Länderarbeitsgemeinschaft Wasser

Guidelines for Forward-Looking Flood Protection

Floods
– Causes and Consequences –

by order of the Environment Ministers Conference

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Foreword

In recent times we have been particularly concerned about floods, especially their violent force. For the people affected every flood is a personal catastrophe with more than just considerable material losses; they also lose confidence in the security of their very existence. Flood damage shakes the very foundations of our high-tech society, where we believe we can overcome all risks by means of technology.

The people expect the state to meet its safety obligation and ward off the threats of floods. The *Länder* Working Party on Water *(Länderarbeitsgemeinschaft Wasser – LAWA)* has taken up this problem and, in conjunction with the Federation/*Länder* Working Party on Soil Conservation *(Bund/Länderarbeitsgemeinschaft Bodenschutz – LABO)*, the *Länder* Working Party on Nature Conservation, Custody of the Countryside, Recreation *(Länderarbeitsgemeinschaft Naturschutz, Landespflege, Erholung – LANA)* and the responsible Federal Ministries, it has drawn up the "Guidelines for Forward-Looking Flood Protection". The Conference of Environment Ministers agreed to these guidelines on 11/12 May 1995.

In essence it must be stated that floods have a natural cause as a result of meteorological events and are a part of the water cycle. However, it is also indisputable that man has intervened in the ecobalance and the water cycle and has aggravated the flood situation. Of particular significance here are interference with the natural storage capacities of vegetation, soil, ground and drainage network. In particular, this includes sealing as a result of residential areas, commerce and traffic, alteration of the landscape by means of land consolidation, the conversion of meadowland into arable land and the development of water bodies.

That is why the catch words "man-made flood" were on everybody's lips. However, this is only half the truth: it is more the flood damage that is man-made than the floods themselves. Residential, commercial and traffic areas have spread into the natural flood basins in recent decades. Damage potential increased in the periods without major floods because people were no longer aware, or suppressed the knowledge, that they were living in a flood basin. Earlier preventative strategies have been forgotten. High-quality furnishings in low-level parts of buildings at the risk of floods will regularly lead to high-level "man-made flood damage" sooner or later.

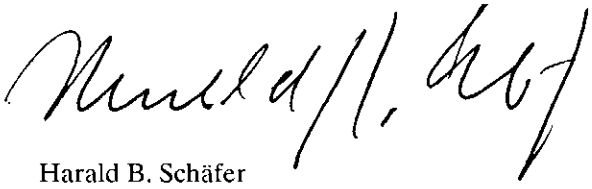
We can defuse the flood situation by encouraging the natural functions of water retention. Reopening the soil, leaching, agriculture and forestry practices suited to the location and water renaturalisation are the order of the day for maintaining natural environmental resources. Furthermore, it helps us if we reverse man's influence on the incidence of floods. The more ambitious flood protection targets will require construction measures such as dykes, walls, retention basins and impounding dams in addition to the relocation of dams and other measures to increase the size of the natural flood basins. None of these measures can be realised in the short term and they cost a great deal of money.

However, in the short term specific measures for individual, endangered properties can be implemented. By thinking back to old precautionary strategies and developing new ones, flood damage can be effectively reduced. A key element of the new precautionary action is reliable flood forecasting.

Politicians, the administration, industry, scientists and researchers as well as each individual, that is to say all of us, are called upon to make our contribution towards improving flood protection.

However, in spite of all our joint efforts, one fact remains: We will have to live with floods – they cannot be abolished.

Stuttgart, August 1995



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Guidelines for Forward-Looking Flood Protection
Floods – Causes and Consequences

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1 Introduction

In January 1995 many towns on the Rhine and Moselle were flooded for the second time in 13 months. In the Netherlands the dykes on numerous rivers almost burst. Several hundred thousand people were evacuated from their homes as a precaution. But it was not just the Rhine and its tributaries that flooded – many other regions in Europe were also affected by floods. The damage is estimated at several billion Deutschmarks.

For the people affected every flood is a personal catastrophe with more than just considerable material losses; they also lose confidence in the security of their very existence. Confidence in security is so valuable that, regardless of the actual risk, a threat to it affects the quality of life more than the actual damage. This is even more the case in a European high-tech society that has become accustomed to having every risk under control. According to this way of thinking, there should be no more floods.

The state is expected to meet the people's security expectations and protect them against the danger of floods. The state must respond by defining to what extent it can meet these expectations.

2 Flood Protection in Germany

In Germany there are 400,000 km of watercourses, of which 20,000 km of waterways with a catchment area of over 1,000 km^2.

The length of the classified flood protection installations in the form of flood dykes and flood protection walls is 7,500 km. The total area of the protected area has not been recorded.

In Germany there are 500 impounding dams and larger retention basins with a flood protection capacity of 1 billion m^3.

The Federal Water Act (Wasserhaushaltsgesetz – WHG) allows flood basins to be defined in order to ensure drainage of the flood water. Flood basins are to be used only in such a way that the flood level is not changed with negative effects for people living upstream and downstream.

Flood alarm systems are in operation on most major rivers offering advance warning times of between a few hours and several days depending on the size of the river. Longer flood warning times are bought at the price of less reliability, particularly if they are based on precipitation forecasts.

Protection from the dangers of floods on the spot is in the hands of the local emergency services responsible for waterways or, if it extends to uncontrollable danger levels, the disaster services.

Under German federal law there is no obligation to protect the public against dangers by building flood protection measures. If such preventative regulations exist, they are based on provisions under *Land* law which vary from *Bundesland* to *Bundesland*.

In all cases these are preventative regulations under public law that are committed to the general well-being without there being an individual entitlement to flood protection. It is the personal responsibility of anyone who lives and works by or on the water to adapt his use of the water to objective flood risks.

3 Floods and Causes of Damage

■ Natural Floods

Floods are part of the natural water cycle. A flood occurs whenever, in a short period of time, large quantities of water flow into the stream and river valleys, following the drop of the river. The sources of floods are the rain and the melt water released when the snow thaws.

In a flood large quantities of mud and rocks from the surface of the catchment area or the waterbed are always transported with the water. Along with the total volumes of water transported, the times at which the quantities of water meet each other at a specific place are decisive for the maximum drainage achieved there – usually stated in cubic metres per second. The water level which thus occurs is also affected by the local marginal conditions of drop and waterbed.

In addition, flotsam, melting ice and rocks can accumulate in a short time and thus cut the flood off from the drainage development. This is how the great ice floods of 1784 in the Middle and Lower Rhine came about when the water reached levels of up to 2 m above the flood levels of December 1993 and January 1995. Icing over is still regularly encountered today on the Elbe and Oder.

Heavy precipitation lasting several days, which can reach several hundred litres per square metre, falls on entire catchment areas and leads to floods in the valleys of major rivers. During each of the floods of December 1993 and January 1995 some 3 billion m^3 of water flowed down the Moselle. In some places the water lay in the streets for up to 10 days.

Summer storms are the cause of the greatest drainage in small catchment areas. Floods caused by these heavy rains in confined areas can occur anywhere. It is therefore not surprising that the statistics covering many years of the Baden-Württemberg flood insurance scheme show that 60 % of the claims for damages was distributed throughout the area of the catchment area outside the major river valleys.

Along with the time and area distribution of precipitation, the storage effect of **vegetation, soil, ground and drainage network** are also of vital importance for the flood levels. Each of these storage media is capable of retaining certain quantities of water for a certain length of time. A large natural storage capacity provides slow rises in water levels and comparatively minor floods; a small storage capacity provides quick rises in water levels and larger floods.

Vegetation

Initially the rain is caught on trees and plants before it reaches the ground. Vegetation is therefore particularly effective at storage when precipitation first starts. Grass land stores two litres of precipitation pre square metre, woodland up to five. After the rain the water on the plants evaporates with the result that the vegetation storage can be used effectively repeatedly when precipitation occurs several times in succession.

Soil

The soil stores water very effectively and can store up to one hundred times the quantity of water as vegetation. The key elements of the storage properties are the cavities in the soil in conjunction with the humus content, the type of soil, the depth of the soil and the soil density. Vegetation secures the soil in steep locations and supports the absorption of water in the soil by means of root penetration.

During a flood the current water absorption capacity of the soil is limited by the amount of water already stored in advance. The soil behaves like a sponge; at first it can absorb a lot of water, but if the precipitation continues it absorbs less and less. In the event of saturation with water, not even the natural soil can store any more water. The performance of soil as a storage medium is therefore largely dependent on the weather beforehand. Ground frost also greatly restricts the current absorption capacity of the soil. Owing to the higher soil moisture the soil absorbs less precipitation in the winter than in the summer anyway. In times without any precipitation, water is released from the soil store into the air by means of evaporation.

Ground

Steep land offers little surface retention and allows the waters to converge quickly. Nature has provided very little surface retention in mountainous areas. By contrast more water is stored in flat areas.

Surface retention is aided by vegetation and certain types of land management. Dense vegetation, land divided into small parcels and land use along the slopes increase the surface retention and thus the length of time until the water leaches off. On the ground up to ten litres of precipitation can be retained on the surface per square metre.

A covering of snow can increase the surface retention many times over. On the other hand, the water stored as snow is also drained away when it thaws.

Drainage network

Flowing water courses and their meadows have another important storage function in the series of natural storage media. The storage effect of the drainage network is greatest on flat land and extensive flood meadows. It is even more effective the sooner the water spills over into the meadows. The water store becomes empty again as the flood waters drain away. The water store influences the level and, primarily, the timing of the flood and, thus, the time at which the flood waters from the main river and its tributaries converge.

For example, the removal of 130 km² of the natural flood basin of the Upper Rhine in the wake of the expansion of barrage weirs with locks between 1955 and 1977, the high water peak from Basle to Karlsruhe has halved from two days to one. The high waters from the Upper Rhine therefore converge more frequently with the high waters from the Neckar, Nahe and Moselle, which have usually already flowed away by this stage.

All four means of storage fulfil their functions within certain natural limits. If one store is exhausted a subsequent one will be more heavily used.

It is only when storage in **vegetation, soil, ground and drainage network** is totally overloaded that the drainage situation changes dramatically. The compensation effect of the natural storage media among themselves is the reason why natural catchment areas in wide limits from the location of the precipitation react comparatively harmlessly but, if excessive demands are made of the natural storage media, they repeatedly behave unexpectedly treacherously for people who live close to the water.

Thus, for example, on the evening of 8 July 1927 following heavy rain storms over the headwaters of the Gottleuba and Müglitz rivers in the eastern Erzgebirge, the flood waters ripped away 165 road and railway bridges and destroyed 196 buildings in the densely populated valleys. One hundred and fifty-eight people drowned or were killed by collapsing houses or tree trunks swept along by the floods.

■ Man-Made Aggravation

In addition to the natural causes of floods, their occurrence can also be influenced by people. Any interference with the natural storage properties of vegetation, soil, ground and drainage network is effective in this process:

- *Sealing as a result of residential areas, commerce and traffic has destroyed the vegetation as well as surface retention and has neutralised soil storage. Storm water drainage means that the extra water is drained directly into the watercourse.*

- *The conversion of meadowland into arable land and the clearance of forests reduce the vegetation storage capacity.*

- *Damage to forests weakens the mountain forests. The result is increased surface drainage and soil flooding.*

- *Forms of agriculture not standard in the area have damaged and sealed the soil storage capacity and have accelerated surface drainage. The incorrect use of pesticides affects life in the soil with repercussions for its storage and leaching properties.*

- *Land consolidation has led to small parcels of land being merged into large agricultural areas and the landscape being drained and cleared. Made-up rural roads act like gutters in the landscape and conduct locally occurring surface drainage immediately into the next watercourse.*

- *Wherever the expansion of waters has lowered water levels, the storage effect of the riverside meadows is used less frequently and less extensively. The flood waters therefore flow to the people downstream more quickly and at higher levels.*

- *The construction of dykes, built-up areas and roads in flood basins has also reduced the natural flood areas and further accelerated flood routing.*

On the Elbe and Rhine 4/5 of the former flood basins are cut off by dykes and are now undergoing new usages. In the Federal Republic of Germany there are only a few watercourses that are still in a near natural condition from the source to the estuary.

The settlement and transport areas in Germany have increased fourfold since 1900, from 3 % to 12 % of the area and have almost doubled since 1950. This trend towards using the ground for housing and transport continues uninterrupted to this day.

The available living space per inhabitant doubled between 1950 and 1980 from 15 m^2 to 31 m^2; a net living space of 47 m^2 is forecast for the year 2000. The proportion of transport areas will also continue to grow. In the 1992 Federal Transport Plan it was decided to expand the trunk road network alone by another 7,900 km by the year 2012.

Since 1900 the proportion of forests has increased by 2 % to a current level of 29 %. The new types of damage to the forests that have been occurring with an ever increasing severity since the seventies pose, in the long term, an unforeseeable threat to the forests. In the same period the proportion of agriculture has fallen from 65 % to 55 %. In the process it has shifted its area to the previously unused wastelands, which, together with expanses of water, make up a portion of a mere 4 %.

Trend analyses of flow series, however, show no **general** rise in extreme flood water flows in Germany. Wherever riding trends in flood water flows have been identified, the common parallel trend of an increase in precipitation must also be taken into account when the results are being analysed.

In addition there are also estimates on the basis of physics and deterministic methods for certain interventions in the natural discharge system. According to a study of the University of Kaiserslautern, the increase in the area of the Rhine catchment area used for housing, commerce and transport since 1950 has led to an increase of the high-water levels of 15 to 20 cm in the Middle Rhine. Thanks to the expansion of barrage weirs with locks in the Upper Rhine between Basle and Baden-Baden and the associated loss of flood basins, in some cases the floodwaters flow downstream at a level several decimetres higher than in the fifties.

Given flood increases of 6 to 8 metres in the Rhine, it is clear that the man-made causes in larger waters may not trigger the flood, but they do

greatly aggravate the flood situation for the people affected by it.

Contrary to popular opinion it is precisely the most extreme floods that are less influenced by anthropogenic effects in the catchment areas. A natural proportion of the precipitation with an effect on the flow of 80 % – as occurred in some of the catchment areas of the Nahe during the floods of December 1993 – can only be slightly increased by anthropogenic changes. In very extreme flows the flood basins protected by dykes are reclaimed by the water.

In recent years there has been evidence of an increase in winter precipitation and a simultaneous reduction in the frequency of snow cover. This trend is confirmed by climate experts who expect global warming and an increase in weather extremes as a result of the release of greenhouse gases.

If these prognoses are confirmed, the increase in precipitation in the form of rain can greatly exceed all other flood risks from anthropogenic influences in the catchment area.

■ Flood Damage

In nature there is no flood damage. Floods only lead to damage when uses by human beings are detrimentally affected. The more intensively and the less suitably the flood basin is used, the greater the potential for damage and then the actual damage when the flood occurs. In addition to the damage to buildings and installations, the interruption to business is also important, as is the subsequent resultant damage of having to reconquer a lost market.

Above and beyond the man-made aggravation of the incidence of floods, the increase of damage potential in the flood basins is a far more important factor in the internationally observed increase in flood damage.

Housing, commercial and transport areas have greatly encroached upon large proportions of the flood basins in recent decades. The pressure for housing has been relieved in precisely those areas that previous generations left clear from experience passed on by their ancestors. Supported by a period of minimal flood activity in the fifties, sixties and seventies, increasing wealth has led to a growth in the potential for damage and, thus, a rise in actual flood damage. At the same time earlier preventative strategies have been forgotten. Fitted kitchens and parquet floors in rooms at the risk of floods will regularly lead to home-made flood damage sooner or later.

Periods without a major flood lead to an additional accumulation of damage potential because the awareness of living in a flood basin reduces over time. In the first major flood the damage potential gathered over the years then translates into flood damage. An aggravating factor is that longer periods with little flood activity and other periods with successions of floods are more the rule than the exception here in Central Europe.

On the Rhine and Moselle there have repeatedly been periods of several decades without a significant flood which have then been superseded by an accumulation of major floods. ***On 9 May 1883*** *Dr Thilenius, a member of the* ***German Reichstag,*** *justified to parliament his application to set up a Commission to investigate the causes and consequences of the great flood in November 1882 and the end of 1882, beginning of 1883 in the Rhine basin as follows:*

"It is to be decided,

- *to examine the current conditions of the Rhine and its tributaries, including the upper reaches,*

- *by hearing interested parties from agriculture, forestry and viniculture from the parts of the country affected to examine the question as to whether and to what extent the river conditions have been of influence on the* ***Rhine floods that have become more frequent in the last few years and have recently caused so much unusual damage.***

- *depending on the result of these examinations, to propose standard rules as quickly as possible on how future threats can be prevented by changes and improvements to the conditions of the river."*

Not even the sequence of the two great Rhine floods of December 1993 and January 1995, which were both classified statistically with a recurrence time of 30 to 40 years in Cologne, is unusual when long hydrological time calculations are observed. However, this long term observation cannot be a basis for assessment for those repeatedly affected by floods within a few years, because they will be the ones who have to bear the burden of frequent damage today and the subsequent periods free of floods will, at best, benefit future generations. Major damage caused by floods today must also be paid for today.

In the Swiss canton of Valais when the Saltina, a small tributary of the Rhône, flooded in September 1993, 250,000 m³ of mud and rocks piled up to 2.5 m high in the town of Brig within three hours. The damage totalled Swiss Franc 500 million.

4 Strategies and Plans of Action

Protection from floods is in the area of conflict between the potential for influencing the incidence of floods and the potential for precautionary action to reduce damage. Only a set of measures following both strategies, can improve the upon the damage situation experienced during the most recent floods. Simple instant recipes do not have any effect. Every advisory sentence beginning "All we need to do is ..." does not do justice to the complex subject matter of floods.

We can help to reduce floods if we encourage the natural functions of water retention. Measures for natural retention do not, however, result in the expected flood protection everywhere. In order to

meet more ambitious flood protection targets, technical flood protection measures must be taken above and beyond this, e.g. dykes, walls, flood retention basins or impounding dams.

However, there is always a greater flood than has been experienced previously or reckoned with. The duty of further reaching precautionary action on floods is for people to adapt themselves to the situation and take preventative action.

Ultimately it is impossible to guarantee preventing major floods, but the limitation of flood damage can be achieved perfectly well.

■ Natural Retention

As much water as possible must be retained on the surface for as long as possible. Natural storage in waters and alluvial meadows must be encouraged.

In the past society dedicated itself only too eagerly to supporting individual demands for the use of waters and alluvial meadows, whether it be demands from agriculture, transport or the development of housing and commerce. The drainage of the landscape and residential areas must be reconsidered today.

We need some degree of dampness in the landscape and must not drain every puddle away. Not every drop of water from yards or roofs need be conducted to the next body of water by means of the sewerage system. Every cubic metre of water not drained away immediately is a gain for the water regimen and it also takes away some of the burden in floods.

• Water Retention on the Surface

Human usage alters the natural landscape and therefore inevitably attacks the storage capacity effective on the surface. The storage scope of vegetation, soil and ground has already greatly changed since the Middle Ages. Whereas the proportion of forests and their positive storage properties has started to increase again since the 18th century and now almost one third of the area of the Federal Republic of Germany is covered by forests, since the beginning of this century and, to an even greater extent since the 1950s, the intensification of agriculture and the increase of residential areas have reduced flood retention on the surface. But forests, too, must be classed as in danger today if they continue to be damaged.

The soil, in particular, as the largest surface storer of water, must be protected and maintained.

Rainwater from sealed areas should leach off where it falls instead of being transported away by way of the sewerage system. The peripheral conditions for the drainage of precipitation water are different in the country than in town centres. It was a mistake to transfer the drainage models that proved themselves there to the countryside. The leaching of precipitation water in built-up areas

combines water management efficiency with ecological benefits.

Space-saving building is not an end in itself. The objectives of space-saving building find their limits in rural areas if it just means that urban building patterns are exported to the countryside without any consideration.

We should no longer allow ourselves to continue with unnecessary sealing of the soil surface, as can be seen everywhere at garage entrances, car parks, school yards, etc. However, we do not always need to take expensive remedial action on these past sins. It is sufficient for water management objectives to disconnect the area from the sewerage system and to let the rainwater leach off into the next area of open land. Everyone, not just urban and local authorities, is called upon to do his utmost in their own area of responsibility. The local authority drainage statutes should offer a financial incentive for this type of sensible action by means of corresponding tariff structures.

But:
We all have to pay for existing rainwater drainage systems built in the past, whether they continue to be used for the intended purpose or not.

But it is not just in residential areas that as much water as possible has to be retained on the surface for as long as possible. In the open countryside, too, land management suited to the site in particular must do justice to this objective, supported by the extensification of land management, leaving land fallow and appropriate reafforestation of useful agricultural sites in line with the EU agricultural reform. Land organisation measures are to be implemented in support of these objectives.

Forests prevent erosion. There is the least erosion in woodlands and grasslands. That is why we must aim for ground coverage with vegetation for as long as possible. Periods of complete fallow should be kept as short as possible. Drainage of the landscape must be reduced in order to increase the length of time the water spends on the surface. Country roads must no longer function as drainage gullies during heavy rain.

Applying fertilisers does not affect just the productivity of the soil, but also the soil structure. Lime and organic fertilisers clearly improve the structure and have a favourable effect on the development of life in the soil. The humus content of the soil is increased and, thus, the storage capacity for water.

The processing of the soil, too, must take into account the conditions at the site in question. Too great soil pressure and processing at the wrong time damage the soil structure. Surface sludge accumulation in soils with a weak structure can be prevented by soil management process which do not involve their being turned. In general, minimal processing methods that are kind to the soil should be preferred.

Support of natural water retention is not to be regarded as an isolated objective of flood

protection. It should much rather be seen as part of integral land and water management to maintain and improve the environment in general.

- **Water Retention in Waters and Meadows**

The storage capacity of the drainage network is much greater for natural flowing waters and their meadows than it is for developed waters. The rate of flow is slowed down and the flood peak is thus kept lower for residents downstream. Besides ecological benefits, woodland along the banks of brooks also leads to a stabilisation of the average water area. A natural transition to alluvial woodlands would not only help flood retention, it would also be beneficial to nature conservation as riverside woodlands are one of the rarest and most endangered types of biotope today.

Areas that have previously been dyked should be reincorporated in natural drainage patterns wherever possible.

As well as reducing the flood peaks, flood water retention in waters and meadows would bring about an improvement to water management and the in many cases urgently needed regeneration of habitats in streams and rivers.

The improvement in water retention will only be achieved with renaturalisation if the flow rate is slowed down, the bottom of the watercourse is raised and the overall water levels become higher. This is the only way that the water can burst its banks more frequently and flood the meadows. Here, too, the truism applies that flood protection by means of water retention leads to higher water levels than previously wherever the water is retained.

We have invested billions in water pollution control in streams and rivers. However, it does not make any sense to divert the water purified at such great expense through sterile effluent troughs which do not support life. That is why the renaturalisation of water flows is so sensible and necessary.

Every measure on the moving back of dykes, unsealing, leaching, appropriate land and forest management and water renaturalisation is essential for maintaining natural environmental resources and, furthermore, helps to reduce man's influence on the incidence of floods. But: there will still be natural, large-scale floods.

■ **Technical Flood Protection**

Even after all the measures for natural water retention have been implemented there is still a natural risk of floods. If existing, higher-lever usages are still to be possible, a reduction of the risk by means of technical flood protection can be taken into consideration. This reduction of the flood risk is, however, only effective up to a predetermined protection target: the base flood.

Efforts are often made to acquire flood protection against floods that occur every 100 years in

residential areas. For floods that are greater than the base level selected, the full flood risk continues to exist. Areas used for agricultural purposes do not need any protection if the land is managed in a manner appropriate to the site.

Technical flood protection is not cheap. The protection gain must justify the expense. This justification becomes ever more difficult, the higher the targets are set. At the same time, accounts must be made stating how the intervention will affect people living upstream and downstream.

- **Flood Protection by means of Dykes and Walls**

Man has always tried to avert floods. In the major river basins dykes and dams were built many centuries ago so that the river planes could be used more effectively. The dykes systems on major rivers familiar to us today have developed from these local origins. After every large-scale flood the dykes and dams were reinforced and made higher.

In the Upper Rhine the dykes were most recently destroyed in the great floods of the end of 1882/ beginning of 1883 and large areas of the Upper Rhine Plain disappeared under several metres of water. Confident of the subsequent raising of the dykes and the fact that the dykes have held since then, usages have constantly intensified up to modern times. All municipalities in the Rhine Plain have pushed forward built-up areas and industrial estates in the Rhine Plain, particularly in recent decades, without being accountable for the consequences if the dykes flood again. With this behaviour, the protected areas have become the actual areas at risk. This type of behaviour is typical for all the river plains in Germany.

When the dykes overflow the dyke material is eroded away and this leads to entire sections of dyke breaking off in a very short time. The protected area behind the dyke is then quickly flooded.

But dykes can break even if they are high enough. Dykes are subject to a natural ageing process. During every impoundage, very fine particles of earth from the dyke and underground are transported from the water side to the surface. In the long term this one-way transport leads to a hollowing-out of the underground and thus jeopardises stability. Burrowing animals can increase this hollowing-out. The risk of a dam breaking increases with the level and duration of the impoundage. In the case of the Rhine floods of January 1995, the main problem was the high water levels at the Dutch river dykes.

In residential areas with limited space there are often flood protection walls, complemented by mobile closures or superstructures. In more recent times, however, mobile walls have been used over longer stretches of river to be protected, whereby the level of deployment depends on the length of the warning and the capacity available for storage, transport and erection.

All the dykes and walls must be maintained as technical constructions. Precisely because

these flood protection installations are used so comparatively rarely, their maintenance is of particular importance. It is a permanent job and, in the interests of safety, must not be neglected.

But even if they are regularly maintained, basic repair is essential after a number of years. Costs of over DM 1 billion are currently estimated just for the basic repair to all the existing Rhine dykes in Germany.

Flood protection is part of the public infrastructure, just like roads, energy supply and telecommunications for use by the public, without guaranteed safety if the agreed service is exceeded. Even after a flood protection installation has been built the area behind it remains part of the natural flood basin, even if better usage scope is guaranteed for the individual until a flood occurs.

- **Flood Protection by means of Retention Basins and Impounding Dams**

Another option for technical flood protection is the reduction of water flow by means of retention basins and impounding dams. Impounding dams are more or less valleys filled continuously with water which provide, for example, drinking water, produce electricity or supplement low flows. Flood retention basins are only filled with water during the flood period after which they are emptied in order to be ready for the next flood.

The flood protection areas of impounding dams are generally run in the same way as flood retention basins. The water stored in the management area of the impounding dam is drawn off from the flood waters, thus bringing about an overall diffusion of the flood situation. The impounding dams in the Alpine region or in the German Hercynian Mountains thus continually help diffuse incidences of floods. During the major flooding which occurred in Thuringia and Saxony-Anhalt in April 1994 for example, the flood water level in the town of Rudolstadt an der Saale was considerably reduced by the retention of water in the nearby Saale impounding dam.

Flood retention basins are run in such a way that during flood periods the water is merely moved for a time from one place to another. A crucial factor in the effectiveness of retention is how long this retention lasts. The further away the protected are, the longer the water retention period required. There is therefore a discrepancy between the interests of long-distance, long-term retention and local interests in short-term water storage emptied immediately after the event. Each time retention is planned therefore a decision must be taken on whether the aim is long-distance or local effect. The use of retention systems based on forecasting is thus limited to the flow time of the flood wave within the framework of available forecasts.

The retention measures conceived in the Upper Rhine area to compensate for the increase in flood risks as a result of the systematic development of the Upper Rhine cannot at the moment be used as incidence dictates and as a direct matter of course in, for example, the flood control procedures of the

city of Cologne because the forecasting period of several days is not available.

Retention areas do not come cheap. The smaller the retention basin the higher, the higher the construction costs per cubic metre of retention area. Realistic costs would be DM 10 per cubic-metre for large retention basins, rising up to DM 50 per cubic metre for small basins.

To retain 100 m³/s during a flood wave of, for example, twelve days for the Rhine, a retention area of 100 million m³ is required involving investment costs of DM 1 billion if a large basin is being built and DM 5 billion in the case of small basins. At 100 m³/s, flood levels in Cologne are reduced by 6 cm.

■ Further-Reaching Precautionary Action on Floods

• Limits of Flood Protection

Leaching, renaturalisation and retention measures in a particular catchment area can, in the main, reverse anthropogenic influences on flood incidents. When this objective is achieved, everything possible has been done in the field of **natural flood retention.** What remains is the natural threat of flooding as a result of natural conditions. To think that every threat of flooding would be removed if nature were left to take its course is a romantic dream refuted by nature itself. Floods cannot be eliminated.

Even **technical flood protection** in the form of walls, dykes or flood retention basins can only improve utilisation conditions around the water body but cannot remove the threat of flooding as such. Any form of technical flood protection can only have a sectoral effect which reaches a certain basic flood level. Any flooding which exceeds this level puts even the protected area under water. A risk always remains and it is often underestimated. The probability that the worst floods for a century will occur over the next twenty years is as high as almost 20%.

As is often the case, not every problem can be solved by technical means alone. Consideration must also constantly be given to human behaviour.

As an initial approach, it indisputably seems sensible to build a flood protection barrier at least, for example, against the flooding which occurs every fifteen to twenty years. This will have a negative effect if the people living in the vicinity acquire so many valuable possessions that flood levels which may be expected every thirty years breach the wall causing damage several times higher than that which would have occurred had the flood protection investments not been made.

The protection measures taken in the old quarter of Cologne which were designed against flooding expected to occur once every fifteen years – i.e. seven times a century – caused people to forget the real threat of flooding and continue to live in the flood zone, with the result that the floods of December 1993 caused DM 110 million of damage.

A year later, in January 1995, the damage caused by floods which were even a few centimetres higher than in 1993 amounted to only DM 65 million. This figure is still much too high but it is almost 50% lower than a year before, showing that there are other, effective measures which can be taken to curtail flood damage.

Preventative flood measures are caught between official state prevention and the responsibility of each individual citizen. The citizen however can only act responsibly if the interrelationships involved are clear.

This realisation lies at the very heart of the elemental problem of damage, be it as a result of fire, flood, storms or earthquakes. Large elemental risks arise at such long intervals that they need not be part of the experience of any one individual. The very term "flood of the century" shows that this flood transcended several times over the experience of any one generation. At this stage, institutional preventative action must come into play.

An additional strategy for avoiding flood damage must therefore be to ensure the presence of latent reminders that large-scale floods are always possible, thus drawing the long-term conclusions for preventative action in water management, settlement policy and finance. This flood plain management, as it is termed, has been under way in many other other densely populated countries for a number of years and forms the basis of a pioneering policy for precautionary action on floods. Only where a risk is recognised can effective measures be taken to prevent it.

Further-reaching precautionary action on floods must comprise a number of individual strategies:

- ***preventive land use,* aimed at preventing areas under threat from flooding being earmarked for building;**

- ***precautionary building* to ensure buildings are constructed and used in such a way that they survive possible flooding;**

- ***precautionary behaviour* so that flood warnings are given which can be translated on site into specific action;**

- ***preventive action against risks* so that financial provision is made for cases where, despite all the above-mentioned strategies, flooding occurs nonetheless.**

- **Preventive Land Use**

Preventive land use means stopping building development in flood basins. Despite the fact that the data we have today is better than that available to previous generations, we must in retrospect realise that we have built up those very areas in the vicinity of water bodies which time-old experience tells us should not be built on. Local authorities are in particular called upon here to incorporate more forcefully than has been the case up to now the proven experience of historical floods into their land use and construction planning.

It is to be hoped that local authority building planning will also realise its responsibility for preventative action and reverse forms of land use which in the past have encroached more and more on the vicinity of water bodies. Where, for example, industrial or commercial use of areas near water bodies comes to an end, the water bodies' original alluvial meadows should, as far as possible, be restored. Anyone, however, who decides to intensify land use, for example, for housing purposes, need not complain when flood damage increases.

The maintenance of open flood plains is supported by schemes and programmes within regional and landscape planning. Here, it is generally required that natural retention areas must be secured by designating specific flood areas and that valley alluvial meadows are kept free of uses which could affect flood drainage and are not built over.

Wherever water drainage provisions require it, Article 32 of the Federal Water Act stipulates that areas susceptible to flooding are designated as flood zones. This not only serves to enhance local flood protection but also ensures hazard-free flood run-off in the water body. The limits of the flood zone are usually determined by the highest known flood level over the past fifty to a hundred years.

If the natural flood zones are not maintained, the flood waters flow downstream higher and more quickly. Any local authority demanding – rightly – from people upstream that flood zones be maintained must start by ensuring appropriate measures are also taken in their own area.

- **Precautionary Building**

Precautionary building means adjusting modes of construction in areas susceptible to flooding so that they are able to cope with any flood which may arise. This offers the best opportunities to reduce damage potential quickly and sustainably. The last few floods have shown that there are still a number of possibilities to be explored in the field of preventative damage containment.

Oil tanks must be secured against lift force and water pressure. Problems obviously arise in ensuring these requirements are complied with. The amendment to the Federal Chimney Sweeps Act *(Bundes-Schornsteinfegergesetz)* in July 1994 paves the way for the monitoring of heating oil storage by chimney sweeps. The risk posed by heating oil storage can also be curbed by extending gas supply.

Fuse boxes must be installed in such a way that they are secure against floods. Cellars and ground floors are to be built in such a way that as little damage as possible occurs in the event of a flood. Wood panelling must be removable and furniture must remain mobile.

Precautionary building is, in the first instance, a matter for those affected themselves. Most of the damage caused by flooding can be avoided by forward planning. Creativity is called for – on the part of the local authorities, architects, engineers, utility companies and construction firms.

- **Precautionary Behaviour**

Precautionary behaviour means using well the time between the onset of flooding and the incidence of critical flood levels. This time available to limit damage is predetermined by flood forecasting. In the case of larger water bodies such as the Rhine, flooding can be predicted between 24 and 36 hours beforehand; this figure drops to between 6 and 12 hours for reliable forecasting at water bodies in the German Hercynian Mountains. Mere estimates can also be made for future flood developments. In small water bodies, where flooding actually originates, the advance warning times are too short for a centrally organised notification system.

The *Länder* flood notification services must continually be adapted to technical and economic progress. The extension of advance warning periods is linked to quantitatively accurate forecasting of precipitation and thaws. Much progress has been made in this field over the past few years on the basis of highly sensitive calculation models carried out be meteorologists. It is possible at the moment to use 24-hour or 48-hour quantitative precipitation forecasts to determine possible flooding trends even over several days. This lengthens advance warning periods but also involves a loss of absolute accuracy.

Flood information must be passed on in situ to those affected in as many ways as possible. This involves telephone information services, radio announcements, Telekom's videotex and teletext. Improving and continually developing notification techniques is an ongoing task given the march of progress in information technology.

It remains a task for local authorities and for those affected to translate the flood information into specific action. Local authorities must warn citizens in the areas under threat of flooding by means of an alarm and action plan adapted to local conditions. This must be done in such a way that the emergency measures required can be taken and controlled. The local authorities that experience has shown to be under threat of flooding must be adequately equipped in terms of emergency services responsible for waterways.

Despite the fact that mild winters have been the norm over the past few decades, there is still a continual risk, particularly in rivers in eastern Germany such as the Elbe, Havel, Spree and Oder of ice formation and ice jams. Long-term frost can lead to a situation where ice blocks freeze together and barriers are formed. It is therefore important to structure banks, bridge piers and dykes in such a way that the drift ice is kept moving for as long as possible. When the ice melts, specific measures must be taken to break it up properly. Ice breakers are used by federal waterway and shipping authorities on large rivers. It may also be necessary to break up the ice by exploding it. The effective combatting of ice is essential for flood protection.

Any potential damage is basically matched by a potential for damage limitation. In many cases construction and reactive measures can contribute more to damage reduction than all the natural water retention measures and technical flood

protection together. The prerequisite for this however is that each individual is made aware of the responsibility he bears for precautionary action on floods. It would certainly be wrong to do this as the floods are subsiding, since at most this would lead to bitterness among those affected. The period between floods is the proper time to provide information on the preventative action required.

- **Preventive Action Against Risks**

Even after every investment has been made in natural water retention, technical flood protection and further-reaching precautionary action on floods, a real risk of flooding remains nonetheless. Preventive action against risks measures must be taken here too.

The individual is often incapable of gathering reserves to cope with the situation since several large-scale floods may occur in quick succession. Elemental insurance against damage is designed to compensate for this risk.

The elemental insurance against flood damage to buildings practised in Baden-Württemberg since 1960 in the form of an obligatory regional monopoly insurance contribution had to be abolished in line with European Community directive under which insurance monopolies were to cease operations by 1 July 1994. Thus obligatory monopoly insurance against elemental damage is no longer an option under European Union law.

In Germany, private insurance firms have been offering elemental damage insurance against flooding since 1991. The idea is to rule out the risk of disadvantages by providing a form of insurance covering earthquakes, avalanches, landslides, snow storms and flooding.

However, in many cases it will be impossible to provide text book solutions but rather each individual case in which damage is predicted to where it has occurred in a previous incident must be looked at in line with prevailing conditions. Higher risk protection also means a higher premium must be paid. This premium is the price which has to be paid for an exposed position at a water body.

High risks need not be accepted by insurance companies either. This has nothing to do with the particularities of elemental damage insurance but rather corresponds to normal insurance practice.

In the case of flooding, the sum of frequent incidences of damage exceeds the sum of rare, large-scale damage. In principle, this means that it is possible to considerably reduce the premiums paid to cover the rare cases of remaining risk.

It is sensible to divide up preventive action against flood risks into public provision, individual provision and insurance-based individual provision:

1. *Architectural protection against flood damage represents an infrastrucutral measure which, with economic justification, facilitates to a certain degree the use of areas near water bodies. The sum of the damage prevented is higher than the costs of construction and operation entailed by flood protection.*

2. *Individual provision, understood correctly, means that residents of areas near water bodies use these areas in such a way that they themselves are able to meet the costs of regularly occurring flood damage up to a certain limit. There is no point in attempting to cover regularly occurring damage by insurance as this could only be more expensive than putting aside one's own savings to meet the costs incurred.*

3. *Insurance-based individual provision covers major risks run by residents of land alongside water bodies. It is possible to distinguish individual provision from insurance-based provision by incorporating a sensibly chosen excess or an exclusion of liability clause up to a certain flood level.*

Public risk prevention, individual provision and insurance-based individual provision do not vie with each other but rather cover the various justified aspects of flood risk. There is a particular need for insurance in those areas that are already protected by technical measures, such as the Upper Rhine Plain.

Without the protection of elemental insurance which also covers flood risk, all investments in structural flood protection and the promotion of individual provision remain incoherent. It is not the burden of costs to be borne over the years for elemental damage which puts a strain on the individual or the community but rather the very high level of damage which occurs in rare individual cases. Insurance can offer temporal and spatial compensation. Proof that this theory is true is provided by the insurance model operated in Baden-Württemberg for over thirty years which provided compensation of this kind with affordable premiums. The insurance sector is called upon to find a viable solution under the terms of the market economy which provide a performance comparable to this. There must be no truth in the defamation of flood insurance often heard: "Whoever has insurance doesn't need it and whoever needs it doesn't get it".

Together with insurance solutions, it remains a task of the state to provide financial assistance to people blamelessly in need as a result of elemental damage. This financial assistance must not, however, have the character of general recompense since this would remove the incentive and the realisation of the need for personal provision and insurance.

The key to limiting flood damage lies in collating state precautionary action and individual action on the part of the individual. If the individual is not called upon to meet his share of responsibility and the state is made solely responsible for flood damage, the scene is set for even higher flood damage in the future.

Guidelines for Forward-Looking, Integrated Flood Protection

Flood damage is caused by a combination of two independent mechanisms. Nature – in part exacerbated by anthropogenic influences - is alone responsible for flood levels. In a parallel move, man has increased the level of valuable assets in the vicinity of water bodies and has created the potential for damage. Only when both these mechanisms come together does a particular incidence of flooding occur at a particular time.

Flooding is for the most part steered by natural processes. Man does influence flooding but only to a limited degree. Any measures taken to influence flooding therefore will only affect damage to a limited degree and this influence can only be measured over decades.

On the other hand, the proliferation of valuable assets in areas susceptible to flooding is almost wholly under man's control and influence. It is thus necessary to ensure measures taken in this field are taken in the flood area considerably more quickly and with a greater degree of vigour.

If we want to limit flood damage consistently and quickly, success is better guaranteed by regulating land use alongside water bodies than merely by attempting to make any long-term influence on the flooding itself. Flood plain management has priority over flood management.

This recommendation does not mean that all the above-mentioned measures to promote natural water retention by restoring flood plains, reopening the soil and encouraging leaching, renaturalisation and agricultural activities adapted to the particular area need not be pursued with vigour. It is however an illusion to expect damage limitation in the short term when major floods strike.

Nor does it mean that technical flood protection measures are not effective and sensible to ensure existing uses alongside water bodies can continue to some degree. However, even technical flood protection measures require a long period of planning and thus cannot bring about short-term relief. This relief is also limited only to certain target areas in flood protection.

The present state of discussions which is largely limited to making <u>one</u> cause responsible for the flooding and of requiring that the problems of flood risk be solved in this field must be dispelled. As in other areas, we must convince ourselves that we cannot use natural resources against nature but only in harmony with nature. Water courses and indeed all water bodies are natural resources to which we must adapt the uses to which we put them and their surroundings.

Against the backdrop of these realisations, the following guidelines have been drawn up to limit damage in the case of flood:

(1) **Hold back water** – *Every cubic metre of water held back by the restoration of flood plains, the renaturalisation of water bodies, the reopening of soil, leachage and site-adapted agricultural and forest management and by maintaining and promoting small-scale water retention structures in agriculture represents a bonus for the natural balance and reduces the threat of flooding. There remains however a natural flood risk.*

(2) **Ward off flooding** – *In order to safeguard existing uses in lowland water bodies, dykes, walls, retention basins can help to ward off to a certain pre-determined degree. Technical flood protection is a public infrastructure measure in the same way as road maintenance and telecommunications which improves the conditions for using certain areas.*

(3) **Maintain protection facilities** – *In promoting the construction of new flood protection facilities, the effect required to maintain existing protection facilities at a high safety standard must not be underestimated. The funds required in Germany for the maintenance of the Rhineland dykes are estimated at over a billion Deutschmarks.*

(4) **Recognise limits** – *Technical flood protection does not however give any absolute guarantee of safety. The threat of flooding still exits when flood levels exceed expectations. The users of areas around water bodies must face up to the responsibility they bear for this residual risk.*

(5) **Reduce damage potential** – *The highest level of short-term success in limiting flood damage may be expected from measures aimed at curbing the expansion of construction areas in sites susceptible to flooding, providing recommendations for flood-compatible building and orienting land use so that it can take effective measures after an early warning has been issued.*

(6) **Make people aware of flood risks** – *In order to limit land use in areas near water bodies, everyone must be made aware of the threat of groundwater as a real element of the natural conditions prevalent alongside water bodies. This involves politicians, institutions and the individual citizen. The floods of the century may not take a century to return – they may strike next week, and then again next year.*

(7) **Warn against floods** – *In contrast to other elemental risks such as earthquakes, storms and hail, it is possible to estimate in specific terms how the floods are likely to develop over a particular period. It is therefore essential to increase the length of this period by improving forecasting techniques and to use them more forcefully than has been the case up to now in damage limitation.*

(8) **Enhance individual preventive measures** – *Precautionary action as the fruit of social solidarity has its limits. Even in the case of flooding, it is ultimately the individual who is responsible for his own actions. In future, no one will have a right to safety from flooding. In some ways, as in other areas of life, insurance may be a suitable investment to underpin individual preventive measures.*

(9) **Promote solidarity** – *Flood protection is a sector in which investments can very quickly realise profit, but where it can also take generations to do so. Thus, flood protection demands not only solidarity today but also solidarity with future generations. For this reason in particular, the decision required cannot be put off indefinitely.*

(10) **Act in an integral fashion** – *Only the package of measures involving natural water retention, technical flood protection, limitation of preventive action against risks, raising of awareness of the remaining flood risk and individual preventive measures can lead to improving protection against floods. The will for change must therefore be measured against the extent to which the means required can be achieved and whether the necessary restriction on land use can be implemented internationally.*

Recommendations for Action

to policy-makers

- **maintain the natural balance as a cornerstone of flood protection without expecting all flood problems to thereby be solved**
- **moreover, recognise the need to limit land uses in areas under threat of flooding**
- **improve the legal prerequisites to ensure limitations on use are actually enforced**
- **avoid giving the impression that flooding problems may be solved by action elsewhere alone**
- **avoid making any promises to flood victims where the financing required is not available.**

to the authorities

- **consistently implement the existing laws by enforcing limitations on use in areas threatened with flooding**
- **draw up action plans for natural water retention, technical flood protection and more far-reaching precautionary action on floods in rivers under threat of flooding *(Länder)***
- **designate flood plains and work towards keeping these areas empty *(Länder)***
- **adapt flood notification and advance warning systems to new notification technology (Federation and *Länder*)**
- **continue to improve the precipitation forecasts of the German Meteorological Service (Federation)**
- **ensure international flood coordination in the case of transboundary water bodies (Federation and *Länder*)**

- **review the framework for elemental damage control insurance in dialogue with the insurance industry (Federation and *Länder*)**

- **promote the natural development of water besides taking account of local drainage conditions when floods strike (water management bodies).**

to urban and local authorities

- **review land use and construction plans in the light of flood risk**

- **allow rain water leachage in construction areas and create financial incentives for this**

- **provide information on flood risks, in particular in the protected areas**

- **draw up and regularly update alarm and action plans for risks posed by flooding and ice.**

to the business sector

- **recognise flood risks as a natural threat and formulate recommendations for environmentally sound construction (architects and engineers)**

- **avoid increased drainage; allow rain water to leach where it falls (engineers)**

- **take account of flood risk in the installation of equipment (skilled workers)**

- **offer blanket insurance for elemental damage including the risk of flood (insurance companies).**

to agriculture and forestry

- **promote water retention by means of site-adapted agriculture and forestry; use flood plains as grassland; promote healthy multifarious forests.**

to citizens	• **accept their own responsibility for damage reduction when floods strike**
	• **gear building work towards the threat of floods and observe limitations on use**
	• **cover the residual risk by insurance – including in the areas protected behind walls and dykes.**
to science and technology	• **improve quantitative forecasts of precipitation and thaws**
	• **provide information on the importance of new forms of agricultural and forest management for flood run-off**
	• **develop operational flood forecasting models taking particular account of the effort required to achieve specific improvements**
	• **improve instruments to manage flood retention systems and demonstrate where their limits are**
	• **provide information on the growing damage potential behind water protection facilities.**
to the media	• **help provide flood information and avoid sensationalist reporting in the interests of the victims.**
to everyone in general	• **if the flood situation is to change, everyone's objectives and actions must change: in the catchment area, alongside water bodies – everywhere. The aims of flood protection are not enhanced if the motto is "Everything must improve but nothing must change."**

Länderarbeitsgemeinschaft Wasser (LAWA)

Länderarbeitsgemeinschaft Wasser

Die Länderarbeitsgemeinschaft Wasser wurde 1956 als Zusammenschluß der für die Wasserwirtschaft und das Wasserrecht zuständigen Ministerien der Bundesländer der Bundesrepublik Deutschland gebildet. Ziel der Länderarbeitsgemeinschaft Wasser ist es, auftauchende wasserwirtschaftliche und wasserrechtliche Fragestellungen gemeinsam zu erörtern, Lösungen zu erarbeiten und Empfehlungen zur Umsetzung zu initiieren. Aber auch aktuelle Fragen im nationalen, supranationalen und internationalen Bereich werden aufgenommen, auf breiter Basis diskutiert und die Ergebnisse bei den entsprechenden Organisationen eingebracht.

Zur Erfüllung dieser Ziele hat die Länderarbeitsgemeinschaft Wasser (LAWA) fünf Arbeitsgruppen und themenspezifische Arbeitskreise eingerichtet, die die Themenfelder Wasserrecht, Gewässerkunde, Gewässer- und Meeresschutz, Ökologie, Hochwasserschutz, Küstenschutz, Grundwasser, Wasserversorgung, Kommunal- und Industrieabwasser und den Umgang mit wassergefährdenden Stoffen bearbeiten.

Die Ergebnisse aus dieser Arbeit sind Grundlage für einen einheitlichen wasserwirtschaftlichen Vollzug in den Bundesländern. Trotzdem lassen die erarbeiteten Muster noch ausreichend Raum für die Berücksichtigung regionaler Besonderheiten.

Die Länderarbeitsgemeinschaft Wasser informiert die Öffentlichkeit mit einer Vielzahl von Publikationen fortlaufend und aktuell über die Ergebnisse aus den Arbeitsgruppen und stellt ihre Grundsatzpapiere allen Interessierten zur Verfügung.

Working Group of the Federal States on water problems

The Working Group of the Federal States on water problems was set up in 1956 as an amalgamation of the ministries of the federal states of the Federal Republic of Germany responsible for water management and water legislation. The aim of the Working Group of the Federal States on water problems is to discuss in detail questions arising in the areas of water management and water legislation, to formulate solutions and to put forward recommendations for their implementation. In addition however, topical questions in the national, supranational and international sphere are also adopted, discussed on a broad basis and the findings submitted to the relevant organisations.

In order to fulfil these objectives, the Working Group of the Federal States on water problems (LAWA) has set up five permanent working parties and topic-related working groups to deal with the topics of water legislation, hydrology, inland waters and sea conservation, ecology, flood prevention, coastal protection, groundwater, water supply, municipal and industrial sewage and handling with water polluting substances.

The results obtained from this work form a basis for the implementation of a standardised water management system within the federal states. The formulated models do however allow sufficient freedom for taking account of specific regional characteristics.

The Working Group of the Federal States on water problems provides continuous and up-to-date information for the general public through a range of publications on the findings of the working groups and makes its policy documents available to all interested parties.

Association des Länder axée sur les problèmes de l'eau

Cette Association a été fondée en 1956 sous forme d'une union des ministères fédéraux allemands compétents en matière de gestion et de législation des eaux. L'objectif de cette Association consiste à éclaircir et résoudre les questions de gestion et de législation des eaux et à initier la réalisation des recommandations élaborées. D'autre part, les questions d'actualité qui se posent au niveau national, supranational et international sont considérées et discutées sur une base élargie et les résultats ensuite soumis aux organisations compétentes.

Pour parvenir à ces objectifs, l'Association LAWA (Länderarbeitsgemeinschaft Wasser) a organisé cinq groupes permanents de travail et des cercles de travail articulés autour de thèmes spécifiques: régime juridique des eaux, hydrographie, protection des eaux douces et des mers, écologie, protection contre les crues, protection des côtes, nappe phréatique, approvisionnement en eau, eaux usées ménagères et industrielles et stockage, entrepose, utilisation et transport de substances dangereuses pour l'eau.

Les résultats de ces travaux servent de fondement à une action cohérente en matière de gestion des eaux dans tous les Etats fédéraux. Toutefois, les modèles élaborés laissent encore une marge de manoeuvre pour pouvoir tenir compte des spécificités régionales.

Par un grand nombre de publications, l'Association informe le public des derniers résultats obtenus par ses groupes de travail et met l'énoncé de ses principes fondamentaux à la disposition de tous les intéressés.