The Integrated Rhine Programme

Flood control and restoration of former floodplains along the Upper Rhine
Dear Citizens,

Water is a basis of life, a habitat and a natural resource, all in one. However, it also poses inherent risks. Therefore, it is a declared objective of our state government to enhance flood prevention in harmony with the natural environment throughout the entire state of Baden-Württemberg.

For this purpose, we plan to create a retention capacity of about 273 million m³ between the cities of Basel and Worms along the Upper Rhine. The state of Baden-Württemberg has pledged to contribute 15 flood retention areas with an overall capacity of 1673 million m³ towards accomplishing this ambitious, internationally agreed goal. For this reason, the Integrated Rhine Programme (IRP) was established back in 1996. Apart from providing environmentally sustainable flood control, the latter also seeks to protect and restore floodplains both inside and outside the designated retention areas.

Currently, Baden-Württemberg provides the following retention areas: the cultural weir near Kehl/Strasbourg, the polders in Altenheim, Söllingen/Greffern, Rheinschanzinsel as well as parts of Weiß/Breisach. This already accounts for approximately 45% of the required retention capacity. Combined with the flood retention measures taken in France and Rhineland-Palatinate, these capacities already ensure the protection of the metropolitan areas of Karlsruhe and Mannheim/Ludwigshafen, safeguarding them against flood events that occur statistically every 120 to 150 years.

Harnessing all available retention capacities along the Upper Rhine during the last major flooding in May/June 2013 allowed us to reduce the peak height of the flood in Karlsruhe/Maxau by 24cm, which prevented the occurrence of larger-scale damage and losses in the Upper Rhine region. Due to the weather conditions prevailing at that particular point in time, Baden-Württemberg narrowly escaped severe and disastrous flooding similar to the floodwaters that had swallowed the rivers Elbe and Danube. Once again, this has shown that the state’s flood control strategy is on the right track.

Due to the allocation and logical increase in financial resources granted by both the state and the federal government, flood prevention and defence measures may quickly progress with further flood retention areas being planned and built in the very near future. Moreover, possible dyke relocations in appropriate locations along the River Rhine will be incorporated in the planning. Alternative proposals submitted by the respective regions will be scrutinized within the framework of the relevant approval procedures.

However, the required retention areas may only be planned, built and operated when the residents living along the River Rhine support the scheme in a show of solidarity. This brochure showcases the parameters and conditions underlying the Integrated Rhine Programme by outlining the IRP’s basic idea and objectives. Further more detailed information on plans pertaining to your specific region is available on the websites of the Regional Administrative Authorities of Freiburg and Karlsruhe.

I hope that, with your support, we will jointly be able to swiftly implement the Integrated Rhine Programme. For this purpose, we must reconcile a multitude of very different interests and will only succeed in doing so if we manage to establish a broad consensus on a social and political level. Against this backdrop, I am asking for your constructive support and cooperation on this sometimes rocky path.

Your

Franz Untersteller MdL (Member of the Landtag)

Minister of the Environment, Climate Protection and the Energy Sector

of the Land of Baden-Württemberg
The risk
In its present state, the River Rhine only has a limited conveyance capacity for floodwater downstream of Iffezheim along the impounded stretch of the river. Thus, the conurbations of Karlsruhe, Mannheim/Ludwigshafen and Woms must brace themselves for considerable damage caused by flooding when the river overtops its embankments and inundates the areas behind the levees. The total damage/losses incurred in Baden-Württemberg alone is estimated to amount to more than EUR 7bn (as of 2013). Moreover, it is expected that such an event will result in human casualties.

THE CAUSES
Until the 1970s, prior to the construction of the dams along the Upper Rhine between Kembs and Iffezheim, the situation proved to be less dramatic. At that time, the number of natural floodplains along the southern section of the Upper Rhine were still sufficient, allowing the retention of water while reducing the river’s flood conveyance capacity along the northern stretch of the Upper Rhine to an acceptable level. With the construction of the dams, the floodplains were cut off from the natural discharge regime of the Rhine. Today, flood events involving comparable flood volumes generate larger river discharges that can no longer run off between the main dams of the Rhine along the northern stretch of the Upper Rhine downstream of Iffezheim.

THE SOLUTION
As illustrated by the example of the River Rhine, it was not so long ago that people were trying to protect the wetlands taken away from the rivers by means of dams that were built higher and higher. Today we know that this tremendously exacerbates the flood hazards for downstream areas. For this reason, raising the dams along the vulnerable section of the Upper Rhine beyond their current height must be ruled out in terms of potential solution to the problem. Thus, the only feasible solution to attenuate critical flood peaks embraces the creation of floodplains. Along the Upper Rhine, there is still a possibility of doing so in quite a number of areas. In former times, prior to the construction of the dams, these areas were always subject to inundation; today, they are mainly used for forestry purposes, with a small proportion being set aside as farmland. Many of these areas still bear witness to the past as they embrace remnants of the typical floodplain landscape that used to exist along the Upper Rhine. Reclaiming these areas for flood control purposes and developing semi-natural floodplains is the objective pursued by the Integrated Rhine Programme (IRP). Baden-Württemberg’s plan to ensure flood control and restore the former floodplains along the Upper Rhine.

THE PLAN IS FULLY WORKING OUT
According to current estimates, the costs incurred in connection with the Integrated Rhine Programme total about EUR 1.47bn (as of 2015); in contrast, in Baden-Württemberg alone, the anticipated damage/losses exceed an amount of EUR 7bn (as of 2015) plus the potential loss of human life. Subsequent to the completion of all flood retention facilities along the Upper Rhine, the measures embraced by the Integrated Rhine Programme are set to prevent almost all of the aforementioned losses, even in the event of a 200-year flood. Hence, the above investment is really worthwhile!

Apart from that, things are also working out for nature. We are witnessing a rise in the number of remaining natural floodplains that constitute the original habitats of a rich diversity of fauna and flora that used to be typical of the Upper Rhine plain in former times. In addition, this will also benefit humankind. In many locations, people’s living environment will become more natural and attractive.

PREVENTION IS BETTER THAN CURE
The flood retention measures carried out along the Upper Rhine merely constitute repair work and will by no means suffice as stand-alone measures. Human interference along the river must be reversed. Housing estates and industrial areas are still being built on potential floodplains. As a consequence, the flood hazard will not recede, but increase. Flood protection can never be absolute. People living in the immediate proximity of the river must always be prepared for the worst. However, even a reduction in unavoidable damage/losses is equivalent to efficient flood control. The respective precautions as well as reliable flood forecasting and warning systems will effectively help lower the damage/losses incurred, even during major flood events.

Taking stock of losses from floods: The economic damage caused by a major flood event in Baden-Württemberg totals approx. EUR 7bn (as of 2013). The measures taken within the framework of the Integrated Rhine Programme will help curb these losses.

Floods on the Upper Rhine pose a threat to 95 towns and municipalities► with a total population of 760,000► with ca. 350,000 jobs► covering a surface area of ca. 1,000 km² (as of 1995)

Floods on the Upper Rhine are a threat to 95 towns and municipalities. Altrip (left), Mannheim (right)
The River Rhine – a wild river falling prey to human intervention

Prior to the 19th century, the River Rhine used to be a wild river that was by and large untouched by man. Subsequent human intervention strongly altered the stream and its natural environment. This resulted in a loss of floodplains while increasing the exposure to flood hazard.

The Wild River Rhine – A Natural River until the 19th Century

About 200 years ago, the River Rhine still used to be a wild river. In the section located between Basel and Lauterbourg (furcation zone), the main channel of the Rhine bifurcated into many side arms. Each channeling changed the course of these numerous shallow channels. Sometimes their course shifted island, sometimes more into the direction of the mouth of the Rhine. Along this reach, the floodplains along the River Rhine were 2 to 3km wide.

The next section of the river between the confluence of the river Laute and the city of Worms (meander zone) had a shallow gradient with the Rhine following an east-west orientation. As a consequence, 2 to 3km wide floodplains flanked both sides of the Rhine.

The systematic development of the Upper Rhine started regulating the river that had remained in its natural state up to the 19th century. The Upper Rhine plain that had been a marshy alluvial zone up until then was subsequently reclaimed by man. An important habitat for flora and fauna typical of floodplains was lost due to the expansion measures that were carried out.

The Correction of the River Rhine

The first corrections by Johann Gottfried Tulla

The first correction of the River Rhine was carried out between 1817 and 1880 according to master plans devised by Johann Gottfried Tulla, engineer and lieutenant colonel in the former duchy of Bai-

For this purpose, numerous channels of the river in the Upper Rhine zone were combined to form one main bed with a width of 200m to 260m, while the wide meander loops were cut through. As a result, the River Rhine received a new riverbed that has essentially remained the same until today. The length of the Rhine section between Basel and Worms was reduced from 534km to 271km. From then onwards, floods were only able to inundate an area that was about 1 to 2km wide.

A navigable river down to Basel – all year round

By implementing these measures, Tulla created settlement areas and converted the mostly Upper Rhine plain into an area suitable for farming and forestry purposes. Thus, people living in the immediate prox-

imity of the Rhine enjoyed a higher level of protection against floods. From 2006 onwards, Max Hasse1 continued Tulla’s work in his capacity as Director of the Grand Ducal Building Authority located in Karlsruhe. By putting up ramp, so-called gorges, he reduced the cross-section of the channel of the River Rhine, with the water concentrating in the main channel of the river. The establishment of a permanent navigation channel (depth: 2m, width: 7km to 10km) provided the possibility of travelling up to Basel all year round.

First adverse effects on the floodplains

All in all, the correction of the Upper Rhine resulted in a major loss of natural wetlands and brought about a reduction in the frequency of floods in the area bordering the river. The mere construction of the dam between Marckolsheim, Rhenus, Gersheim, and Strasbourg in 1877 the river had to use the construction of the probably last dams at Gambsheim and Iffezheim, which are located directly in the river.

Loss of important habitats for fauna and flora

The systematic development of the Upper Rhine resulted in a loss of 15,000ha of previously flooded wetlands which in turn, entailed the loss of important habitats that sheltered rare animals like kingfishers, beavers and black storks. It is true that the systematic development of the Upper Rhine did not entail the complete disapperance of the semi-natural habitats typi-

A navigable river down to Basel – all year round

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This particular section of the floodplains covered an area that was 10 to 12km wide. Back then, floods were able to inundate the terrain without coming across any major obstacles. However, people settling in the plains along the River Rhine perceived this scenario as a threat. Every now and then, permanently recurring floods engulfling whole estates while inundating the vital fields for weeks in a row. The alluvial floodplains with their great diversity of fauna and flora were still in a mostly natural condition.

The Treaty of Versailles concluded back in 1919 constituted the point of departure for further substantial changes along the Upper Rhine. In Article 338 France was conferred the right to divert water from the Upper Rhine and harness water power for generating electricity.

Between 1926 and 1977, a total of 10 dams were constructed within the framework of these development phases. First of all, the Grand Canal of Alsace (Grand Canal d’Alsace) between Märrt and Strasbourg with the Kehl, Ottmarsheim, Fessenheim and Vögelsheim dams were con-

ected. Between 1939 and 1970, the expansion of the Upper Rhine progressed and brought about 4 locks located be-

tween Breisach and Strasbourg, with dams close to Marckolsheim, Rhenus, Gersheim and Strasbourg. By 1977, the river had to use the construction of the probably last dams at Gambsheim and Iffezheim, which are located directly in the river.

The loss of natural floodplains has given rise to distinctly higher flood peaks. Moreover, due to the shortening of the river, the peak heights of the River Rhine coincide with the higher discharge volumes of its tributaries such as the River Neckar and the River Main.

Increased flood hazards

As a direct consequence of dam construction, the risk of flooding downstream of Hillesheim along the developed steens of the River Rhine has increased considerably.

Human management instead of a complete mosaic of alluvial biotopes that form part of a river floodplain network within a wider system of biotopes, we are left with only small isolated remnants of the former natural floodplains of the River Rhine.

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The Integrated Rhine Programme (IRP)

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**IRP Objectives: Flood Control and the Restoration of Floodplains**

The Integrated Rhine Programme proposes the creation of flood retention areas at 13 sites located on former alluvial floodplains on the Baden-Württemberg shore of the river Rhine; all in all, it seeks to preserve and restore the wetlands along the Upper Rhine to the maximum extent possible.

The measures taken in the context of the integrated Rhine Programme cover the Baden-Württemberg shore of the River Rhine between Basel and Mannheim. Furthermore, flood control measures are also implemented in Rhineland-Palatinate and France in conjunction with the integrated Rhine Programme, they ensure sustainable flood protection along the Upper Rhine.

**Framework Concept of the Federal State of Baden-Württemberg for the Implementation of the Integrated Rhine Programme**

The overall IRP schema comprises a plethora of individual measures. All of them are based on the “Framework Concept of the Federal State of Baden-Württemberg for the Implementation of the Integrated Rhine Programme.”

**A Project Embracing Inter-Disciplinary Cooperation**

Commissioned by the state government, the programme was drawn up by the state environmental management body in interdisciplinary cooperation with other departments and third party experts. It was set up as a framework programme allowing the proposed measures to be planned and implemented step by step. The entire scheme as well as the local implementation in the administrative district of Freiburg was put under the local management of the Regierungspräsidium Freiburg (Regional Administrative Authority Freiburg). Local implementation in the administrative district of Karlsruhe is ensured by the Regierungspräsidium Karlsruhe (Regional Administrative Authority Karlsruhe).

**Important Stages Leading to the IRP**

As early as in 1968, the “International Commission on the Hydrology of the Rhine”, which comprised representatives from France, Switzerland, Austria and Germany as well as representatives from the federal states of Baden-Württemberg, Rhineland-Palatinate and Hesse, conducted a study on the impact of the systematic development of the Upper Rhine. The findings of the Commission underlined the need for restoring the level of flood protection that existed prior to the systematic development of the Upper Rhine.

The goals pursued by the Integrated Rhine Programme (IRP) include flood control as well as the preservation and/or restoration of the Upper Rhine floodplains. Following the example given by nature, today’s conservation ensures tomorrow’s flood control.

**The Franco-German Agreement**

Years later, the above requirement was incorporated into the Franco-German Agreement concluded in 1982. This agreement on the systematic development of the River Rhine between Kehl/Strasbourg and Neuhausen/Lauterburg listed measures deemed necessary for the purpose of flood control at that particular point in time.

Apart from the emergency operation of the Rhine power stations, the measures to be taken on German territory included a weir at Rhine kilometre 220.3, the cultural works at Breitsch and Kehl, the Polders Achenheim and Söllingen Polders as well as further polders downstream of the Franco-German border. Pursuant to this agreement, France is to contribute to the restoration of flood protection by assuming the emergency operation of its Rhine power plants and by operating the Mosel and Eistener Polders.

**The Framework Concept Brings Clarity**

During the planning stage it became evident that it was impossible to carry out the measures as originally planned due to technical problems that occurred during implementation and on account of new intelligence gleaned from environmental impact assessments, which had already been completed by then.

It became obvious that ecological concerns had to be increasingly taken into consideration and that the number of sites proposed in the Franco-German Agreement would not suffice.

The Baden-Württemberg State Government responded by commissioning the then Ministry of the Environment to draw up a framework concept for restoring flood protection (Framework Concept, Part I) as well as the alluvial floodplains along the Upper Rhine (Framework Concept, Part II).

Finally, in 1996, the State Government adopted the “Framework Concept of the State of Baden-Württemberg for the Implementation of the Integrated Rhine Programme.”

**Important events:**

- 1919 Treaty of Versailles
- 1928-77 Systematic development of the Upper Rhine
- 1968 Establishment of the “International Commission on the Hydrology of the Rhine”
- 1982 Franco-German Agreement on the systematic development of the Rhine
- 1987 The first flood retention areas, i.e. the Feder Altferien as well as the cultural weir near Kehl/Strasbourg, became operational
- 1988 Decision in favour of the development of a framework concept by the State Government of Baden-Württemberg
- 1996 Adoption of the Framework Concept for the implementation of the Integrated Rhine Programme by the State Government of Baden-Württemberg
- 2002 Unanimously, the Landtag reaffirmed its approval of the 13 sites embraced by the Integrated Rhine Programme
- 2010 Cabinet reaffirmation of the Integrated Rhine Programme
The possibilities and impact of flood retention on the Upper Rhine

POLDERS

In the event of increased discharge volumes of the River Rhine, which are specifically stipulated within the framework of existing rules and regulations, polders are artificially flooded via inlet structures. This flooding allows the water of the River Rhine to pass unimpeded through the polders with the water finally re-entering the river bed with a certain delay via the corresponding outlet structures. Since both the timing of artificial flooding and the level of flood retention may be controlled to a large degree, polders may be used in a targeted and highly efficient way. The dedicated use of polders for floodwater retention purposes is required approximately every ten years. For obtaining approval of such controlled polder management on non-farmland under nature conservation law, ecological flooding during the period between such retention events is necessary. This results in the creation of wetland-like habitats and living conditions that reproduce the natural environment as far as possible.

DAM RELOCATIONS

Subsequent to a dam relocation, the River Rhine may once again rely on a larger number of natural floodplains enabling the river to overtop its banks without meeting any obstacles. The higher the water level of the river, the more water will inundate the wetlands and flow back into the Rhine with a time lag. As a consequence, the mounting flood levels are already reduced at an early stage when discharge volumes are still fairly uncontrolled. Flooding cannot be controlled and this implies that the retention volume may not be utilised in a targeted way. This type of flood retention is closest to natural conditions.

EMERGENCY OPERATION OF THE RHINE POWER STATIONS

Along the systematically developed stretch of the Rhine between Basel and Strasbourg, the water of the River Rhine is divided and channelled into the loops that hold the power stations and/or the Grand Canal of Alsace as well as the original river bed. In the event of a flood, the so-called ‘emergency operation of the Rhine power stations’ reduces the discharge conveyance of the loops to a minimum, trying to ensure that nearly 100% of the Rhine’s total discharge volume is channelled through the old river bed. This brings about a rise in water level along this particular reach. This way, the river is allowed to overtop its banks and the water may freely inundate the adjacent floodplains. Due to its controllability, the emergency operation of the Rhine power stations may be used in a targeted and highly efficient way. Its impact is comparable to that achieved by polders and weirs.

WEIRS

With the help of weirs located in the River Rhine, the water level of the main channel and that of the floodplains upstream of the respective weir may be controlled in accordance with a stipulated set of rules and regulations. For all of the floodwater is retained by the weir itself, whereas it is allowed to spill into the adjacent floodplains due to the increased water levels upstream of the weir. After opening the weir gates, the water is removed from the retention area. Like polders, weir may be utilized for the purpose of flood retention in a targeted and highly efficient way, and just like polders, their operation may require ecological flooding.

The Upper Rhine retention areas down to Mannheim

Comprehensive studies conducted over a period of several years have revealed that each of the proposed retention areas is suitable for the purposes of flood retention and the restoration of semi-natural floodplain conditions. However, not all sites will enjoy an optimum achievement of both objectives.

Integrated Rhine Programme of the state of Baden-Württemberg

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Flood protection in harmony with nature
(Framework Concept, Part I)

Flood protection must be achieved in an environmentally-friendly way. This is stipulated in the Nature Conservation Act. The latter requires that any change entailing a considerable adverse impact on the efficiency and functional capabilities of intact habitats and their respective fauna and flora (intervention) is to be avoided, mitigated or offset.

Only semi-natural wetlands along the River Rhine are able to fulfil their important functions within the framework of landscape ecology. Floodplains provide natural space for flood control.

**GENTLE ADAPTATION TO FLOODING STRESS**

The former floodplains along the River Rhine that are to be re-flooded must be slowly and carefully readjusted to this changed environment while allowing the traditional alluvial forests to redevelop. Semi-natural wetland forests embrace flood-tolerant communities capable of surviving flood events without sustaining larger damage.

For this reason, the task of the Integrated Rhine Programme goes beyond flooding the retention areas during major flood events – i.e. every 10, 20 or 30 years – by raising water levels to a height of several metres, in addition, it is to ensure that the areas are exposed to water even if Rhine discharge volumes are lower.

**ENVIRONMENTALLY-FRIENDLY FLOOD CONTROL VIA ECOCLOGICAL FLOODING**

The IRP reintegrates areas that have not been exposed to flooding for several decades into the natural flood regime of the River Rhine. Fauna and flora currently occupying the former floodplains are not adjusted to inundations. They would not survive flooding without sustaining damage. Thus, inundations during periods of flood retention result in changes that constitute interventions in existing habitats as defined in the Nature Conservation Act.

For mitigating losses in future retention areas, it is necessary to create the prerequisites for the development of intact, floodplain-like ecosystems.

**HYDROLOGICAL BALANCE**

**TYPICAL OF FLOODPLAINS**

Fluctuations in groundwater levels typical of floodplains as well as flood-induced sediment transfer processes are to be restored and/or allowed whenever possible.

Ecological flooding, in such will not suffice to restore the entire mosaic of natural biotopes in the Rhine floodplains. Dam relocations provide optimum conditions for the development of semi-natural wetlands. This is the only way to allow the multitude of interactions between the river and the floodplains to develop without any interference from outside.

Intact floodplain communities need regular inundation. However, floods requiring the use of retention areas are not frequent enough to ensure this regularity. On average, they occur every 10 years or even less frequently. But intact ecosystems will only develop if regular flooding is ensured. As a consequence, this regular, managed flooding (called ecological flooding) embraces the mandatory mitigation action legally required under the Nature Conservation Act.

Without being subjected to regular flooding, the retention areas would only attract fauna and flora unfit to cope with inundations during the periods between individual flood events. To ensure that these areas are regularly exposed to water, ecological flooding is carried out when Rhine discharge volumes are low. Thus, the flooding of wetland habitats, fluctuations in groundwater levels and flood-induced soil shifts are restored and/or allowed to the maximum extent possible.

Based on the findings of available surveys and the experiences gained so far, ecological flooding is key to avoiding and/or mitigating losses that will occur as a result of flood retention.

Streams will be restored, e.g. by building fish ladders. This enables fish, such as the salmon, to reclaim their spawning grounds.

Biotope networking will be performed by incorporating sites located outside the retention areas. This results in the restoration of natural habitats for fauna and flora.

Drained and previously marshy or boggy areas located in the Upper Rhine basin at the foot of the escarpment will be reconverted into wetlands, e.g. by dispensing with the further maintenance of drainage channels.

There are still remnants of alluvial woodlands along the Upper Rhine. They will be preserved and protected.
Using the Polders Altenheim in the event of flooding

“And now let’s turn our attention to the weather. The sudden heat will persist at higher altitudes. Just like the past few days, today will bring sustained heavy rainfall to southern Germany and Switzerland. For the rest of the week, there is no change in sight.”

This could be the rough wording of a forecast by the German Meteorological Service. As a consequence, the Altenheim Polders would be used for the purpose of flood retention as described below.

Stage 1: Due to heavy rainfall, the discharge volume of the Upper Rhine exceeds the flood alert level of 8m at the Hauenstein gauging station. Flood alert levels are also exceeded at other gauging stations located on the Black Forest tributaries as well as on the River Neckar.

The Central Flood Forecasting Office (“Hochwasservorherseungsstelle” – HVZ) of the Federal State of Baden-Württemberg, which permanently monitors the discharge regime of the key water bodies of the federal state by means of a computer-controlled system, has already started to provide its round-the-clock service. From now onwards, the HVZ office computes flood forecasts for the most important gauging stations of the federal state that are updated on an hourly basis and based on water level and precipitation data as well as rain forecasts provided by the German Meteorological Service.

The projections made by the HVZ office predict the occurrence of a major flood event along the River Rhine. The discharge volume at the Maass gauging station in Karlsruhe will exceed both the level of 3,800 m$^3$/s and 4,200 m$^3$/s. The use of the Polders Altenheim for flood retention purposes is prepared. There is a permanent exchange of updated information between the Central Flood Forecasting Office, the Ministry of the Environment, Climate Protection and the Energy Sector as well as the operator of the Polders Altenheim.

Stage 2: Via public address announcements, the general public is notified of the polder flooding and requested to leave the retention areas. The staff of the operating company, the workers of the municipal building control offices, the police and the volunteer fire brigade are working 24-hour shifts. In the meantime, the Polders Altenheim and their immediate vicinity are widely cordoned off. For safety reasons, people are no longer allowed to access the polders while this gives animals a chance to withdraw without being disturbed. The body in charge of the entire operation and responsible for permanent monitoring is the central control station located at the cultural weir near Kehl/Straßburg.

Stage 3: When the decision in favour of flood retention measures is taken, the polders are flooded. Up to 150 m$^3$/s of Rhine water are channelled into the polders via inlets and culverts. In these locations, water levels keep rising until the river overtops its embankments and finally inundates the entire area. Once the planned retention water level is reached, the polders retain a total water volume of 17.6 m$^3$.

Stage 4: In order to prevent any adverse impact caused by rising groundwater levels in the adjacent Altenheim area, specific protection measures (Altenheim pumping station and inlet/outlet control) are implemented simultaneously with the operation of the Altenheim Polders. These measures ensure that groundwater levels in the Altenheim region do not deteriorate due to the retention of flood water. During flood retention periods, the local fire brigade keeps checking the dams. Equipment and materials for securing seepages are available.

Stage 5: Declining water levels of the River Rhine result in a termination of water retention measures and polder drainage is commenced. For this purpose, the polder outlets are fully opened. Afterwards, cleaning-up operations by the operating company are required.

In conjunction with the cultural weir near Kehl/Straßburg, the Polders Söllingen/ Giffhoven as well as parts of the Weil-Breisach retention area, the total volume of water that my be retained today amounts to 73.5 m$^3$. An operation of this kind may last up to 5 days. Once all retention areas are ready for use, they are operated in accordance with the rules and regulations stipulated at an international level, always subject to the respective flood event. On the Baden/Württemberg shore of the river, a total of 167.3 m$^3$ of water may be retained subsequent to the completion of the Integrated Rhine Programme. Moreover, the flood peak of the Rhine may be reduced by a further 105.3 m$^3$ of water once flood retention measures in France and Rhineland-Palatinate are completed.
Importance of the floodplains

New habitats for a large variety of fauna and flora
(Framework Concept, Part II)

The protection, conservation, development and preservation of the remaining semi-natural floodplain biotopes constitute important prerequisites for the restoration of the Upper Rhine wetlands.

This goal may be achieved by way of designating conservation areas and establishing and implementing preservation, development and networking schemes. Intensively managed areas are to be reconverted into a semi-natural state by means of appropriate measures. In the Upper Rhine floodplains, this is brought about by reconnecting parts of the former floodplains to the discharge regime of the River Rhine, engaging in the extentionisation of intensively managed farmland and by gradually reconstructing forest stands, to same but a few examples.

Diversity of species and structural diversity

Floodplains display many interesting faces. Again and again, the dynamics of the water generate new habitats for a large variety of fauna and flora. This is where many endangered animals and plants included in the Red List of Threatened Species like the kingfisher still find refuge.

These ecological measures are instrumental in enhancing the situation of the entire Rhine basin. The IRP helps put into practice the objectives and fundamental principles of nature conservation in the natural environment of the “northern and southern Upper Rhine lowlands”. These goals are in line with the provisions laid down in the national and international agreements for the protection of the Upper Rhine lowlands. In many ways, both fauna and flora along the Upper Rhine are already benefiting from the measures taken in the context of the Integrated Rhine Programme. First signs of success are visible in the Rhine basin north of Iffezheim.

Alluvial floodplains are priceless. Representing a mosaic of different habitats or biotopes they form an important ecosystem. This ecosystem does not constitute a confined area, but is characterized by permanent change and natural development. It is the diversity of factors, species, biotopes and communities that makes up the unique character of a wetland ecosystem.

Rarity

In Europe, many floodplains are destroyed by human intervention. This also applies to the Upper Rhine, where only few connected areas are left. The Integrated Rhine Programme harbours the great opportunity of preserving one of the last river landscapes in Europe. For some animal and plant species, such as the floating fern, the Upper Rhine area constitutes the only or one of very few habitats.

Flood prevention function

Floodplains constitute a landscape’s natural flood retention areas and protect both man and the environment against damage, losses caused by floods. Restoring and conserving wetlands is instrumental in providing flood control.

Human recreation and the experience of nature

In the floodplains, human beings may gain a first-hand experience of the conflict between water and the landscape. The large diversity of flora and fauna always surprises the visitor by unveiling new secrets. Floodplains provide natural areas for recreation while allowing for ample time spent in harmony with nature.

Genetic potential

The River Rhine does not only transport debris, sand and gravel. After each flood, organic substances, branches, fruits and seeds are deposited in other areas and mixed with the local plant material. Not only for fauna, but also for flora, water bodies flowing through wetlands constitute a kind of ferry allowing plants to venture out and open up new habitats.

Unique character

Alluvial floodplains are priceless. The interplay between the duration, level and frequency of flooding results in a comprehensive mosaic of habitats.

The protection, conservation, development and preservation of the remaining semi-natural floodplain biotopes constitute important prerequisites for the restoration of the Upper Rhine wetlands.

This goal may be achieved by way of designating conservation areas and establishing and implementing preservation, development and networking schemes. Intensively managed areas are to be reconverted into a semi-natural state by means of appropriate measures. In the Upper Rhine floodplains, this is brought about by reconnecting parts of the former floodplains to the discharge regime of the River Rhine, engaging in the extentionisation of intensively managed farmland and by gradually reconstructing forest stands, to same but a few examples.

Diversity of species and structural diversity

Floodplains display many interesting faces. Again and again, the dynamics of the water generate new habitats for a large variety of fauna and flora. This is where many endangered animals and plants included in the Red List of Threatened Species like the kingfisher still find refuge.

These ecological measures are instrumental in enhancing the situation of the entire Rhine basin. The IRP helps put into practice the objectives and fundamental principles of nature conservation in the natural environment of the “northern and southern Upper Rhine lowlands”. These goals are in line with the provisions laid down in the national and international agreements for the protection of the Upper Rhine lowlands. In many ways, both fauna and flora along the Upper Rhine are already benefiting from the measures taken in the context of the Integrated Rhine Programme. First signs of success are visible in the Rhine basin north of Iffezheim.

Alluvial floodplains are priceless. Representing a mosaic of different habitats or biotopes they form an important ecosystem. This ecosystem does not constitute a confined area, but is characterized by permanent change and natural development. It is the diversity of factors, species, biotopes and communities that makes up the unique character of a wetland ecosystem.

Rarity

In Europe, many floodplains are destroyed by human intervention. This also applies to the Upper Rhine, where only few connected areas are left. The Integrated Rhine Programme harbours the great opportunity of preserving one of the last river landscapes in Europe. For some animal and plant species, such as the floating fern, the Upper Rhine area constitutes the only or one of very few habitats.

Flood prevention function

Floodplains constitute a landscape’s natural flood retention areas and protect both man and the environment against damage, losses caused by floods. Restoring and conserving wetlands is instrumental in providing flood control.

Human recreation and the experience of nature

In the floodplains, human beings may gain a first-hand experience of the conflict between water and the landscape. The large diversity of flora and fauna always surprises the visitor by unveiling new secrets. Floodplains provide natural areas for recreation while allowing for ample time spent in harmony with nature.

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The successful implementation of the Integrated Rhine Programme will depend on many individual measures. So far, the following flood retention areas have been completed and successfully put into service: the Polder Alftenheim, the cultural weir near Kehl/Strasbourg, the Polder Söllingen/Greifen as well as the Polder Rheinschanzenb. In addition, some of the areas of the retention basin Weil-Breisach whose soil surface was lowered to some extent are also instrumental in providing flood protection. Thus, currently around 45% of the required retention capacity is available. Further flood retention areas are in the process of construction or undergo approval procedures.

The Integrated Rhine Programme can only be implemented when all stakeholders closely collaborate and make a joint effort. In the long run, these endeavors will pay off.

The Upper Rhine Plain will benefit from recurrent wetland biotopes with their diversity of species and multifaceted structures. At the same time, flood hazards will be mitigated.

The IRP is the prerequisite for the reduction of damage/losses caused by centennial floods along the Upper Rhine.
For further information on the Integrated Rhine Programme, please visit our website at www.irp-bw.de. There you will also find comprehensive information available for download or ordering.