

# PROGRAM GRAZ STREAMS

## FLOOD MANAGEMENT IN URBAN AREAS

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### INTRODUCTION

Under the pressure of demographic, infrastructural and spatial problems the issue of flood risk has often been dodged in urban areas. Its neglecting, though, has proved to have disastrous consequences. The “Graz Streams Program” provides an example of how to identify the difficulties and problems connected to “flood risk management in urban areas”.

### PRESENTATION OF THE PROBLEM

The City of Graz has an extension of about 13,000 hectares, of which somewhat more than half are building land and roads. Besides a multitude of smaller watercourses, the Graz urban area counts more than 50 streams plus 10 torrents.

As built up areas and higher-order land use are moving more and more towards watercourses, the following results can be observed in urban areas in general and along most streams in Graz: along the lower course, flood catchment areas are disappearing while discharge cross sections are falling rather than rising. The room required to safely take up the arriving floodwaters, therefore, is no longer there. Tubing and covers as well as canalisation out of the depth contour compound the situation by utterly separating run off from the stream bed and leaving water masses to flow off uncontrolled through the urban area.

### FLOODS

Innumerable historic flood disasters have been recorded in the urban area of Graz. The memory of the 1975 flood prompted the first steps towards a flood prevention strategy.

In 1997, after several years work, an assessment of discharge values with indication of catchment areas for the 1-in-30 and 1-in-100-year event (HQ30 and HQ100) for all main Graz streams was finally ready. Calculations revealed that there are about 1000 flood-endangered objects in Graz. With respect to the torrents, a hazard zone map was completed in 1999. The results of both assessments were included in form of a map in the zoning plan, nonetheless it seems that they never actually found the necessary consideration when it came to the granting of building permits.

The flooding of many streams on August 21, 2005 reached such a scale that a state of civil emergency had to be given out for the Graz urban area. Hundreds of cellars and ground floors were invaded by the waters. The damage amounted to approximately 5 million Euros.



**Fig. 1,2: Flood Aug. 2005**

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## **GRAZ STREAMS PROGRAM**

A study carried out in close cooperation between the Graz City Council, the Government of the Province of Styria, the Forest Technical Service for Torrent and Avalanche Control and the Federal Ministry for Agriculture and Forestry, Environment and Water Management yielded a strategic paper called “Graz Streams Program”.

Taking into consideration the requirements posed by the departments for spatial planning, urban development, open space planning, water ecology, water management in urban areas and civil protection, the primary objective was formulated as follows: “To achieve sustainable flood protection of endangered objects in the City of Graz”. In the course of the study, the slope water problem, affecting many quarters in Graz, and problems connected to floodings due to surface water were examined and pointed out.

Seven civil engineering firms were hired to develop a flood control plan. Two further firms were tasked with specific assessments in the fields of water ecology and spatial planning. In August 2006 work was completed. The proposed catalogue of measures is very extensive and includes:

- the categorical preservation and further creation of floodplains,
- the construction of 29 flood retention basins (retention capacity approx. 1.0 million m<sup>3</sup>),
- the removal of bottlenecks (beds and culverts/bridges)
- the achievement of “good state” or “good ecologic potential”.

And yet, notwithstanding the widest possible exploitation of local possibilities and extensive acquisition of land, it will not be possible to guarantee HQ100 protection for all settlement areas at risk. As compared to the present state, though, clear improvements will be made everywhere. For those segments where technical defence is not going to suffice to grant adequate flood protection, integrative measures are to be adopted directly at the objects’ sites and further detailed alert and intervention plans are to be worked out for civil defence forces.

Implementation will take place within a 10-year programme period (2006-2015) and according to a priority list taking into account the individual flood risk and possible damage at each site. The total cost of this ten-year programme has been estimated at € 65.0 million on the price basis of August 2006. Funding will be provided by the Federal Government, the Government of the Province of Styria and the City of Graz.

Parallel to the first implementation schemes, preliminary work has begun for the drawing up of individual stream management plans, flood prediction models, analyses of residual risk as well as alert and intervention plans.

Particular attention is being devoted to public relations (citizen information and awareness raising for bodies of water). Citizens are to be shown how each and every one who is affected by the problem can contribute to enhance public protection measures through their own initiatives, by thinking in terms of and implementing passive defence, such as flood-resilient building techniques and flood-adapted living habits, use of mobile flood barriers, flood damage insurance and personal emergency plans.

## **CONCLUDING REMARK**

The interdisciplinary collaboration on the “Graz Streams Scheme” has produced good results and will hopefully stand as an example for the fact that concerted work between urban development, hydraulic engineering and environmental agencies and forward-looking planning can avoid costly reconstruction, which afterwards is barely possible especially in urban areas.

**Keywords:** Risk Management, flood protection, torrent control, spatial planning