Summary, Evaluation and Perspectives of the report on

The Implementation of the Action Plan on Floods by 2000

Summary

A consequence of the great floods of the Rhine in 1993 and 1995 was, that the12th Conference of Rhine Ministers adopted the ICPR „Action Plan on Floods“ on 22nd January 1998. The Action Plan on Floods targets at improving the protection of man and material assets against floods and at ecologically enhancing the Rhine and its floodplains at the same time. The phased action plan will be implemented in all Rhine bordering countries by 2020. The report in hand is the first one on the implementation of the Action Plan on Floods. Performance targets referring to the starting point 1995 are to

- *reduce damage risks – no increase of damage risks until 2000, a 10 % reduction by 2005 and a 25 % reduction by 2020.*
- *reduce flood water levels – reduce extreme flood peaks downstream the impounded stretch of the river (about downstream of Baden-Baden) by up to 30 cm by 2005 and by up to 70 cm by 2020.*
- *increase flood awareness – increase flood awareness by drawing up flood risk maps for 50 % of the inundation areas and of the flood prone areas by 2000 and for 100 % of these areas by 2005.*
- *improve the flood announcement system – short term improvement of the flood announcement systems due to international co-operation. Prolong forecasting periods by 50 % by 2000 and by 100 % by 2005.*

Within the EU IRMA program (**I**NTERREG **R**hine-**M**euse-**A**ctivities) the European Union has allocated 140 million Euro for the period up to 2001 in order to encourage improved flood prevention along the rivers Rhine and Meuse. The governments of the states bordering these rivers have increased the sum to about 420 million Euro. At the time being 153 individual projects are being set in hand.

In the meantime, all Rhine bordering countries have protected a large part of the inundation areas by law and with respect to spatial planning. Thus flood damage risks may be influenced by law. Since these legal instruments only become effective with some delay it must be assumed that large parts of the development areas already at the planning stage at the time of the last flood – in particular those behind dikes or other flood protection facilities – have in the meantime been covered by buildings without taking into account their flood compatibility and that assets in the inundation areas have been increased after local flood protection facilities were raised. Therefore, the target of the Action Plan on Floods “not to increase flood damage risks by 2000” has not been reached. Information and flood awareness must be further increased in order to encourage preventive construction and private prevention of citizens at risk of flooding.

Measures aimed at improving water retention along the Rhine and in its catchment have been implemented or initiated in all Rhine bordering states. The relocation of dikes, creation of technical retention facilities along the Rhine, renaturation of streams and regaining of former inundation areas (give back more room to the water bodies), the promotion of extensive farming, nature development, afforestation, rainwater seepage and the creation of smaller technical flood retention facilities effective on a local scale in the catchment range among these measures. Mostly they simultaneously encourage

groundwater recharge and the ecological enhancement of the Rhine system. This is particularly true of the relocation of dikes, renaturation and the promotion of extensive farming.

In the meantime, the performance target for the year 2000 (5 cm reduction of water level downstream the impounded stretch of the Upper Rhine) has largely been reached due to the measures implemented. Since 1995 10 million m^3 of retention areas have been created with the help of technical measures, a further 32 million m^3 of retention facilities are under construction and will probably be operational in 2001. 2,2 km^2 of inundation area have been created along the Rhine, 15 km^2 are currently being created and numerous other water retention activities have been carried through in the entire catchment area. Once the measures planned for 2001 will have been implemented, the targeted 5 cm reduction of the water level will be achieved. At the same time these measures improve the ecological function of the Rhine system.

Today nearly 100 % of the inundation areas along the Rhine and about 40 % of the inundation areas in the Rhine catchment are delimitated. By the end of 2001 the ICPR will have drafted maps on flood danger and risk for all inundation areas and flood prone areas in the lowlands of the Rhine on a scale 1:100.000. These new maps put the contents of the Rhine Atlas related to flood damage risks into concrete terms. Thus, as far as the main stream is concerned, the target set for 2005 will already be reached in 2001. It will however not be possible to plan measures on the basis of these general maps. This will only be possible if much more detailed maps are drafted on a regional or municipal scale, as it has already been done in the Rhine bordering countries or as are currently being drafted. Risk maps are a means of visualising flood danger. A lot of work has been done to convince people of the necessity of flood protection, for example in workshops, congresses, exhibitions on flood-related issues and local discussions. The population at risk must be aware of the flood danger if it is to take countermeasures. Therefore, in future, public relations work must be noticeably reinforced and remains a permanent task. Different non governmental organisations actively support the work targeted at increasing public awareness for matters of flood prevention and ecological enhancement.

Timely warning is an important part of flood prevention. It enables the population to get out of danger and to get their mobile goods into a safe place in order to largely avoid damages. It has been possible to reach the target of prolonging forecasting periods by 50 % between 1995 and 2000 and to maintain the current level of reliability. Formerly the forecasting period for the High Rhine covered 12 hours, that for the Upper, Middle and Lower Rhine covered 24 hours, for the Rhine delta (downstream of Lobith) 48 hours. Today forecasting periods for the High Rhine cover 18 hours, for the Upper, Middle and lower Rhine 36 hours and for the Rhine delta downstream of Lobith 72 hours.

To sum up it can be established that

- In many places flood awareness has risen,
- Among others due to increased EU subventions (IRMA) the implementation of the Action Plan is largely developing according to schedule
- Work aimed at increasing public awareness for measures within preventive construction and at promoting private prevention of citizens at risk of flooding must be continued with a view to minimizing damage
- Efforts in the field of financing and organisation targeted at improving water retention must continue
- Expenditures are developing as planned.

In the next five years the Rhine bordering countries and the European Union must noticeably reinforce their financial efforts in order to reach the performance targets of the Action Plan on Floods set for 2005. EU subsidy programs, such as IRMA would noticeably encourage and accelerate the implementation of the further measures.

Evaluation and Perspectives

The Action Plan on Floods applies to the entire Rhine catchment area. Its targets may only be reached if the measures agreed upon are implemented on a national scale.

The assessment of the implementation of the Action Plan on Floods so far is based on the four performance targets and the extent to which they have been put into concrete terms in 2000. Furthermore, the individual categories of measures are being examined with a view to determining whether work on reaching the detailed performance targets has started or whether these targets have already been reached. An outline of focal points of action in the next five years will be given.

(1)Reduce the risk of flood damages

The Action Plan on Floods demands "not to increase flood damage risks in the period running up to 2000".
In the meantime a great variety of measures targeted at securing floodplains legally and with a view to spatial planning have been initiated. Due to these measures it is today possible to protect these areas in all Rhine bordering countries by law. It is thus possible to take legal influence on flood damage risks.

However, these legal instruments only become effective with some delay. At the time being it is therefore not possible to assess whether, after the last flood events, flood risks have increased in the inundation areas and in flood prone areas. On the one hand municipalities in several Rhine bordering countries have a sovereignty of planning restricting direct state influence, on the other hand we do not yet dispose of reliable assessment instruments permitting to evaluate whether damage risks have continued to increase or whether they have diminished. Therefore, it must be assumed that large parts of the development areas already at the planning stage at the time of the last flood – in particular those behind dikes or other flood protection facilities – have in the meantime been covered by buildings without taking into account their flood compatibility and that assets in the inundation areas have been increased after local flood protection facilities were raised. Information and flood awareness must be increased in order to promote prevention in the field of construction and private prevention of citizens at risk of flooding. According to the Action Plan on Floods damage risks are to be reduced by 10 % by 2005. This also requires a quantitative assessment of the effectiveness of preventive measures in other fields than hydraulic engineering, such as spatial planning and urban development, property protection, emergency planning, forecasting, evacuation, management of residual risks and information of the public.

At the time being there is no basis for such an assessment. That is why the ICPR has commissioned a study entitled **"Basis for the identification of flood damage risks and evaluation of measures aimed at reducing these risks"**. This analysis will also include a documentation of flood damages registered in other European river catchments, such as those of Meuse, Danube and Odra. The focal question is: "Under which conditions and with the help of which measures is it possible to reduce flood damage risks and by how much?". Methods are to be developed permitting to quantify how non-hydraulic flood prevention measures influence the targeted reduction of damage risks. It is particularly interesting to learn how it is possible to take influence on the residual risk of rare, but very high flood stages in protected areas behind the dikes. The effectiveness of the individual measures and of the bunch of measures will be checked and quantified with the help of past flood events and case studies. The results will be fixed in a catalogue of measures recommended for implementation.

(2) Reduction of flood stages

All Rhine bordering countries have implemented or initiated measures targeted at improving water retention along the Rhine and in the Rhine catchment. These measures concern the relocation of dikes, the creation of technical retention facilities along the Rhine, the renaturation of streams, the restoration of former inundation areas (give back

more room to the rivers), the promotion of extensive farming, nature development, afforestation, enhancement of rain water seepage and creation of smaller technical flood retention facilities effective on a local scale in the catchment. The measures targeted at increasing water retention mostly also serve the ecological enhancement of the Rhine system. This is in particular true of the relocation of dikes, renaturation measures and the promotion of extensive farming. The same measures encourage groundwater recharge.
The figures for the assessment are listed in the table on the implementation of the Action Plan on Floods/Rhine by 2000 below.

The **performance target for 2000** (5 cm reduction of the water level below the impounded stretch of the Upper Rhine) has **largely been reached** with the implementation of measures along the Rhine and in its catchment. By 2001 the creation of 10 million m³ technical retention areas and the creation of another 10 million m³ of retention volume currently under construction and expected to be operational in 2001, the regaining of 2,2 km² of inundation areas along the Rhine, ongoing measures concerning further 15 km² and numerous activities aimed at water retention in the entire Rhine catchment will contribute to reaching the targeted reduction of water level. At the same time these measures enhance the ecological function of the Rhine system.

It is not possible to make any statements on the category of measures concerning "unsealing the soil" which above all concerns the seepage of rain water, as there is no monitoring system capable of inventorying the numerous individual measures on the local scale.

In order to be able to reach the ambitious target of reducing the water table by up to 30 cm by 2005, the implementation of all measures targeted at reducing flood stages must be noticeably promoted at all levels. This also includes improved co-ordination in matters of use and management of retention areas within the available forecasting of upstream and downstream users. The co-ordinated operation of retention areas must increasingly be encouraged.

Retention measures taken along the Upper Rhine will not or hardly lead to a reduction of flood peaks on the Middle and Lower Rhine which solely originate in the northern Rhine catchment area (e.g. Moselle). These questions are currently under discussion in the Netherlands. In December 2000 the Dutch Government will fix the starting points for water management in the 21st century. They particularly concern the extension of the river bed and measures targeted at flood retention. These starting points are based on an expertise taking into account a maximum flow of 18.000 m³/s at Lobith.

Additionally it must be said that by 2005 we will dispose of a calculation method permitting to prove the factual reduction of the water level. This will enable an evaluation of the effects of the totality of the above mentioned measures.

(3) Increase flood awareness
Along the Rhine near 100 % of the inundation areas are delimitated, in the Rhine catchment this is true of nearly 40 % of these areas. Many measures targeted at increasing the flood awareness of the population have already been implemented and must urgently be continued.
By the end of 2001 the ICPR will have drafted maps on flood danger and risk for all inundation areas and flood prone areas in the lowlands of the Rhine on a scale 1:100.000. These new maps put the contents related to flood damage risks set out in the Rhine Atlas published in 1998 into concrete terms. With this general map the target fixed for 2005 has already been reached.
It will however not be possible to plan measures on the basis of these general maps drafted by the ICPR. This will only be possible if much more detailed maps are drafted on a regional or municipal scale, as it has already been done in the Rhine bordering countries or as are currently being drafted. Similar maps must in future be drafted on a

national, regional or municipal scale for all Rhine tributaries and for further hydrographical systems. An example of such maps for the Cologne area on the Lower Rhine may be consulted under www.iksr.org.

Risk maps are a means of visualising flood danger. A lot of work has been done in all Rhine bordering countries to convince people of the necessity of flood protection, for example in workshops, congresses, exhibitions on flood-related issues and local discussions. Different non governmental organisations actively support the work of the authorities targeted at increasing public awareness for matters of flood prevention and ecological enhancement. These efforts must be noticeably encouraged.

By 2005, regional flood risk maps are to be drafted for the inundation areas and the flood prone areas behind the dikes along the Rhine and its most important tributaries. It is up to the municipalities to translate these standards into precise instructions for action. The risk maps are designed to disclose the flood danger to all those locally responsible as well as to the population at risk and to encourage private responsibility and preventive construction. Much conviction work remains to be done at all levels.

The population must be aware of the flood danger if it is supposed to take countermeasures. Thus, public relations work remains a permanent task.

(4) Improve the flood announcement system due to international co-operation and prolong forecasting periods by 50 % by 2000

Timely warning is an important element of flood prevention. It enables the population to get out of danger and to get their mobile goods into a safe place. This permits to avoid a large part of the damages. Flood announcement and flood forecasting are important means of damage reduction.

It has been possible to reach the target of prolonging **forecasting periods** by **50 %** between 1995 and 2000 and to maintain the current level of reliability. Formerly the forecasting period for the High Rhine covered 12 hours, that for the Upper, Middle and Lower Rhine covered 24 hours, for the Rhine Delta (downstream of Lobith) 48 hours. Today forecasting periods for the High Rhine cover 18 hours, for the Upper, Middle and Lower Rhine 36 hours and for the Rhine delta downstream of Lobith 72 hours.

Public access to flood announcement and forecasting of all alert centres has in particular been noticeably improved due to **internet**. **Videotext** gives a survey of Swiss, German and Dutch **Rhine water levels.**
A **standardized ICPR website** (www.iksr.org) with links to the national authorities in charge along the Rhine will be available in the beginning of 2001 in order to assure a more rapid and standardized information of the public in matters of flood announcement and flood forecasting in the Rhine area.

It is possible to prolong the forecasting period for the Rhine delta downstream of Lobith to four days in 2005, but this depends on the development of modelling calculations and on the delivery of meteorological data material from Germany. This work will be carried through in the next years. If the implementation of measures is continued, the targeted improvement of flood forecasting in the Rhine area as defined by the Action Plan on Floods may be reached by 2005.

Due to the high assets at risk estimated to about 1,500 billion Euro in the flood prone areas the implementation of the Action Plan on Floods/Rhine is an economic must. All efforts towards implementing the Action Plan must be continued and encouraged at all levels, at the international level as well as at the national, the regional and the municipal level, in the field of financing as well as in that of organisation.

The total expenditures for the implementation of the Action Plan on Floods until 2020 have been estimated to 12.3 billion Euro, about 1.9 billion Euro are to be spent by 2000. So far, the Rhine bordering countries have spent more than 1.6 billion Euro, the breakdown of expenditures being as follows:

- ***10 % for improving water retention along the Rhine***
- ***about 35 % for improving water retention in the Rhine catchment area***
- ***about 53 % for reinforcing and securing dikes and for local flood protection measures***
- ***about 2 % for flood prevention in the area of spatial planning and forecasting.***

To sum up it can be established that

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- ***Work aimed at increasing public awareness for measures within preventive construction and at promoting private prevention of citizens at risk of flooding must be continued with a view to minimizing damage.***
- ***Efforts in the field of financing and organisation targeted at improving water retention must continue.***
- ***Expenditures are developing as planned.***

In the next five years the Rhine bordering countries and the European Union must noticeably reinforce their financial efforts in order to reach the performance targets of the Action Plan on Floods set for 2005. EU subsidy programs, such as IRMA would noticeably promote and accelerate the implementation of the further measures.

The complete report can be downloaded in German
in French
in Dutch

Rhine Action Plan on Floods Survey of measures and implementation by 2000								
Categories of measures	**Contribution to**				**Measures**		**Expenditure**	
	Hz 1	***Hz 2***	***Hz 3***	***Hz 4***	***Target***	***Actual value***	***Estimate mill. Euro***	**Actual *mill. Euro***
(1) Water retention in the Rhine catchment								
renaturation measures (km)	+	+	+	-	1280	> 1010	129	125
reactivation of inundation areas (km^2)	+	+	+	-	100	> 100	250	
promotion of extensive farming (km^2)	+	+	+	-	800	> 950	135	> 250
nature development, afforestation (km^2)	+	+	+	-	450	> 865	88	> 120
encourage rainwater seepage (km^2)	+	+	+	-	90	> 10	70	unknown
technical flood retention facilities (mill. m^3)	++	+	+	-	4	> 2,6	50	>69
(2) Water retention along the Rhine								
reactivation of inundation areas (km^2)	++	+++	++	-	5	14,2	60	150
technical flood retention facilities (mill. m^3)	++	+++	++	-	33	10 +32 (2001)	136	9,7
(3) Technical flood protection								
Maintain and strengthen embankments (km), adapt them to level of protection	++	-	+	-	730	730	662 (NL korr)	868
(4) Preventive measures in the field of spatial planning								
- Sensitization	++	+	+++	-		> 40 % tributa-ries 100% Rhine	13	33,8
- Draft maps on the danger and risk of flooding	+++	+	+++	-	50 %			
(5) Flood forecasting								
- prolong forecasting periods	+++	-	-	+++	50%	50%	4	
- improve flood warning systems	+++	-	-	+++				
Sum							1.900	>1.630
Various categories of measures are not only justified due to their flood protection effects but fulfill important performance targets in other policy areas, as e.g. the renaturation of streams.								

Legend: (+ littel effect, ++average effect, +++ strong effect, - no effect)

Hz 1 → Reduction of damage risks
Hz 2 → Reduction of flood levels
Hz 3 → Increase flood awareness
Hz 4 → Improve the flood warning system