beginning of the 20th century at least along the 1 in 100 year flood levels.
- **Schleswig-Holstein** has designated retention areas in the 1970ies and 1980ies on the basis of 1 in 100 and 1 in 200 year flood levels.

Interesting is the initiative of Hessen (along the Rhine), where retention areas can be given a preliminary and temporary protected status for a period of 5 years, awaiting further legislation. At the local level, municipalities develop local plans (the Flächennutzungsplane and the legally binding Bebauungsplane); these plans need to in line with the regional plans. Within a Flächennutzungsplan there are several possibilities to designate areas for the retention of water. As an example the regional plan for the Unterer Neckar can be cited that has
incorporated priority zones for flood risk, reserve zones for flood risk with specific regulations with respect to safeguarding retention capacity, preventing an increase in damage potential and for improving retention in the catchment area. Municipal plans need to assess the risk of floods. In the Bauleitplanung regulations can be formulated related to flood risk.

Recent reports on the requirements for spatial planning from the standpoint of river flood prevention (http://www.umweltdaten.de/rup/45-99/texte-45-99-kurzfassung.pdf) and the safeguarding of present and future retention areas (http://www.umweltbundesamt.de/rup/ueberschwemmungsgebiete.html) stress that the German planning system gives ample opportunities for flood prevention. However there is a lack of cooperation and coordination, as well as integrating concepts and forms of planning that use the full scope of the available instruments. The spheres of land use planning and nature conservation planning have more efficient tools than the sphere of water management planning. If those tools can be put to use much more can be achieved in the creation of retention zones, retention facilities and the reduction of potential flood damage. Comprehensive flood prevention concepts for river areas are still not compulsory.

At present, a federal bill of law (ontwerp) of on Improvement of Preventive Flood Protection (Gesetz zur Verbesserung des vorbeugenden Hochwasserschutzes or Hochwasserschutzgesetz) is under consideration (see http://www.bmu.de/de/1024/js/sachthemen/gewaesser/index_hochwasser/). The law consists of amendments to the main existing federal laws with reference to flood prevention and protection (the Water Management Law Wasserhaushaltsgesetz) and Spatial Planning (Raumordnungsgesetz). The main points of the bill of law are:

- all persons that may suffer from floods, must take reasonable measures to prevent damage to life, property and the environment
- Bundeslander are required to designate within 5 years the flood areas (Uberschwemmungsgebiete) that will flood in a 1 in 100 year event, as well as the flood hazard areas (Uberschwemmungsgefahren Gebiete) that will flood when dyke breaks occur. Flood areas and flood hazard areas must be indicated in regional and local spatial plans. In flood areas no new residential or industrial areas (excepting harbours) may be assigned; in principle, arable farming in flood areas must be replaced by pasture before 2013, in order to reduce erosion and transport of pollutants during floods. Flood areas must keep their present function of water retention and floodplain; retention and floodplain functions must be restored to past levels if possible. In flood hazard areas the storage of water polluting substances must be forbidden or reduced.
- Within 3 years, Bundeslander are required to make flood prevention plans for 1 in 200 year events on the basis of river basins, and to coordinate these plans with other Bundeslander and countries within the basin. They are required to create retention areas, set back dykes, retain precipitation in catchments and restore floodplains. In case of disagreement between Bundeslander, the federal government will mediate.

9.5.2 Urbanisation plans and building permits

At the local level (Bauleitplanung) several instruments for flood prevention are embodied in the building law (Baugesetzbuch, BauGB, 1998). These include the designation of areas for retaining and infiltrating precipitation. Bebauungsplan Vogelwiese in the city of Naumburg (Hessen) is an example of an urban development plan with building regulations directed at reducing the impermeable surface and to further the infiltration of rainwater. Urbanisation in flood plains is generally not allowed. There are however exceptions with additional building regulations to ensure a minimum hydraulic impact, to limit the risks to human life, or to limit the potential for flood damage. An example is the obligation to construct open cellars that do not obstruct flow (durchflutbare Untergeschosse). In areas behind dikes and with potential high groundwater table a minimum height of the cellar floor may be required. There is
one example of an urban plan that limits the use of the ground floor because of the hazard of high water.

9.5.3 Insurance and compensation
According to federal law the state and Bundeslander will not compensate flood damage. However compensation is given in the case of catastrophic events. In the aftermath of the Elbe flood, almost € 10 billion was pledged for recovery work; part of this to be provided from federal funds under the federal Flood Victims Assistance Act (adopted in September 2002) and part to be made available from the EU Structural Funds. About 35 insurance companies offer voluntary insurance with specific restriction in order to make flood insurance manageable, such as selection on the basis of flood hazard and/or by an obligatory combination with other insurance forms on houses. Insurance companies tried to base premiums on flood frequency but this was not considered an option for households. The insurance companies will differentiate their premium on the basis of flood hazard maps, using 1:10 and 1:50 contours. EU guidelines prohibit insurance monopolies, which has led to the cancellation of an existing scheme in Baden-Württemberg for compulsory flood insurance.

9.6 Case: "Setback Levee project Lenzener Elbtalaue"

9.6.1 General Project description
Within the Biosphere Reserve Flusslandschaft Elbe-Brandenburg a levee/dike setback has been planned and is presently realized between Lenzen and Wustrow. The areas lies in the Nature park Elbe-valley floodplains (Elbtalaue) that cover 560 km2 on the eastern shore of the Elbe between Havelmündung and Dömitz. The levees in this area need major restructuring. The idea for a setback dates already 30 years back because at this site the Elbe is forced through a bottleneck, which was considered problematic, hence its nickname (Boeser Ort). The total project area covers more than 1500 hectares. Centrepiece is the restoration of 400 hectares of flood plain (Deichvorland) by the reallocation of a dike. Of this area 300 hectares is designated for nature restoration, especially of flood plain forests, which forms part of the EU-Habitat guidance areas. The restorations will double the surface area of floodplain forest in the middle Elbe region. About 250 years ago these were still forested floodplains. At present some 25 hectares have already been restored. It is at present the largest levee setback project in Germany.

The restored floodplain is capable of retaining 15 million m3. Peak flood levels will be reduced by 30 to 40 centimetres upstream and even at Wittenberge a reduction of 4 to 8 centimetres in peak flood levels is expected.
Levee setback projects (Deichruecklegung) are a main topic in Germany. The first larger ones were established along the Upper Rhine as part of a German-French treaty to create large retention areas. Various levee setback project feature on the Interreg-project list for the Rhine, they are also a common topic on the Elbe and Oder. A characteristic of all these projects is the close alliance between flood management and nature conservation, the latter often being the main driving force. Not all projects are or were easily implemented, mainly because of lack of funds, legislation and local politics. The project Lenzener Auer can be seen as a success story, although it required many years of preparation, a near catastrophe and generous outside funding by EU and Bund. Critical were however also the way in which land acquisition and reallocation schemes were used and the vital role of a local organization that adopted the project.

9.6.2 Type of flood problem
The project area lies in Brandenburg and forms part of the (former) floodplains of the Elbe that faced major flood events in year 2002. The Elbe is far less urbanised and endiked as the Rhine. It still flows through large semi-natural and natural areas. Nevertheless flood protection works have greatly reduced the former flood plain area. As a consequence floods have become steeper and higher. This was clearly shown by the 2002 flood levels that were higher than flood levels with lower discharge rates as observed in the middle of the 19th century. The 2002 floods caused very large flood damages especially in the upstream Sachen and Sachen-Anhalt, were many dikes collapsed and large areas were flooded. Damages in Sachen alone have been estimated at 17 billion Euros. The flood damage of the Elbe floods of 2002 are estimated to be in the order of 20 billion Euro, of which only 3.4 billion Euro are covered by insurance. Brandenburg faced 270 Million Euro of flood damages of which 30 million in agriculture.

The 2002 August flood was unpredicted and very fast in coming. Many dikes breaches in the upstream areas reduced flood levels and slowed down the advance of the peak in downstream Brandenburg. This created a one week time-lapse in which this state could prepare itself. Still flood levels were unprecedented in this century. In several areas ground water levels behinds the dikes did rise several metres, such as in the city of Dresden, and cause problems of water logging for many months thereafter.

Damage was far less in Brandenburg than in upstream Sachen and Sachen-Anhalt, partly because they had more time to prepare themselves and their dikes for the coming flood. Also

Figure 9-12: Elbe close to Lenzen

Figure 9-13: Part of the Elbe dike will be set back for water and nature conservation,
the 1997 flood events on the Oder had made Brandenburg alert. The dike at Muehlberg was the first to be heightened by the help of the fire brigade, but evacuation of about 6,000 people remained still necessary one day later. The dike near Falkenberg almost collapsed but held against all odds, otherwise the damage would have been far greater. In the Prignitz county over 46 villages with 21,000 inhabitants were at risk. In this area, that includes the project area, the dike was heightened 50 centimetres over a length of 13 kilometres. A total of 4.5 million sandbacks was placed in Brandenburg alone, mostly carried by volunteers. Still a catastrophe could only be avoided by flooding the Havelpolder, which is an agricultural area that was designed as an retention facility. The flooding of the Havelpolder led to an estimated 50-centimetre reduction over the critical 46 hours that the peak flood endured. So the effectivity of polders for peak flood attenuation was clearly demonstrated.

9.6.3 What stakeholders were involved

The main stakeholders are German Biosphere Reserve Fluesslandschaft Elbe, the municipalities of Lenzen, the two small villages of Wuslow and Gandow and local landowners. Critical for the success and implementation was however the participation of Burg Lenzen, Traegerverbund. The latter organisation adopted the nature conservation part of the project in 2001 and proved important in gaining more momentum and local acceptance of the project. The Traegerverbund Burg Lenzen e.V is a regional alliance that grouped among the ownership and preservation of the medieval castle of Lenzen. Part of the alliance are the City of Lenzen, the County of Lenzen, the largest land user of the region (GWL-Lenzen GmbH) and the "Bund für Umwelt- und Naturschutz Deutschland (BUND) e.V." (one of the largest German conservation groups) - the latter having received ownership of the castle in 1994.

The Traegerverbund formulated an additional objective for the project. A future use of the castle complex as a European centre for floodplain ecology is intended and the setback levee project will act as their major study site. The Bund invested 2 million Euros in studies that involved...
hydrological, ecological, economical, agricultural and sociological aspects of the project. These studies helped the Traegerverbund to formulate a financial proposal for the Bund for additional financial support. However the Traegerverbund als functioned as a necessary legal entity able to apply for funding.

9.6.4 Type of measures proposed

Floodplain restoration is a hot topic along most larger European rivers. Often objectives of flood protection are combined with nature conservation objectives. Despite increasing proclamations of willingness to initiate such projects on the side of politics, very few projects manage to get beyond the planning stage due to a large number of difficulties, which have to be overcome in the process. Kommunalpolitik that further local interests are a major component in this. In the area of Lenzken, a small town in the Brandenburg-part of the German Biosphere Reserve "Flusslandschaft Elbe" the restoration of floodplain area is in the advanced planning stage and is to be completed by the year 2006. In the process of the regular levee restoration measures along the Elbe river in Brandenburg, a levee-segment of 6.4 km length will be set back away from the river in order to re-open the original floodplain area. A limited number of lowered segments will be built into the existing levee for the flooding and subsequent emptying of the floodplain (see figure 1).

![Figure 9-15 The project area - new levee in yellow, old levee-tract in red with proposed gaps](image)

The first preparations for the construction of the new levee began in 2002 in accordance with the existing schedule. The area to be periodically flooded in the future is largely agricultural land, specifically low-intensity grazed meadows (see fig. 1). It is intended to subject this area to the dynamic natural processes of the periodically inundated flood plain. Much of the project area will be turned into floodplain forests with hardwood and willow-forests (about 300 hectares) according to their respective ecological habitat requirements. Some of the area will be turned into extensively horse-grazed floodplain meadows. Over the last couple of years forest initiation has already begun on 70 hectares of state-owned lands. Scientific studies have been conducted on these plots in order to gather and document practical experience with the initiation of flood
plain forests. A nursery has been established locally in order to raise native plant material. The goal is to initiate an additional 100 to 120 hectares of floodplain forest.

Figure 9-16 Grazed land makes up for much of the current project area. The red line indicates the new levee. Floodplain forests will be initiated in the new forelands. The arrow marks the town of Lenzen

The setting back of the levee will restore more than 400 hectares of floodplain between the ferry Lenzen and the "Böser Ort" ("Bad place"- historically named for its tenuous location in a hydrologically dangerous situation where an abrupt river bend and a bottleneck-like narrow coincide). The existing dike will be lowered in six places after the new dike has been completed. The above-mentioned "Böser Ort"-situation will then be relieved, and unimpeded in- and out streaming of the water will be achieved.

According to the hydrological calculations of the Federal Agency for Hydro-Engineering (BAW) a mosaic of fast, moderately and slowly running waters will result in the project area. Annual flooding of the area is to be expected due to the topographically low situation. The extensive investigations of the BAW allow for the prediction of the effects of the project on the flood situation of the river. According to the studies, much of the river waters will overflow the new floodplain when the flood level is high. In case of a 25-year flood (i.e. a flood event with a likelihood to occur once in 25 years) about 30% of the river water will bypass the original river-bed.

The increase in the river cross-section will lower the river level locally by 25 to 35 cm. This beneficial effect will continue upstream with a gradual decrease in water level. The town of Wittenberge, situated about 25 km upstream, is expected to experience 5cm of flood-peak decrease through the project. The reforestation of the project area will largely recreate a historic floodplain forest which used to be called "Lenzener Kuhblank" which is well documented as the last big floodplain forest west of the Elbe river on the old map of the 1775-land survey of Hanover ("Kurhannoverschen Landesaufnahme").

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Under natural conditions regeneration of floodplain forests takes place spontaneously under the canopy of mature trees. Such natural regeneration by succession processes under extreme site conditions is to be expected over extremely long periods of time only, since tree cover as a reproductive source is largely lacking in the project area. Consequently, artificial planting has to be used to support this process. Patches of initial planting will be spread over the area in order to support and speed up the re-growth of the hardwood floodplain forest. Planting of an additional 80 ha will begin in the area behind the old levee in order to allow the young trees to establish without being harmed by flooding and ice floes over their first years. Another 20 ha will be reforested in the area bordering the new levee on the inland side where water seeps through the levee when the water level in the new retention area is high.

Figure 9-17 The larger Elbholz forest in Lower Saxony on the left river side - on the right the small Eichholz ('oak wood'), the only remaining fragment of the former Lenzener Kuhblank forest.

About 80 ha of the new floodplain area will be turned into a floodplain grazed meadow complex. It will be managed as open to half-open pasture with soft, park-like transitions between forested and open areas. Grazing will be carried out year round by family-herds of a horse breed called "Liebenthaler Wildlinge", which are a crossbreed between Norwegian Fjord horses and Polish Konik horses (fig. 3). The grazed meadow complex will consist of a number of different habitat types, namely spring-wet meadow, pioneer communities along long-inundated pools, small reed areas, moist meadows, transitional habitats of intermittent wetness and transitions to patchy and continuous woodland. Low intensity grazing (0.3-0.5 animals/ha) with wild horses on floodplain meadows is unprecedented in Germany so far.

The herd is currently owned by the Landschaftspflege GmbH Lenzen (Landscape Management GmbH), the current and future land manager of the grazed lands in the project area. This organisation also participates in the Traegerverbund.
9.6.5 What instruments played a role

The major instruments used are land acquisition on a voluntary basis followed by land realloction in order to create a lot of 400 hectares that will be restored as the floodplain proper. The land realloction (Bodenneuordnungsverfahren) covers a larger area of 3,500 hectares, so it benefits a far larger area and also aims at other objectives. As indicated the Bund financed many studies that also played a major role. Several alternatives were studies with varying degrees of dike reallocation and agricultural use of floodplains.

9.6.6 Status and character of planning

9.6.6.1 Sense of urgency

The sense of urgency is unquestionably high because of the recent floods in the region. There are no hazard maps available in the area but for decades it was clear that major reconstruction works were necessary at the project site. Something had to be done. Part of the older levee has been named Boeser Ort (bad place) for years because of the hazardous situation. During the flood the dike had to be fortified with millions of sandbacks.

The Gruenen but also the SPD followed for over 12 years a strategy in which the ecological consequences of floodplain management are taken more into account, and a joint declaration was issued on the 30th of January 2002 that put emphasis upon levee set back as a benign solution to flood problems. In 1996 a joint Elbe declaration issued by the Bundesverkehrsministerium und den Naturschutzverbänden.

The project was debated in the Landtag Brandenburg (Plenarprotokoll 3/62, 2002) just shortly after the major and disastrous floods on the Elbe. Although the general lack of funds dominated the debate, the importance of the project was generally acknowledged. In addition the finance by the Bund, covering all costs in addition to the alternative of dike restoration, was an importance incentive for voting in favour of the project.

9.6.6.2 Planning status

Project planning and project preparation for this project already started in 1994. Most of it were initiated by the Landesanstalt für Großschutzgebiete (State agency for large protected areas Brandenburg). The project area forms part of a larger nature park. Some of these are the acquisition of 550 ha of land and preplanning funded by an EU-LIFE Project (1994-98, totalling 3 Mio. Euro) as well as a scientific program under the "Elbe-Ecology"-program of the German Ministry of Science (1996-2000, totalling 1.9 Mio. Euro) consisting of scientific studies investigating different project variants in an interdisciplinary approach. Of great importance was the continuous monitoring and technical support by the Landesanstalt für Großschutzgebiete in order to increase public acceptance in the region and a state-run legal process for the rearrangement of property rights in the area including the aggregation of state owned land for the project (2000-2006). The setback of the levee follows a normal planning procedure (Feststellungsverfahren).

9.6.6.3 Status negotiations

Negotiations started from the viewpoint of nature conservation, an objective that forms part of the Elbetal-Auen nature reserve programme. The setback of the levee added to that. Formal documents were lacking that designated the area as to be restored. The project largely depended upon land acquisition on a voluntary basis. Critical for land acquisition was the work of a trusted local man, who in many bilateral talks convinced people to sell. After initial land

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acquisition the land reallotment scheme gave good conditions to create one lot in the floodplain owned by the project organisation.

9.6.6.4 Initiative
As indicated the Biosphere took the initiative for land acquisition. In addition regarding the setback of the levee and its financing negotiations started mainly on the national and Bundlevel. In the end the project was largely financed by the Bund because of its large ecological potential. This made the project also financially much more attractive for Brandenburg. Other local initiatives more or less joined in form of the Traeverbund, such as the City of Lenz.

9.6.7 Status and character of spatial solution
- Alternatives for “space for water”
  Restoring the existing dike in its present position was a realistic alternative. This would than have been combined with the restoration of floodplain forest in a less favourable position behind the dike. Also a larger 670-hectare alternative was studied. However it proved less optimal from a hydraulic and especially a socio-economic point of view.
- Role of other objectives
  Several other objectives played a major role. The nature conservation objective was no doubt the most important, the area being part of a Biosphere reserve. Also important was the objective of turning the area in to a research area for a new floodplain research centre. This made the project far more attractive to the City of Lenzen.
  - “Space for water” the most cost-effective solution
    The setback of the levee was not the most cost-effective solution. In fact it costs double the amount needed for dike restoration. Because the Bund paid half of the cost, the project was not more expensive to Brandenburg, which may have played a more role in their acceptance of the project. It may be argued that the setback alternative would make dike restoration and strengthening less expensive upstream. However, in the upstream section the dikes were already strengthened. Furthermore, the effects of the setback in case of a very large flood will be limited.
  - “Space for water” has most societal benefits
    Mainly because of the other objectives, nature conservation and a flood plain research centre, the project has more societal benefits than the alternative. Economic studies have been conducted into the economic benefits of floodplain restoration along the Elbe. Also this study showed that flood plain restoration was, in general, more economically beneficial.
  - “Space for water” has most benefits for key-stakeholders
    The set-back levee alternative clearly had major advantages for many key stakeholders. For the Bund it meant a prestigious project with perfect timing. The state president announced the co-financing shortly after the major flooding along the Elbe. For the state of Brandenburg, it also was a more attractive and no less expensive solution, because of its nature interests. And the city of Lenz and the county of Lenz got their floodplain research centre. The landowners got an improved allotment of their land due to the land reallocation scheme. There is one large and critical landowner, a former state farm, that benefited in different ways. Participating in the Traegerverbund made it a far easier to apply for a land reallocation and have it accepted. Within the context of this land reallocation the structure of his land improved. In addition part of the works within the scheme are paid by the state. Furthermore the project allowed him to diversify his activities, with a nursery for trees and the grazing of the floodplain.

Several studies were conducted looking at the local acceptance of the project by the local inhabitants of the two nearby villages. ( Gerhard Trommer: Naturschutzakzeptanz in Großschutzgebieten am Beispiel des Biosphären-reservates Flusslandschaft Elbe im Brandenburgischen Elbtal). These studies mainly showed that the acceptance depends upon
the degree in which the normal activities of the local population are not hindered by the project. Interviews were held with all inhabitants in the villages of Gandow and Wustrow with respect to the planned levee setback project and related floodplain forest restoration. The presently open agricultural landscape will change into a forested one.

Nearly 75% of the local population was interviewed. Results were very similar for both villages. The inhabitants appreciate the landscape and also the floodplain landscape is considered positive. Recreational values of the floodplain are important to them. Over 2/3 has an open mind regarding nature conservation. Half of the population is skeptical regarding the planned nature protection measures. The major reasons for this are the fear of individual limitations to the visitation and use of the area and skeptic regarding the change in traditional land uses in the area. The concepts of Nature Park or Biosphere reserve are no concrete concepts for them. There clearly has been a lack in project communication. The restoration of the floodplain is generally regarded as a positive change in the landscape. The setback of the levee is only accepted by one third of the population. The population appears to be not well informed about the project and do not see what it will mean to the area.

![Figure 9-18 The village of Gandow](image)

Figure 9-18 The village of Gandow

Nearly 75% of the local population was interviewed. Results were very similar for both villages. The inhabitants appreciate the landscape and also the floodplain landscape is considered positive. Recreational values of the floodplain are important to them. Over 2/3 has an open mind regarding nature conservation. Half of the population is skeptical regarding the planned nature protection measures. The major reasons for this are the fear of individual limitations to the visitation and use of the area and skeptic regarding the change in traditional land uses in the area. The concepts of Nature Park or Biosphere reserve are no concrete concepts for them. There clearly has been a lack in project communication. The restoration of the floodplain is generally regarded as a positive change in the landscape. The setback of the levee is only accepted by one third of the population. The population appears to be not well informed about the project and do not see what it will mean to the area.

![Figure 9-19 How do you expect the landscape will change](image)

Figure 9-19 How do you expect the landscape will change (n=47, in %).
Floodplain restoration is regarded positive because it improves nature conservation. We note that the inhabitants have already become familiar with reforestation activities in the past years. The setback of the levee is considered negative mainly because of socio-economic arguments (devaluation of land prices, more costly solution, general well being of inhabitants). One also argues that the setback will bring the village closer to the river. On the basis of this study it was argued that the best strategy would be to integrate the flood management argument more into the nature conservation argument. It was also recommended to use the nature conservation employees for communication. Furthermore communication should focus more on the emotional arguments and allow for a permanent discussion platform.

An argument in favour of the project and that expressed the benefit for the local population was the fact that a new dike would be safer than an old restored one. The reallocation scheme gave also ample opportunity to sell land if so wanted. Many farmers are old and have no successor. The potential creation of employment by the nursery or the flood plain research center played no role.

### 9.6.7.1 Status and character of financial arrangement

- **Role of external subsidies**
  
  External subsidies played a very important role. As indicated the project was initiated on the basis of EU money that covered also 50% of the costs for land acquisition. The financial construction for the project was based on flood management and nature conservation objectives. As can be seen from this table the State Brandenburg financed on the basis of the alternative costs of a regular levee restoration. The addition costs for levee setback and reconstruction almost equalled that amount and were argumented on the basis of nature restoration. Of this latter amount the State Brandenburg financed 18%, while the larger part (75%) was paid by the Federation. Also some private foundations, among them a lottery, contributed to the project.

**Table 9-2 Financing the levee setback project**

<table>
<thead>
<tr>
<th>Flood management</th>
<th>Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Brandenburg budget</td>
<td>Large scale conservation project (Trägerverein der</td>
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Flood protection management 2002-2006

<table>
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<tr>
<th>Ca. 6,3 Mio Euro</th>
<th>6,98 Mio Euro</th>
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<tbody>
<tr>
<td>(equals the amount that would have been needed for the regular levee restoration including mitigation)</td>
<td>for levee construction:</td>
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<tr>
<td></td>
<td>5,7 Mio Euro</td>
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<td></td>
<td>(75 % Federal funding (BfN/BMU)</td>
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<td></td>
<td>18 % State funding</td>
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<td></td>
<td>7 % Private money (foundations etc.)</td>
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</table>

Burg Lenzen e.V.) amount of funding:

Not included in this table are the costs for land acquisition on the basis of EU money or the costs of the land reallocation scheme and additional financing of work within the context of this scheme. However this scheme benefits a far larger areas (circa 3.500 hectare) than the flood plain restoration project.

- Role of other economic incentives
  There were no other economic incentives.
- Joint sharing of costs
  See table 1. Sharing of costs was partly done on the basis of alternative costs calculations for dike reconstruction and budgeting lines for nature conservation and flood management.
- Joint sharing of costs and benefits
  The question remains whether the full economic benefits were calculated. One may argue that the peak flood reduction that is cause by the flood plain restoration may have created also downstream benefits, because in this area dike reconstruction would in theory be less costly.

9.6.7.2 Status, need and character of land acquisition

- Land acquisition necessary
  Land acquisition was essential to project execution. Over 400 hectare was bought between 1994 and 1998 as preparation for EU life Nature project. The total costs were 1,3 million Euro of which the EU paid 50%. The acquisition involved exchange lots (Tauschflaechen) that were reallocated with the land in the floodplain area. Land acquisition was comparatively easy because of the presence of very large landowners and several older farmers without successors.
  - Land ownership
    Was largely in the hand of one large landowner, a former state farm.
  - Land acquisition
    Was done on a voluntary basis, and involved the critical use of a trusted local persons.
  - Land prices
    A Preisrahmen that stipulates minimum and maximum land prices limits the prices that can be offered by authorities. Payed was the upper limit (Gute normal Preis).
10 Hungary

10.1 Type of flood problems
Due to the fact that Hungary is surrounded by mountains, a large part of the country is vulnerable for floods (Figure 10-1). Minor floods occur 1 in 2-3 years; large floods occur 1 in 10-12 years. 25% of the population (2.5 million) and a large part of the economic activity are in flood-prone areas, which cover about 20% of the country. Nearly 95% of this area is protected by dikes and levees. Most primary defences were built in the middle of the 19th century and have a combined total length of about 4,000 km. The length of secondary defences is in the order of 1,000 km.

Figure 10-1 Flood prone areas along the Danube and Tisza in Hungary (from http://www.ecologic-events.de/floods2003/de/documents/LajosSztaviklStvanlijas.PDF).

Flood problems in Hungary fall generally into 3 different categories:

The larger rivers Danube and Tisza
Two major rivers flow into the Hungarian plains. These are the Tisza and the Danube. Both have their origins in upstream countries and a large watershed. As a consequence both rivers have slowly rising floods. The rivers flow through the Great Hungarian Plains, the present day pustza. Breaching of the flood protection works would result in the inundation of vast areas and a large damages. In the past decade there have been major floods of the Danube (2002) and the Tisza (1998, 1999, 2000 and 2001). There was no loss of human life but often considerable damage, many people had to be evacuated and over 250 km2 of agricultural land was inundated.
Smaller rivers
In addition to this a number of smaller tributaries can be characterised as having faster rising floods. Some of them originate in surrounding countries, the smaller ones originate in hilly foothills in Hungary. They have often confined river valleys except for the downstream confluences with either Danube or Tisza or where they flow into the plains. Floods events leading to inundation and damage occur less often than along the Tisza and Danube.

Plains
The melting of snow in combination with heavy rains over frozen ground may lead to slowly rising floods. These floods are large but shallow and generally occur at the end of winter till spring. Sometimes these floods are very extensive with several thousand km$^2$ inundated, approximately once every ten years. In spring damage occurs mainly in settlements, in summer also in agriculture.

Safety standards
Dikes along the major rivers must be designed to withstand 1 in 100 year flood events. Larger cities like Budapest, Gyor, Szeged and the Algyo oil-mining area are protected against a 1 in 1000 year flood event. So safety levels are differentiated according to the level of potential flood damage.

10.2 Political momentum
Flood protection is a political issue. The government has allocated vast sums to remediate the largely neglected flood defence system. The recent flood events have shown that flood protection can never offer a 100% guarantee against flooding. As a consequence diminishing flood-damage is under discussion and is of great importance. Improving agricultural conditions is an additional objective of flood protection measures as is nature restoration along rivers. As a
consequence of the floods that hit the Tisza basin a flood protection plan (Vasarhelyi Plan, see next paragraph) for the river Tisza is being prepared at the moment. The effects of climate change on floods and excess surface waters has so far not been taken into account in designing flood protection but will be taken into account when drafting the new strategic plan for the Tisza river.

10.2.1 Vasarhelyi Plan
The Vasarhelyi Plan is an example of how presently flood problems are handled. The objective of the project is to decrease the flood probability, to stimulate the rural development of the region (the population in the Tisza basin is decreasing and ageing, and unemployment is relatively high) and ecological restoration.

Figure 10-2 Proposed retention areas ("emergency flood reservoirs") along the Tisza as part of the Vasarhelyi Plan (from http://www.ecologic-events.de/floods2003/de/documents/LajosSzlavikIstvanIjjas.PDF). Existing retention areas are shown in red.

The main elements of the plan are:
- construction of 10 -15 retention areas along the Tisza with a total area of 400 - 700 km2 (see Figure 10-2). The flooding frequencies of these areas may vary from seasonal flooding to 1 in 30 years.
- increase of the flow capacity of the flood channel by removing forest and underbrush from the active floodplains (due to forestation and silt accumulation the flow capacity of the active floodplains has decreased considerably during the last 30 years)
- maintenance and improvement of dikes
- storage in the upstream part of the catchment; mostly in neighbouring countries
These measures would reduce the flood probability to 1 in 1000 years. Project costs are estimated at 5 billion Euro. The authorities took the initiative; the negotiations were largely public. The most important instrument used was negotiations with stakeholders in order to convincing them that a change in land use is needed. The first version of the plan met with strong local resistance. The stakeholders involved are the municipalities, local inhabitants, land owners and also enterprises. The spatial measures are a cost-effective alternative especially at the state level, because land prices are low. However, there is a conflict of interest between the local and state levels when spatial solutions are applied, as the spatial measures do not have significant benefits for society and for key stakeholders. Agricultural land use in the retention areas will become more difficult. Due to local resistance the initial plan may have to be amended.

10.3 Organisation
The protection of different works from flood damage is the responsibility of the owners (state, water associations, enterprises, private owners). The Ministry of Environment and Water and the 12 regional Water Directorates are responsible for flood protection on the larger and medium sizes rivers. The Water Directorates are the regional representatives of and supervised by the National Water Authority, which is part of the Ministry of Environment and Water. The Water Directorates take the initiative for flood protection planning and works. The responsibilities are vested in the Water Act. The public gets information continuously about the protection and its tasks. The final decision is in the hands of the local/central leader of the protection. In addition to flood protection, the Water Directorates are also responsible for licensing and quantitative water management. Within the 12 Directorates, 35 River sub-catchment area districts are identified. River basin management plans have been made in 7 river basins. Responsibilities for services such as nature conservation, solid waste collection and water utilities management (water supply and sewage) are given to the Municipalities (over 3000). They often lack financial resources and expertise to operate the utility effectively.

10.4 Measures

10.4.1 Technical measures
The construction of dikes generally started in the middle of the 19th century. Since Hungary has dry summers a lot of small reservoirs have been built on the smaller tributaries for irrigation, fisheries and cooling of power plants. Most of these reservoirs also have a role in local flood protection. Drainage works are a crucial element of the Hungarian plans as are pumping stations, since the need to pump out excess drainage water largely coincides with peak flows on the Danube and Tisza. Because of the very limited slope, canals can only transport larger amounts of water if pumping is applied. At present pumping stations and canals are in a poor condition because of lack of maintenance.

10.4.2 Retention areas along rivers
Presently there are 11 retention areas with a total surface of 260 km2 and a storage capacity of appr. 380 million m3. Since 1960 these reservoirs have been inundated 3 times per reservoir on average. Along the Koros river 2 retention areas were built in the 1970s, and a third in 1999, with a total area of 60 km2 (see Figure 10-2); these retention areas have been operational 2 to 3 times. The “normal” land use of these areas is arable land and forest (willow, oak). Within the Tisza basin and especially along the Tisza, up to 30 locations for potential storage and floodplain restoration have been identified that may hold up to 1,500 million m3. Storage reservoirs are considered to be the most cost-effective measure.
10.5  Instruments

10.5.1  Role of planning and planning procedures
Planning generally targets the formulation of ideas for development and is meant to influence budget decisions by the central government. So far there have been only experiments with open planning. It is expected that the Water Framework Directive will change this. However there is no tradition, experience and economic incentive for participatory planning.

10.5.2  Hazard zoning and building regulations
There are zones with different roles (settlements, industrial, etc.), having their special regulations for building. There are however no real regulations regarding flooding or flood probability. There are no real financial-economical incentives yet, but there is the intention for developing them.

10.5.3  Financial arrangements and economic instruments
The discussion on the use and role of economic and fiscal instruments has just begun. Except for the Vasarhelyi Plan, cost-benefit analyses generally do not play an important role in decision-making. Financing is largely done out of central budgets, this means that there are no economic incentives for the local authorities that apply for funds to come up with the most cost-effective designs. Local authorities have only very limited means to generate income. Multi-objective or multipurpose projects are largely unknown. Because most of the budget is provided by the government, there is no real need to optimize the design of projects in order to attract co-financing. The focus is still largely on sectoral plans, such as flood protection. It is the expectation that this will change because of the Water Framework Directive. There will be more focus on integrated regional river basin management plans. EU-sources may become more important and work not only along the line of water management but especially through rural development and the Common Agricultural Policy.

10.5.4  Insurance and compensation schemes
The system of insurances by private companies has to be developed yet. People living at flood-dangered parts of the country generally haven’t insurance and that is the reason why the government has to help them in case of damages. The government used to help in rebuilding the houses. There is so far no legal obligation or regulation regarding compensation, but compensation schemes are being developed in the framework of the Vasarhelyi Plan.
11 Italy

11.1 Type of flood problems
Italy has a wide range of flood problems. In mountainous areas such as the Alps, torrential rains have caused disastrous flood events causing extreme damage in the last decades. Flood events in mounteneous areas are often strongly related to problems of erosion, and land slides (frane) and mudstreams. This is partly due to the geology of many steeper river valleys, and weakly consolidated clays and schists that predominate large parts of Italy. Sometimes frane are the cause of major inundations such as in Pieve Santa Stefano, where in February 1855, a massive frana blocked the Tiber (Tevere) setting the upstream village under 3 meters of water, before effective action could be taken.

Several rivers flow through floodplains, the most extensive being the river and floodplain of the (pianura di Padua). In 1951 a major flood, at 12,000 m3/s, led to the inundation of over 1000 km2. In the aftermath, levees were upgraded and again after floods in 1977. The flood event of 1994 was at 14,000 m3/s larger but inundated only 130 km2, mainly in the foothills of Piemonte. The major rivers of middle Italy, the Arno and the Tiber flow through intermontane basins that contain floodplains that are prone to inundations. In 1966 massive floods on the Arno caused large damages especially in these intermontane bassins. The largest problems occur where larger cities have been built on and partly into the floodchannel, which is the case in Florence and Rome. Most flood protection works are set on a 1 in 100 year level.

11.2 Political momentum
In terms of flood damage Italy faced the largest flood events in Europe, with over 9 billion Euro damage in 1996 along northern tributaries of the river Po. This has created much political momentum and has given considerable legislative power to the river basin authorities (Autorita di Bacino), that formally date from 1989.

11.3 Organisation
The river basin authorities have a Comitato istituzionale, a Comitato tecnico, a Segretario generale and a Segretaria tecnico-operativa. These organisational bodies have participants out of all provinces covered by the river basin.

The river basin authorities are required to formulate integrated river basin plans. Aspects that should be described and assessed in these plans include land use, socio-economic and demographic trends, seismic activity and also cost-benefit analysis.
Non-structural measures and flood damage prevention are by now key elements in flood management in Italy. The emphasis is on the maintenance and restoration of floodplains and retention areas. The creation of retention areas in non urbanised areas appears to be successful, often with nature objectives predominating. The direction is mainly decided by the provincial level who also largely finances flood protection.

11.4 Measures

11.4.1 Retention in the catchment
Within the river basin plans and regulations generally a distinction is made between hilly (tratti colinari) and floodplain (tratti di pianura) river stretches. Along the hilly stretches, soil erosion, slope stability and throughflow capacity are major management issues. Most river basin plans address these issues which largely lie within the competence of the river basin authorities.

11.4.2 Infiltration in urban areas
The river basin plans often contain the requirement of hydrologic compensation in case larger surface areas become impermeable due to urbanisation. Hydraulic effects need to be based upon modelling in case of more than 30% impermeable surface on more than 10 hectare project areas.

11.4.3 Technical measures
In Italy some of the flood defences go back to Roman times. Also today, technical measures important. Extensive river dikes exist along the Po and its tributaries. Flood protection walls are very common in urban areas along rivers.

In the 80 and 90s large reservoirs have been created on several larger rivers, such as the Tiber and Arno. These were meant for irrigation and well as flood alleviation. An example is the Grande Diga di Montedoglio, that contains the water of the Tiber upstream of the Alto Valle di Tevere. The reservoir is used for interbasin transfer of water for irrigation in the Chianto area. In addition to several large reservoir, many medium sized reservoirs have been built as well as thousands of laghetti colinari, small reservoirs for individual farmers.

11.4.4 Floodplain restoration and retention areas along rivers
There are a few cases of retention areas (casse di espansione) that go back to the beginning of the 20th century but it is especially a measure much debated after the 1960th - a period with major flood events.

Most retention areas so far have a primary function as nature reserve. Often the natural retention areas are restored. Some examples:

- The most well known and one of the largest of these is the Casse di espansione del Fiume Secchia, along the river Secchia (a tributary of the Po). This is an important nature reserve of 254 hectares, situated in the floodplain between Modena and Reggio Emilia. It was planned in 1966 and constructed in 1980, with a capacity of 15 million m3.

- Another important retention area is Valli di Campotto in the Vale Santa along tributaries of the river Reno (tributary to the Po) that consists of three water basins of 200, 250 and 400 hectares with a retention capacity of 30 million m3. It is an artificial system partly based on already existing water basins. Lately, in 1995, a 30-hectare large wet grassland was added. The area has been designated as a Ramsar site. It functions as a polder; consequently the water has to be pumped into the river Reno after passing of the peakflow.
Under discussion are plans for a retention area meant to safeguard the city of Latisana from the 1 in 100 flood event. This retention area is planned on the river Tagliamento, one of the most natural rivers in Alpine Italy and an exceptional nature area. The
controversy arises because the plan aims at improving the retention capacity by digging and altering the already natural floodplain.

- A system of retention areas has been created along the Tiber upstream of the city of Rome in order to safeguard the metropolitan area of Rome.
- A system of retention areas was recently approved along the Arno. The 12 approved retention areas are situated in former floodplains. In 2004 work will begin on the largest of these at Renai, a 180 hectare large area with a retention capacity of 16 million m\(^3\). It will be created in the commune of Signa, that is also owner of the land. The area was previously designated as a park. Half is paid by the river basin authority, 25% by the Regione, the Province contributes 12,5% and communes of Firenze, Campi Bisenzio, Sesto Fiorentino and Signa also pay 12,5%.
- At Montaletto there is an ongoing discussion whether to create an retention area or a canal (Canale Leonardo) to attenuate peakflows on the river Reno.

11.5 Instruments

11.5.1 Hazard zoning and building regulations

In the past decades the river basin authorities have created flood hazard maps and regulations. The flood contours need to be integrated in the plans of regions and communes. In zone C, the zone with low flood hazard it is up to the communes to decide how safety of humans and vital infrastructure can best be ensured. Assessment procedures are compulsory for all interventions in zone A and B in order to ensure that construction does not lead to flow obstruction and a decrease in peak flood attenuation capacity. An important element is that for public infrastructure the procedure may also require an assessment of best alternatives (example Po).

Regulations for high risk areas are directed at preventing flood damage potential such as restricting construction and/or demanding flood proofing such as a minimum floor level with respect to flood heights. The construction of cellars is not allowed in specific zones. In the zones of moderate flood hazard the objective is mainly to prevent constructions that diminish flood retention capacity and functioning and regulations to reduce flood damage. The zone of low flood hazard (zone C) requires special attention in case of planning. There are rules and assessment procedures that need to be followed in case of larger interventions planned.

Below a few examples are given.

- In the Tiber basin the river basin authority makes a distinction is in zone A (zona del rischio) and B (piani di protezione civile). Flood contours of events with a frequency of 1 in 30-50 years, 1 in 200-250 years and less than 1 in 500 determine the use of instruments. Three types of events are analysed, very intense but local rainfall, regional events and rainfall that covers the whole river basin. The zone up to the 1 in 30-50 year contour line contains the active floodplain where construction is not permitted. Agriculture is possible but can not be guaranteed. In the zone up to the 1 in 200-250 year contour line no constructions are allowed that hinder flood dynamics. Regulations exist that require the construction of robust infrastructure and that require industrial complexes to be built only on elevated positions. Also emergency plans are required for this zone. The 1 in 500 years flood contour line contains the area for which a flood safety plan (piani di protezione civile) needs to be formulated. This implies also that land use is only permitted if it does not pose additional risks in case of flooding. There are no other construction regulations in this area.

- In the Po basin, the river basin authority (http://www.adbpo.it/) distinguishes three zones (fascia A: permanent flood channel, B within the 1 in 50 contour line and C within the 1 in 200 contour line). The river authority has formulated regulations for ensuring that waste treatment plans and bridges are flood proof, as well as building regulations for
different flood hazard zones. Four different zones are distinguished within A and B, of which two for steep confined river valleys and two zones for valley-bottoms and floodplains. The restrictions in the zones for valley-bottoms and floodplains are:

Zone I: allowed is demolition without reconstruction, maintenance and restoration works but not enlargement. Flood proofing, and maintenance and upgrading of public infrastructure is allowed as long as these do not increase flood risks; being subject to an assessment by the river basin authorities and mitigating measures.

Zone B-r: outside urban areas the reconstruction and improvement of buildings is possible, also enlargement if accompanied with flood proofing, notably uplifting, and sanitary facilities that are legally required.

For all public infrastructure plans and public works proposed within Zone A and B it is required to prove that there are no alternative locations outside these zones and that these works do not pose hazards to humans.

In the category C area it is up to the communes to formulate additional regulations.

11.5.2 Financial arrangements
The provinces and the river basin authorities mainly finance larger flood protection works. Local works are co-financed by the communes.

11.5.3 Insurance and compensation schemes
In Italy several insurance companies offer the possibility of flood insurance as part of the house insurance. Often excluded is the damage to goods that are on the ground floor up to a certain height (e.g. 20 or 50 centimeters). This is meant also to work as an economic incentive to flood proofing and in order to limit the number of procedures on smaller damages.
12 Poland

12.1 Type of flood problems.
About 7% (20,000 km²) of the country’s surface is under threat of flooding, mainly caused by rivers. The recent flood problems in Poland have been caused by flooding of rivers. Coastal floods and floods through local rainfall (flooding sewage systems) are less serious and are not dealt with in this quick scan.

The two major rivers in Poland are the Wisla (Vistula or Weichsel) and the Oder (Odra). They both have their source in the mountainous border area of Poland and the Czech Republic, flow to the north and discharge into the Baltic Sea. The catchment area of the Wisla (length 1000 km) is almost 200,000 km² and the catchment area of the Oder (length 900 km, 86% in Poland)
is almost 120,000 km$^2$. Because of the large catchment areas the average (and maximum) discharges of those rivers are large as well. The average discharge of the Oder in Gozdowice is 532 m$^3$/sec.

It is estimated that floods in the Wisla catchment area occur on the average every 5 years and in the Oder catchment area every 7 – 10 years. In the twentieth century 45 large floods have occurred in Poland. In 1997 a catastrophic flood occurred of the Oder, and to a lesser extent of the Wisla. Over 5000 km$^2$ of land was flooded after a period of heavy rainfall. The floods claimed the lives of 55 people. The total damage is estimated to be 2.4 – 3.7 billion $ (3% of GDP), mainly along the Oder but also along the Wisla. In 2001, a large flood in the Wisla catchment caused a damage of 0.6 billion $ (source Lizak 2001 http://nck.krakow.pl/klizak/doc/floodpoland.pdf)

After the 1997 flood an evaluation of the factors causing the flood and the enormous damage has been performed. For Poland the national meteorological institute has not discovered a positive trend in extreme precipitation. Extreme periods of rainfall, especially in the upstream Czech Republic part of the Oder catchment, has caused the extremely high discharges. Hydro technical works were dimensioned on the high water periods in 1903, but the discharges in 1997 crossed these levels by 40-60%.

Many people suggested that the dikes and reservoirs were not working properly. However, the extreme weather situation in 1997 was simply not predicted. The hydro-technical works (dikes, sluices, weirs etcetera) would (probably) not have collapsed under the circumstances they were built for. Nevertheless more technical measures (including the construction of large reservoirs) are proposed for the coming years.
Figure 12-2  Oder flood 1997
http://www.ihr.uiowa.edu/education/international/europe/Poland/Poland-Wroclaw.htm
http://www.guycarp.com/portal/extranet/pdf/Polish_Floods.pdf;jsessionid=%4031016b%3af9cc1ba0a1?vid=1
12.2 Political momentum

The impact of the recent flood of 1997 can be compared to the impact of the 1903 flood in Poland. The 1903 flood caused a flooding of the Oder river valley over a width of 50 km. After this event the authorities decided to make large investments in protection against floods. The main reason was not the high (financial) damage but the realisation that future economic development in the Silesia area needed flood protection. Dikes were constructed or improved, reservoirs and ‘green’ rivers were constructed, and the river bed was regulated. However, the damage caused by the 1997 flood was much higher than the 1903 damage: the pace of the economic development in the twentieth century has turned out to be much higher than the pace of flood control measures.

After the 1997 flood the Polish government started a national programme aimed at offering aid to people who suffered losses during the flood, reconstructing towns and settlements, and modernising infrastructure in the areas affected by the flood.

The programme was divided into three parts:

- temporary actions, aimed at removal of the direct effects of the flood, eliminating the hazards and securing the basic aid for flood victims
- medium-term projects, involving help for agriculture, repairs of public buildings and houses, basic repairs and maintenance of various facilities
- long-term programme, comprising the reconstruction and modernization of a number of regions affected by the flood, mainly in the field of water condition control, hydro-technical constructions, public utilities, reforestation, communication, transportation and implementation of early warning systems in case of natural disasters.

It was concluded that a more effective flood prevention and control system had to be developed. With a loan of the World Bank in 1997 the Emergency Flood Recovery Project was started. The Polish government is now planning to set up the action plan “Odra 2006”, which includes an extension of the dikes and seeks to channel the river bed, and furthermore wants to build two new dams along the Oder River. This action plan should ensure that big boats can ship along the Oder River throughout the whole year. Furthermore, the creation of jobs in underdeveloped north-western Poland is a well-seen side effect of the action plan “Odra 2006” for the Polish government.

In the alliance “Zeit für die Oder” (Time for the River Oder) 32 environmental groups in Poland, the Czech Republic and Germany are united. This group is fighting against the action plan “Odra 2006” of the Polish government. They fear that execution of the plan will affect one of the biggest remaining floodplain forest in Europe.

The group claims that natural floodplain areas must be protected, not only for natural protection causes, but also because they are retention basins for flood protection. On top of that further retention areas (“Polders”) should be created in order to ensure the flood protection of the people. The principle “more space for the rivers” should be realized. They also feel that retention of the water in the catchment area must be increased by reforestation and protection of the (floodplan) forests in Poland and Czech Republic. Improving agricultural conditions is an additional objective of flood protection measures as is nature restoration along rivers.

Another initiative after the severe flood event in 1997, was the start of a discussion between Germany and Poland about the right way to reduce the danger of further floods. The German and Polish government started some action plans to reinforce the dikes along the River Oder. The German philosophy about flood protection includes the floodplain as a natural retention basin. The Polish philosophy has a more technical direction; that means more dikes and reservoirs.
12.3 Organisation
In general the national government is responsible for flood control. The ministry of Environment executes this task in 7 Regional Water Development Authorities (RZGWs): Gdansk, Warsaw, Cracow, Szczecin, Poznan, Wroclaw and Gliwice. Their tasks are management of navigable rivers, regulation of mountain streams, investments in multifunctional reservoirs and management of hydro-technical constructions in the rivers.

Flood control tasks of the Ministry of Environment are:
- care for high water discharge
- management of water supply in retention reservoirs
- steering high water wave within high water retention
- early warning system
- ice breaking (to prevent damming up in winter)
- participation in crisis activities.

Management of the main rivers is the responsibility of the RZGWs, but 70% of the Polish rivers are under responsibility of other bodies (for instance the Ministry of Agriculture and Voievodship institutions, i.e. Provincial Boards of Land Improvement and Water Facilities).

In the main rivers the water flow between dykes is the responsibility of the RZGWs, but the maintenance of the dykes, (which are localised in valleys of main rivers) is the responsibility of Provincial Boards of Land Improvement and Water Facilities. In Poland, there are a lot of anti-flood projects. The main problem however is that these projects all work independently: there is a lack of co-ordination of these projects.

12.4 Measures
Flood prevention measures that are under discussion in Poland are:
- realisation of more reservoirs and increasing their storage capacity
- find solutions for conflicts in interests with regards the management of reservoirs
- addressing the backlog in maintenance and investments in hydro-technical infrastructure
- improving protection of cities against ‘small risk floods’
- avoiding economic development in inundation areas
- reforestation of catchment areas
- stimulating cross-border management of flood control and retention measures.

The emphasis is on technical measures.

12.5 Instruments

12.5.1 Role of planning and planning procedures
Planning generally targets the formulation of ideas for development and is meant to influence budget decisions by the central government. In 2002 a new Water Law has entered into force. This Water Law obliges regional authorities to prepare plans for flood protection. It is expected that the WFD will change this. However there is no tradition, experience and economic incentive for participatory planning.

Town and country planning are dealt with in the Land Development Act and the Law 1994. Spatial planning as an instrument for flood prevention is gaining attention in Poland. The flood hazards are obviously highest on the floodplains, but the areas have been built on during the last decades. Even large cities are partly built in these flood hazard areas and to remove these houses and other buildings would be unacceptable and impossibly dear. These cities must be protected with dams or other constructions.
12.5.2 Hazard zoning

Three zones are determined:
zone 1: winter bed with water flow
zone 2: winter bed including retention part
zone 3: area between flooding border at 'normal' high level and the largest probable flood area.

Housing and building should not be situated in zone 1 and 2, but in the past this rule had been broken many times.

Due to absence of legislation and the lack of co-ordination hardly any organisation, even local municipalities, know how to make use of hazard maps. Insurance companies hardly believe that hazard maps exist. The water management offices (RZGW) that are theoretically responsible for preparation of this kind of maps, are still in the process of their preparation. WWF has prepared a hazard-atlas of the Oder river basin with financing by GELIN, a German insurance company. People tend to rely on the government, which, in their opinion, is obliged to deal with the flood issue and protect them against the flooding. The connection between their personal choices like, for example, the localization of a house and the personal vulnerability to the flood disaster seems to be poorly accepted (and not only in Poland).

12.5.3 Insurance and compensation schemes

In Polish practice nobody is financially responsible for flood damage compensation except insurance companies. Few people in Poland own a flood insurance policy. The main problem in Poland is that people strongly believe that the government is responsible for damage recovery. However, the real situation is that the Polish budget does not have the money for such kind of expenses. If a new crisis occurs like in 1997, the Polish government has no money to compensate anyone or anything.

The 1997 flood on the Odra river showed that there is no financial system that could help people organise their lives after the crisis. People who were not insured could not rebuild their houses. Temporary dwellings were provided for those who suffered the most by the government and private sponsors. Those who were not insured received some help from other organisations like the Red Cross, or were dependent on private donations. This kind of help is always insufficient and covers only basic needs.
13 Sweden

13.1 Type of flood problems
The major hazard area for flooding in Sweden is the area where the rivers from the mountain region on the Norwegian border enter the floodplains. This type of floods is quite predictable, as the water rises slowly.
In 1995 a high spring flood caused considerable flooding in most of the large rivers in the country. In the summer of 2000, the northern part of Sweden (southern Norrland) was hit by large amounts of rain. In November of that year, the western part of Sweden experienced the worst floods in a century. Rainwater from mountains in Norway flowed into Lake Vänern in western Sweden, inundating hectares of cropland and the city of Arvika. Problems arose for water supply and water treatment.
Another type of flooding happened to Kristianstad in southern Sweden in March 2002. This town lies on reclaimed land, 5 km² of which lies under sea level.
In urban areas basements flood may occur due to local rainfall. The water comes up fast.

13.2 Political momentum
The floods in Sweden and in the rest of Europe have put climate change higher on the EU agenda during the Swedish EU-presidency in 2001. Some actions are taken to re-evaluate design criteria in case of critical storm events.

13.3 Organisation
The Environmental Protection Agency (Naturvårdsverket) is responsible for general water protection as part of national environmental objectives.
For larger rivers that are regulated for hydroelectric power production the company who runs the power stations must follow the regulations set for the specific river.
For urban areas the domestic water company (usually the community) is responsible for the design of the urban drainage.
The national Board of Housing, Planning and Building (Boverket) is responsible for landuse planning. The Rescue Services Agency (Räddningsverket) encourages municipal Rescue Services (Räddningstjänster) to be involved in landuse planning to prevent damage from floods. Insurance companies can play a role by putting pressure on responsible local actors.

13.4 Measures
In Sweden there are few measures for preventing floods, and no measures for decreasing the cost of floods. The erratic character of floods makes structural flood defenses too expensive. The floods can vary in space and time very much; therefore floods are tackled when they occur, by temporary dikes and evacuating people.

13.4.1 Technical measures
In some cities, roads and other constructions are designed to handle the urban rivers which may flood after very heavy rainfall. This is not very common though.
In regulated watercourses, dams for hydroelectric power can be managed to minimize damage and flows.
Figure 10.3. The location of the city of Arvika
13.5 Instruments

13.5.1 Hazard zoning and building regulations
The Swedish Meteorological and Hydrological Institute makes flood hazard maps of many rivers in Sweden. The Swedish Meteorological and Hydrological Institute (SMHI) makes flood hazard maps of many rivers in Sweden. These hazard maps show the flooded area both for a 1:100 year precipitation and for the highest estimated flood. These maps can be used by municipalities for land use planning.
Generally, there are no restrictions to building in sensitive areas for flooding. On the contrary, municipalities along larger rivers allow recreational houses at lower areas for financial reasons. The Swedish Rescue Services agency wants the municipal Rescue Services to be involved and be informed about land use planning.

13.5.2 Insurance and compensation schemes
Insurance is voluntary.
14 Annex: Relevant EU projects under Interreg III

14.1 Introduction
In this chapter we give a short overview of relevant projects under Interreg IIIB. At present, many projects are being conducted in this program that focus on flood prevention, and in the process pay attention to spatial measures.

Interreg IIIB is one of the strands of Interreg III, the Community initiative which aims to stimulate inter-regional cooperation in the EU between 2000-06. It is financed under the European Regional Development Fund (ERDF), with a total budget of 4900 M Euro.

Information on Interreg IIIB can be found at (transnational cooperation). The program is divided into 9 regions, each with its own budget, Secretariat, priority themes and calls for projects. The Netherlands falls in 2 regions (North Sea and Northwest Europe); some parts of the Netherlands fall in both regions and can apply for projects under both regimes. All regions have been scanned for projects that focus on spatial aspects of flood prevention. Relevant projects are listed below, per region. Most projects have only started in 2002 and 2003, the important results will only become available from 2004 onwards. Many projects are concerned with investments, but all projects have an aspect of sharing knowledge and experience.

Interreg IIIC
Interreg IIIC focusses on large-scale information exchange and sharing of experience (networks) over larger areas (see Figure 14-1). This program also may be relevant, but has not been searched extensively. More information can be found under interregional cooperation.

Figure 14-1 Regions distinguished under Interreg IIIC
Interreg IIIA
Interreg IIIA is less relevant for the subject at hand, as it focusses on cross-border cooperation between adjacent regions (see Figure 14-2 Regions distinguished under Interreg IIIA Each blue dot in the figure represents as separate region for cooperation, with its own set of priorities. For more information see cross-border cooperation
14.2 North Sea
http://www.interregnorthsea.org/

The priority themes for the North Sea Region are:
1. Transnational spatial development strategy and actions for urban, rural and maritime systems in the North Sea Region.
2. Efficient and sustainable transport and communications and improved access to information society.
3. Sustainable management and development of the environment, natural resources and cultural heritage.
4. Water management.
5. Technical assistance

Relevant projects on spatial aspects of flood prevention are found under theme 4

14.2.1 COMRISK
Common Strategies to reduce the risk of storm floods in coastal lowlands
www.comrisk.org

The project aims at sustainable coastal risk management in the North Sea Region through exchange of experience and common evaluation and pilot studies. It will address the following aspects of risk management: Improvement of policies and strategies, common strategic planning tools, participation methods and performance indicators as well as common technical methods.

Period: 2002 - 2005
Lead: Schleswig-Holstein State Ministry of the Interior (D)
Partners: Environmental Agency (UK)
National Centre for Risk Analysis and Options Appraisal (UK)
MVG Afdeling Waterweg Kust (FL)
RWS-DWW (NL)
Kystdirektorat (DK)
NLWK Betriebsstelle Norden (D)
RWS RIKZ (NL)

14.2.2 FLOWS
Flood Plain Land Use Optimising Workable Sustainability
www.flows.ru
The project seeks to improve the sustainability of development in flood risk areas by working with both technical and social aspects of flood risk information and its integration into decision support systems for spatial planning. The project will also consider transferable strategies for improved water management.

Period: 2002 - 2006
Lead: Cambridgeshire County Council (UK)
Partners: Lansstyrelsen Varmland (S)
Ministry of Civil Construction and Transport (D)
Norwegian Water Resources and Energy Directorate (N)
Provincie Flevoland (NL)
Waterschap Friesland (NL)

14.2.3 FRaME
Flood Risk Management in Estuaries: Sustainable New Land Use in Flood Control Areas

The project seeks to reduce flood risk in North Sea estuaries by combining Flood Control Areas, where water can be stored when water levels are high, with alternative sustainable land use. Activities include specific practical action at demonstration sites.

Period: 2003 - 2006
Lead: Dienst Landelijke Gebied (NL)
Partners: Environmental Agency (UK)
Ministerie van de Vlaamse Gemeenschap (FL)
Provincie Zuid Holland (NL)

14.2.4 PURE
Planning for Urban-rural River Environments

PURE aims to develop the various spatial functions of water catchment areas in the urban-rural fringe, focusing especially on public participation, water quality and flood risks. Pilot projects and guidelines developed by the project will address various issues such as integrating water management into spatial planning, improving the multifunctionality of water, discovering water related identities, restoring water systems and storm water management.

Period: 2002 - 2006
Lead: Provincie Groningen (NL)
Partners: City of Goteborg (S)
Municipality of Deventer (NL)
Environmental Agency (UK)
14.3 North West Europe
http://www.nweurope.org/

The priority themes for North West Europe are:
1. An attractive and coherent system of cities, towns and regions.
2. External and internal accessibility.
3. Sustainable management of water resources and prevention of flood damage.
4. Sustainable development, prudent management and protection of other natural resources and of cultural heritage.
5. Promoting the maritime potential of North West Europe and its territorial integration across the seas.
6. Technical assistance

Relevant projects on spatial aspects of flood prevention are mainly found under theme 3

14.3.1 AMEWAM
Agricultural Measures for Water Management and their Integration into Spatial Planning
As a joint project between regions in the Netherlands, Germany and the UK, AMEWAM (Agricultural measures for water management and their integration into spatial planning) addresses land use and water systems. In the partner regions, recent freak rainfall has given rise to rapid water run-off from arable fields into residential areas and rivers. The project tackles the problem of surface water runoff, soil erosion and water retention capacity of soils in small catchment areas through a set of agricultural, forestry and environmental measures, in collaboration with farmers and other land users. The project also addresses water management and land use planning. It addresses the problem of water scarcity among different users and contrasts different approaches to water management between them.
Period: 2002 -
Lead: Town of Schaiern (D) Johannes.Hauser@schaiern.de
Partners: Morley Research Centre (UK)
Dienst landelijk Gebied Limburg (NL)
Community of Sulzfeld (D)
Costs: 1.4 MEuro

14.3.2 CFM
Creating New Landscapes for Flood Risk Management
http://www.environment-agency.gov.uk/
This is an action project that seeks to change perceptions of flooding and develop common principles for relevant decision-making. The objective is to promote new sustainable landscapes in planning that combine water issues with nature conservation, agriculture, building and recreation. The investment component, involving the construction of a retention basin, is intended as a pilot project to test theories, models and methods of public communication and decision-making processes and their monitoring. Although the physical infrastructure will benefit one partner, a transnational benefit is sought for the whole partnership through the transfer of experience and testing of techniques throughout the construction and evaluation phases.

Period: 2002 -

Lead: Environment Agency (UK),
Partners: Fulda, Diemel Watersheds Hessen Ministry of Environment (D)
Agriculture and Forest & Federation Baunatal FRP Kassel University (D)
Ministry of Agriculture, Nature Management & Fisheries (NL)
Ministry of the Flemish Community, Waterways and Marine Affairs (B)

Costs: 8.8 MEuro

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### ESPACE

**European Spatial Planning: Adapting to Climate Events**

The ESPACE Project aims to ensure that adaptation to climate change is recognised and to recommend that it is incorporated within spatial planning mechanisms at the local, regional, national and European levels. This four year project is being led by Hampshire County Council with 10 partners from across North West Europe.

Through ESPACE, a change in the philosophy and practice of spatial planning should be achieved by ensuring that climate change is acknowledged as a major influence on spatial planning decisions and processes.

Period: 2001 - 2005

Lead: Hampshire County Council (UK)
Partners: Environment Agency (UK)
Regionaal Landschap Zenne, Zuun en Zoniën (B)
South East Climate Change Partnership (UK)
South East England Regional Assembly (UK)
Surrey County Council (UK)
Waterschap Rivierenland (NL)
West Sussex County Council (UK)
Ministerie van VROM (NL)
Bayerisches Landesamt für Wasserwirtschaft (D)

Costs: 4.7 M Euro
14.3.4 FaF

Freude am Fluss

This Dutch-led project with a total of 12 partners from France, Germany and the Netherlands, aims at reducing the opposition from local stakeholders to “room-for-river” measures against flooding. The project’s objective is to develop expertise for assistance of NWE decision-makers, engineers and local communities in joint planning and design of ‘room-for-river’ packages, and to apply the method in the implementations of local measures and/or regulations e.g. dike relocation, flood-proof urban development, nature rehabilitation. The project develops a transnational planning method that integrates room-for-river measures with the enhancement of local benefits and fosters mutual understanding between authorities and communities; for example, mixed teams of experts and local communities will be engaged in a series of focused communication activities. The project analyses those measures already implemented to develop a new joint planning approach which it will test in a selection of pilot areas. It also supports a well-known, effective approach to fight flooding but addresses an issue which has previously hindered its implementation: the opposition of the stakeholders. In this regard, the project adopts an innovative approach to spatial planning and can provide very useful solutions for flood management in NWE.

Period: 2003 - 
Lead: Catholic University Nijmegen (NL) w.degroot@maw.kun.nl 
Partners: Equipe Pluridisciplinaire Plan Loire Grandeur Nature & Université de Tours (F) 
Rijkswaterstaat Directie Oost-Nederland (NL) 
Darmstadt University of Technology, Institute WAR (D) 
Delphiro B.V. (NL) 
Erasmus University Rotterdam (NL) 
Habiforum (NL) 
Research and Marketing B.V. (NL) 
Institut für Landschaftsökologie und Naturschutz Bühl (D) 
Region Starkenburg (D) 
WL | Delft Hydraulics (NL) 
Rijkswaterstaat Road and Hydraulic Engineering Division (NL) 
Costs: 7.7 MEuro

14.3.5 FAR

Extreme Floods and Flood Protection along the Rhine

The project between four Dutch and German partners builds upon a transnational co-operation agreement in the field of flood prevention signed in 1997 by the Province of Gelderland, the Ministry of Transport and Water Management of the Netherlands, and the Ministry of Environment of the Land of Northrhine-Westfalia. FAR (Extreme floods and flood protection along the Rhine) follows up a number of IRMA-funded studies. The geographical scope of the project is the section of the Rhine running from Andernach (Germany) to the centre of the Netherlands (around Arnhem). The project’s objective is to strengthen transnational co-operation between the aforementioned regions in the field of flood protection mainly by increasing the technical knowledge on the occurrence and behaviour of extreme floods in the area, as well as examining the effectiveness of proposed flood protection measures and their influence downstream.

Period: 2002 - 
Lead: Province of Gelderland (NL) c.veraa@prv.gelderland.nl 
Partners: Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen (D),
14.3.6 JAF  
Joint Approach for Managing Flooding
In the project five partner regions from the Netherlands, the UK and Germany will work together over four and a half years to examine the delicate balance between water systems, nature/climate and the environment. The objective is to develop a joint approach to manage flooding, in particular in catchment areas at particular risk from heavy rainfall. The partnership will endeavour to achieve its goals by improving spatial planning to promote multifunctional land use, restoring rivers to enhance water storage capacity, implementing new technologies to link groundwater and surface water management, and increase public awareness and support for innovative policy solutions.
Period: 2002-
Lead: Waterschap Regge en Dinkel (NL) P.J.J.vanerp@wrd.nl
Partners: Waterschap Velt en Vecht (NL)
Waterschap Groot Salland (NL)
Somerset County Council (GB)
Wasserverband Eifel-Rur (D)
Parc Marais du Cotentin (FR)
Costs: 14 MEuro

14.3.7 NOAH
Description not yet available
Period: 2003-
Lead: Stichting Toegepast Onderzoek Waterbeheer (NL)
Partners: information not yet available
Costs: 6.5 M Euro

14.3.8 RHINENET
RHINENET for a sustainable and participatory management of the Rhine Basin
The 5-year project seeks to develop two inter-related issues of sustainable water management and the involvement of stakeholders and the civil society in the decision-making process. The overall objectives are to develop a sustainable, participatory and integrated water management approach in the Rhine river basin and to promote solidarity among users and local residents, based on principles of democracy and the respect of shared natural (water) resources. In the long term the aim is to change habits in water usage both on the river and domestically. RHINENET signals a creative transnational approach to water management, for which the range of actions envisaged include the organisation of cultural and music events, development of educational guides and promotional materials, information days, pilot actions for monitoring protection zones and classifying wetlands, and various communication activities targeted at local populations.
Period: 2003-
Lead: Naturlandstiftung Saar (D) freiheit@nls-saar.de
Partners: Solidarité Eau Europe (F)
Ecologic (B)
Regiowasser e.V. (D)
14.3.9 SDF
Sustainable Development of Flood Plains

The bursting of river banks, flooding of towns and evacuation of communities, have, in recent times, brought about the need for drastic short-term measures including the construction of emergency dams and dykes. With flooding predicted to become ever more acute and ever more frequent, German and Dutch governments have been forced to take more drastic long-term action to cope with rising water levels. One way of doing this is to address the storage and drainage capacity of the river Rhine. Thus, the key objective of SDF, led by the Dutch Ministry of Transport, Public Works and Water Management), and in collaboration with 8 partners from Germany and the Netherlands, is to take steps to expand the Rhine’s main drainage capacity. The project envisages creating new, innovative facilities for temporary water storage. Building on assessments made during the former IIC IRMA Programme, this 5½ year project will carry out a number of investments, to bring added-value and synergies to a range of activities being carried out in the areas of flood management, multiple land use in flood plains, nature development, public consultation and the involvement of PPP. A high level of cross-sectoral integration is to be achieved transnationally, with a transfer of experience at the design and implementation stages through collaborative approaches to 9 technical investments at 7 different locations. The project addresses engineering and navigation, environmental protection and development, and communication and social action, all with a view to sustainable territorial development.

Period: 2003 -
Lead: Rijkswaterstaat Directie Oost Nederland (NL)  h.j.nijland@don.rws.minvenw.nl
Partners: Directie Landelijk Gebied Gelderland (NL)
Directie Landelijk Gebied Overijssel (NL)
Struktur- und Genehmigungsdirektion Süd, Regionalstelle Wasserwirtschaft, Abfallwirtschaft und Bodenschutz Mainz (D)
Emschergenossenschaft (D)
Deichschau Haffen-Mehr (D)
Gewässerdirektion Nördlicher Oberrhein Bereich Karlsruhe (D)
NABU Naturschutzstation Kranenburg (D)

Costs: 31 M Euro

14.3.10 TRUST
Transformation of Rural and Urban Spatial Structure

Description not yet available

Period: 2003 -
Lead: Hoogheemraadschap van Schieland (NL)  m.quapp@schieland.nl
Partners: information not yet available
Costs: 10 M Euro
14.3.11 Urban Water

Sustainable Water Management in Urban Space

Description not yet available

Period: 2003 -

Lead: Emschergenossenschaft (D)

Partners: information not yet available

Costs: 12.3 M Euro
14.4   Central European, Adriatic, Danubian, South-Eastern European Space
http://www.cadses.net/

14.4.1 ILUP
Integrated Land Use Planning and River Basin Management
http://www.schabl.at/ilup.htm

The risk potential in river basins has increased strongly due to the enormous use pressure. In view of the demographic concentration in river basins and potential climate changes, safety in valleys is only possible if protective water management and other disciplines cooperate. In selected river basins, exemplary new methods are being tested, strategies developed and pilot projects implemented. Due to space limitations, infrastructure planning, land use and the protection of resources require an integrated approach, and multifunctional strategies must be developed.

A solution for problems of foothill and hill countries regarding integrated management of water resources, risk and landscape management can be solved sustainably only in an interdisciplinary way. ILUP pursues the basic concept of a holistic, network-oriented landscape assessment from the problem solving approach to the implementation of measures.

Period:  01/2002 -12/2006
Lead:  Ministry of Agriculture, Forestry, the Environment and Water Management, Forest Division (D)
Partners:  Federal Ministry of Agriculture, Forestry, Environment and Water Management, Water Division (A)
Forest Technical Service for Torrent and Avalanche Control (A)
14.4.2  NETWET 2
Networking Perspectives of Transnational Co-operation and Participatory Planning for Integrated Water Resources Management through the promotion of new forms of Spatial Governance
http://www.medregio.org/netwet2/netwet2.htm
NetWet 2 focuses on various important problems in the field of water (salinity of groundwater aquifers, ecological balance of sensitive aquatic ecosystems, drinking water, environmental impact of organic agricultural practices on waters, protection of flood risk areas, protection of drought areas in relation to flood development, protection of areas with high environmental hydraulic risk, economic value of humid areas water) and aims at the promotion of bottom-up participatory spatial planning and new forms of spatial governance at transnational level for the integrated management of water resources. The project's principal objective is the development of transnational co-operation for water management through:
- the promotion of water management integrated methods and
- the development of new conditions of bottom-up participatory spatial planning and new forms of spatial governance at transnational level.

Period:  01/2003 -12/2005
Lead:  Center of Euro-Mediterranean Regions for the Environment (Greece)
Partners: Presidency of the Council of Ministers, Department of National Technical Service, Hydrographic and Tidal Service (I)
University of Udine, Dept of Crop Sciences and Agricultural Engineering (I)
Region of Lombardia, DG of Water Sources & Public Utilities (I)
Technical University of Crete, Laboratory of Environmental Engineering and Management (Greece)
Aristotle University of Thessaloniki, Department of Hydraulics, Soil Science and Agricultural Engineering (Greece)
University of Thessaly, Dept of Planning and Regional Development (Greece)
Regional Development Fund of Thessaly Region (Greece)
Union of Local Authorities of Achaia (Greece)
Union of Local Authorities of Etoloakarnania (Greece)
Union of Local Authorities of Ilia (Greece)
Union of Local Authorities of Kefalonia & Ithaki (Greece)
Union of Local Authorities of Kerkynra (Greece)
Union of Local Authorities of Korinthia (Greece)
Union of Local Authorities of Lefkada (Greece)
Union of Local Authorities of Messina (Greece)
Union of Local Authorities of Preveza (Greece)
Union of Local Authorities of Thesprota (Greece)
Union of Local Authorities of Zakynthos (Greece)
Institute of Geography – Bulgarian Academy of Sciences (Bulgaria)
14.4.3 **ODERREGIO**

Transnational Action Program Spatial Planning for Preventive Flood Protection in the Oder Catch

http://www.oderregio.org

In the last years dramatic flood events have occurred along the European rivers (Oder, Elbe, Danube, Po) causing enormous damage. ODERREGIO is concerned with the spatial planning possibilities of minimizing this risk by influencing the course and the effects of flooding. This requires an integrated transnational approach, considering the Oder river catchment area as a whole.

The objective of ODERREGIO is the development of an action program of spatial planning for preventive flood protection for the Oder catchment area, transnationally agreed between the countries Czech Republic, Poland and Germany. The action program will contain realizable actions, covering preparation of enlargement of retention areas by spatial planning, protection of areas endangered by flood as well as increasing of awareness of experts and inhabitants. Furthermore, guiding principles for spatial development of the Oder-region will be developed, regarding requirements of flood protection and providing fundamental information for regional planning.

**Period:** 12/2002 - 12/2006

**Lead:** Joint State Planning Department Berlin-Brandenburg (D)

**Partners:**

**Project costs:** 3 M Euro

14.4.3.1 **SUMAD**

Sustainable use and management of alluvial plains in diked river areas

http://www.sumad.org

The rivers which are the central subject of this project are mainly diked in order to ensure sufficient flood protection. The alluvial plains between the dikes grow constantly due to sedimentation which leads to the problem that the flow profile originally calculated is decreasing. This development is additionally enhanced through the natural succession of the alluvial plains. The whole process multiplies the risk, that the present dikes are not able to prevent future flood disasters.

The authorities responsible are the water management agencies. As preventive measures, they have so far cleared alluvial plains and increased the water flow rate in riparian woods. However, these clearing activities (for example tree clearing) become more and more in contradiction to nature protection goals and existing regulations (NATURA 2000 and the respective national protection regulations). The need for integrated strategies is increasing.

The objective of the present project is therefore the transnational development and testing of applicable strategies and instruments for a sustainable and integrated management of alluvial plains in diked river areas. All stakeholder groups will be involved: water management, nature protection, agriculture, associations, municipalities.

The expected outcomes are:

- Umbrella initiative "Rivers need space"
- Joint management strategies and implementation procedures
- Pilot testing of investive implementation scenarios
- Recommendations and model texts for the political level

**Period:** 10/2002 - 12/2005
Lead: Bavarian State Ministry for State Development and Environmental Affairs (D)
Partners: ........
Project costs 2.8 M Euro
14.5 Alpine Space Programme

The first objective of this project is to create a shared approach for the definition of hydro-geological risk scenarios in Alpine catchments and on alluvial fans. To achieve this all aspects of hydro-geological hazards affecting catchments will be analysed, in particular: flooding and mass transport phenomena; droughts and aquifer depletion; and landslides, such as rock falls, soil slips, and debris flows. This will lead to the evaluation of hazard and risk both in the catchments and on the alluvial fans. The final objective is to provide guidelines addressed to professionals and administrators to support decisions for improving water management, land use and protection measures planning, and risk management. Dissemination of results will include workshops addressed to professionals, administrators and the public, to inform and increase awareness on hydro-geological risks. Expected impacts include a contribution to changing the attitude of local administrators to risk and land management into a more comprehensive process, and establishing a network between partners, also by setting a common terminology.

Period: ..... - 2005
Lead: Regione Lombardia - Direzione Generale Territorio e urbanistica (I)
Partners: Oanneum Research Forschungsgesellschaft mbH - Institute of Hydrogeology and Geothermics (A)
Land Bayern - Bayerisches Geologisches Landesamt (D)
Regione Autonoma Friuli Venezia Giulia – Direzione regionale delle foreste - Servizio della tutela del suolo montano. (I)
Amministrazione Provinciale dello Spezia - Area Difesa del Suolo (I)
Regione Piemonte - Direzione Servizi Tecnici di Prevenzione (I)
14.5.2 NAB

The increasing frequency of natural disasters in Europe is indicative of a clear need for action in the field of risk management. In the future, integrated strategies will play a central role in the sustainable protection of the Alpine region.

The goal of NAB is to achieve intensive cooperation between the various disciplines and administrative levels in order to develop an innovative land use management regime targeted at sustainable risk mitigation for natural hazards. The project will produce a transnational procedure combining the different sectoral risk assessment methods in place in the various regions. A general area assessment of the effects of site, vegetation cover, and land use on protection against flooding, erosion and mudslides will serve to develop harmonised handbooks and maps for transnational action in support of the protection-based management. An Internet-supported information system will provide general access to project data and will also serve as the basis for a transnational knowledge network. Application of the resulting process by public administrations will constitute practical implementation of the project results for the authorities.

Period: ..... - 2006

Lead: Office of the Tyrolean Regional Government. Regional Forestry Commission (A)

Partners: Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Resources (A)
Torrent and Erosion Control Service (Slovenia)
Tyrolean Section of the Forestry Service for Mountain Torrent and Avalanche Control (A)
Regional forestry department - Kanton Graubünden (CH)
Bavarian Ministry of Regional Development and the Environment (D)
Bavarian State Institute of Forestry (D)
Provinz Bolzano. Abteilung Forestry (D)

Project costs: 1.3 M Euro

14.5.3 RIVER BASIN

The risk potential in river basins has risen sharply throughout Europe due to the enormous pressures of utilization in the narrow valleys. In order to improve safety for the valley populations, increased, sustained inter-regional and transnational commitment is required. The Alpine River Basin Agenda thereby makes innovative contributions in 10 selected river basins:

- from working focussed on the riverbed to planning and working in the whole river basin
- from end of pipe measures in the riverbed to the reduction of damage potential in the risk zones
- from sectoral planning to integrated River Basin Management
- new forms of cooperation: flood protection – spatial development
- new dynamic planning methodology (first implementation phases during planning)
- integrated planning: involve stakeholders at an early stage
- new communication strategies to promote the bottom up approach to reach more acceptance
The River Basin Agenda aims to transfer innovative methods experimented on a small scale to larger areas.

Period: …… - 2006

Lead: Bavarian Ministry of State for Country Development and Environmental Questions, Department Water Management (D)

Partners: Amt der Kärntner Landesregierung, Abteilung Wasserwirtschaft (A)
Ministry of the Environment and Spatial Planning (Slovenia)
Amt der Salzburger Landesregierung, Fachabteilung Wasserbau (A)
Swiss Federal Institute for Environmental Science and Technology Amt der Steiermärkischen Landesregierung (CH):
Amt der Tiroler Landesregierung, Abteilung Wasserwirtschaft (A)
Provincia Autonoma di Bolzano-Alto Adige; Opere idrauliche (I)
Comune di Budoia (I)
Groupe de Recherche Rhône-Alpes (F)

Project costs: 3.3 M Euro