

### Field excursion 3: ERRC2014 – SEE River Final Project Event

### Integrated Flood Protection Systems at the Danube and tributaries

### Programme

08:30	Departure from Tech Gate Vienna. Bus travel via A22/B3 to Krems
09:30	Arrival at Krems city (northern Danube banks) near World Heritage Center Wachau
9:30 to 11:15 10:30	Flood protection system at city banks Krems-Stein Walk from cruise ship quai up to old bridge (flood wall at rowing club) by bus to city fire brigade of Krems:
	storage house for movable flood walls; demonstration wall
11:15 to 12:15	Krems river flood protection system at urban area of Krems Walk along restored river bed that was strongly regulated and is subject to flash floods, re-built river bed and weirs, recreation at river
12:15 to 12:45	Flood protection system at Oberloiben Bus travel to current construction site; adaptation of flood protection systems in coordination with local village interests
12:45 to 13:00	<b>Flood protection system at Hundsheim</b> Bus travel along wall floods that worked well at big Danube flood in June 2013
13:00 to 14:30	Lunch at Winzerstüberl in Rührsdorf
14:30 to 15:30	Flood protection system at Rührsdorf / side-arm restoration Integration into historic village; wine tourism & Danube cycling route
15:30 to 16:30	Flood protection system at Oberarnsdorf Visit of the village's storage area of movable flood wall and of Danube banks
16:30 to 17:30	Stop at typical Heurigen "Pulker's" in Rührsdorf Return travel by bus

18:30 Arrival at Tech Gate Vienna;



### Field trip hosts and guides:

Dipl.eng. Jörg Handhofer Dipl.eng. Alexander Raßmann Dipl.eng. Christoph Braunstein Phone +43-2732 806-680 Phone +43-1 5227522-620 Phone +43-1 5227522-610; http://www.hydro-ing.at

Email j.handhofer@hydro-ing.at Email a.rassmann@hydro-ing.at Email c.braunstein@hydro-ing.at

# **ERRC2014 - SEE River Project Final Event**

Excursion no. 3 Integrated Flood Protection Systems at the Danube and tributaries



- 1 Danube flood protection Krems-Stein
- 2 River Krems flood protection for the town of Krems
- 3 Danube flood protection Loiben
- 4 Danube flood protection Hundsheim

- 5 Danube flood protection for Rührsdorf
- 6 Danube old distributary connection Rührsdorf
- 7 Danube flood protection for Oberarnsdorf



ÖK M1: 50.000

#### References

### Danube flood protection Krems-Stein

#### **Task Description**

For the twin town of Krems-Stein, which in 1995 celebrated its 1000 year jubilee, the River Danube was historically important for trade. Today, the River Danube has greater prominence as part of the tourist centre that Krems-Stein has become. Krems, and Stein in particular, had inadequate flood defences and was subject to frequent flooding from the River Danube. Hydro Ingenieure was engaged to provide design consultancy services for the provision of flood defences for Krems-Stein. As well as providing flood protection, maintaining the image of the twin town and access to the River Danube were essential project aims.

#### Solution

A demountable flood protection system was installed in areas where it was important to maintain existing views of the twin town from the River Danube and access onto the River Danube. A permanent low profile wall was installed with deep foundations acting a barrier to groundwater flow. During periods of high water, steel columns are installed on top of this wall, and between these, aluminium stop logs are slid in. The stop log system can be adjusted gradually in height as required to suit the anticipated flood level. Stone-clad flood control walls and dams, together with a drainage network with a flood control pumping station, complete the flood protection system.

- Total length of the flood protection system: 1,670 m
- Stop log system length: 890 m

- Consists of 247 columns, with approximately 2,600 stop logs
- Height of the demountable flood wall (not including the permanent wall): up to 1.6 m
- Demountable flood wall height at crossings: 3.2 m
- Flood control pumping system
- Flood protection system is stored at the voluntary fire defence force

#### Services

- variants investigation & Sensitivity Testing
- Detailed Design and Drawing Submission for Planning Approval
- Application for Project Funding
- Tender Preparation and Procurement
- Project Management
- Site Supervision in accordance with construction site co-ordination law (BauKG)
- Residual Risk Analysis
- O&M Manual Preparation and Emergency Planning

- client: the town of Krems an der Donau
- project funding: provided by the Austrian Government and the county of Lower Austria Government
- total costs: € 16,000,000
- project period: 1994-1996
- contact person: Jörg Handhofer, MSc





#### References

### River Krems flood protection for the town of Krems

#### **Task Description**

In recent decades the River Krems has risen over its banks and caused catastrophic flood damage within the town of Krems. The Project required the provision of a flood protection system that on the one hand should provide protection against recurrent flooding, and on the other hand, must neither visually nor physically separate the eponymous river from the city. The use of temporary demountable flood protection systems was not possible due to potentially very rapidly increasing flood waters. The ecology and the multi-functionality of watercourses in urban areas were also an essential part of the project in addition to the flood protection system.

The flood protection system, with a length of 6,200 km, is located in a densely built-up urban area. The transport system and existing infrastructure within Krems, the limited space availability, as well as the diverse demands placed on urban rivers posed particular challenges for the design and construction.

#### Solution

The flood protection was achieved primarily by means of river construction measures as optimisation of river bed slope and adjustment of flow affecting cross section respectively mean water channel to meet hydraulic, environmental and urban requirements. With the development of the river shores by an architecturally designed waterfront with direct access to the river, a new recreation area in the centre of Krems was created.

Other system components:

 Rehabilitation and an increase in the existing river walls and embankments

- Underpinning and ground sealing using mixed in-situ walls and jet grouting
- Construction of flood protection walls
- New construction of three bridges and three footbridges
- Demolition of two weirs and construction of new fish passes
- Renaturalisation of manmade channel beds and the creation of riparian areas
- Adaptation of existing transport and service infrastructure

#### Services

- 2-Dimensional Outflow Modelling
- Designation of Zones at Risk
- Sensitivity testing
- Detailed Design and Submission for Planning Approval
- • Application for Project Funding
  - Invitations to Tender & Procurement
  - Project Management
  - Site Supervision in accordance with construction site coordination law (BauKG)
  - Residual Risk Analysis
  - O&M Manual and Emergency Planning

- client: city of Krems an der Donau
- project funding: provided by the Austrian Government and the county of Lower Austria Government
- total costs: € 34,000,000
- project period: Total project completion planned for 2018
- contact person: Jörg Handhofer, MSc





#### References

### Danube flood protection Hundsheim

#### **Task definition**

**Services** 

In 2002 as well as so often in previous years, almost the entire Hundseim was flooded by the Danube river. An understandable wish of inhabitants was the sustainable protection against the flooding from the Danube waters.

Further requirements were as follows:

- Maintenance of possibly undisturbed water balance, so there will be no flood through the underground during the time when the river water level is high
- Solution with view and free access to the Danube
- Safer protection with little action in case of high river water levels
- Observance of nature and landscape preservation (World cultural heritage)

#### Solution

- After intensive underground investigations the feasibility study with different variants was elaborated. The solution from combination of static walls and mobile elements was evaluated as the most suitable.
- Protective structures shall be located along the parallel road; therefore the reduction of noise level from the road shall be achieved as well.
- Sealing of the underground shall be solved by 15 m deep walls which provide natural water balance and in case of flood it provides regulated groundwater level by drainage discharge.

- Draft design
- Hydraulics
- Detail design •
- Procurement and construction supervision
- Project management
- Project funding development
- Residual risks analysis
- Emergency and operation control plan

#### Facts

- Client: Municipality Mautern an der Donau
- Funding body: Bund und Land NÖ
- Total costs: € 6.950.000,-
- Commencement of construction: September 2006
- Start of operation: December 2007
- Completion of all works: September 2009
- Contact person: Jörg Handhofer, MSc





#### References

### Danube flood protection for Rührsdorf

#### **Task Description**

Subsequent to significant flood events in recent years, the project aim was to protect vulnerable people and properties in the area of Rührsdorf against the 1 in 100 year return period River Danube flood. Additional priorities including maintaining the visual aspect of the town and landscape, provision of a flood control system that could be easily operated, the reduction of residual risks and minimising the impact on the existing groundwater flow regime.

#### Solution

Following a feasibility study, a combination of permanent flood walls and demountable flood walls was designed and optimised in relation to the visual aspects of the town and landscape prior to submission for planning permission. With a total length of approximately 1,350 m, the flood control system has the following principal components:

- Flood protection wall along with foundation and underground waterproofing over a length of approx. 950 m
- Flood protection earth embankments, including a groundwater cutoff, over a length of approx. 400m.
- A flood control pumping station including drainage pipes with a capacity of approx. 1,080 l/s
- Planning, delivery, installation and commissioning of demountable flood barriers with a total area of approx. 250 m<sup>2</sup>
- Warehouse for demountable protection elements

#### Services

- Feasibility Study
- Draft and Detailed Planning Submissions
- Residual Risk Analysis
- variants investigation & Sensitivity Testing
- Emergency Planning
- Application for Project Funding
- Invitations to Tender & Procurement
- Project Management
  Technical and Common
- Technical and Commercial Construction Supervision
- Site Co-ordination
- Final Approval

- client: Municipality of Rossatz-Arnsdorf
- project funding: provided by the Austrian Government and the county of Lower Austria Government
- total costs: € 9,850,000
- project period: 2011-2012
- contact person: Jörg Handhofer, MSc





#### References

### Danube old distributary connection Rührsdorf

#### **Task definition**

In 2003 via donau decided to connect the existing old distributaries to Danube within the EU-Life-Projekt.

The goal was to achieve the max. flow rate during the period when the Danube river shows low water level what is to be achieved by max. possibly deep river bed.

The old distributary in question is located in Rührsdorf and it is spread into approx. 3 km long area at the right orographical side of the Danube river.

#### **Solution**

- 2d-hydraulic variants investigations of main and outer flow areas for cross-linking with the main stream
- Hydraulic calculation of objects "Silberseetraverse" and "Rührsdorfer Traverse"
- Hydraulic calculation and optimization of flow profile
- Design for applicable permissions fort he entire river part taking into consideration the geo-technical limits.
- Coordination with the ecological detail design
- Procurement
- Construction supervision and taking-over of completed works

#### Services

- Flow modelling
- Variants investigation
- Design for permission, Detail design
- Application of funding
- Procurement
- Contracting
- Project management
- Construction supervision
- Coordination with ecological supervision body
- Evaluation and adjustment to new conditions during the construction period
- Final acceptance

#### Facts

- Client: via donau Wasserstraßen GmbH
- Project period: 2005 2007
- Investment volume: € 600.000,–
- Contact person: Christoph Braunstein, MSc; Andreas Käppl, MSc





#### References

### Danube flood protection for Oberarnsdorf

#### **Task Description**

Subsequent to significant flood events in recent years, the project aim was to protect vulnerable people and properties in the area of Oberarnsdorf against the 1 in 100 year return period River Danube flood. Additional priorities including maintaining the visual aspect of the town and landscape, provision of a flood control system that could be easily operated, the reduction of residual risks and minimising the impact on the existing groundwater flow regime.

#### **Solution**

Following a feasibility study, a solution was developed consisting of a combination of a permanent flood wall and a demountable flood wall. As part of the planning submission and detailed design, the flood system was optimised in relation to the visual aspects of the town and landscape. With a total length of approximately 890 m, the flood control system has the following principal components:

- Provision of a flood protection wall and foundation, together with subsoil sealing over a length of approximately 890m.
- A flood control pumping station including drainage pipes with a capacity of approx. 1,560 l/s.
- Planning, delivery, installation and commissioning of demountable flood barriers with a total area of 1,150 m<sup>2</sup>.
- Warehouse for demountable flood protection elements.

#### Services

- Feasibility Study
- Draft and Detailed Planning Submissions
- Residual Risk Analysis
- variants investigation & Sensitivity Testing
- Emergency Planning
- Application for Project Funding
- Invitations to Tender & Procurement
- Project Management
- Technical and Commercial Construction Supervision
- Site Co-ordination
- Final Approval

- client: Municipality of Rossatz-Arnsdorf
- project funding: provided by the Austrian Government and the county of Lower Austria Government
- total costs: € 9,730,000
- project period: 2011-2012
- contact person: Jörg Handhofer, MSc



