4. Governance of Flooding Risks in the Region and the City of Hanover

Frank Scholles
Institute of Environmental Planning
Leibniz University Hannover
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Abstract

The article deals with flood protection and flood prevention as a contribution to a more resilient city region in general and in Hanover. Flood protection of Hanover's city centre has been dealt with since the 15th century. Today, floods are prevented by land-use and sectoral planning of the city region and the municipality. The regional plan has designed binding priority and reserve zones for flood prevention on the basis of flooding areas identified by the water management administration. Urban planning has set up an informal local action programme, but a basic update of formal plans, especially the preparatory land-use plan, is missing.

1. Flooding and Flood Protection in Hanover's History

The city of Hanover has been built on the so-called high banks of the river *Leine*. Later on, lower areas and especially the floodplain have been used for urban development including housing and administration. This means that the city of Hanover, right from its origin, had to learn how to cope with flooding.

There have always been flooding events in history, as the Leine may seasonally carry an enormous run-off due to melting of snow or heavy rain in its catchment area, especially in the *Harz* mountain.

Therefore, there has been already the idea in the 15th century to protect the city centre against flooding by deviating the *Leine* in the south of the city and by using the brook Ihme for the bulk of the run-off arriving from the South. Thus, the canal *Schneller Graben* has been constructed in the *Leine* and *Ihme* floodplain south of Hanover and the *Ihme* has been broadened to bypass up to 90% of the overall run-off. The project has been built in the 17th century and renewed in the 18th century. The city centre, as well as the *Südstadt* neighbourhoods, could be protected by this first flood protection activity, however at the expense of more flooding events for *Calenberger Neustadt* and *Linden*, the latter being an independent city until the 1920s. In 1922, a hydroelectric power plant was added to the weir, thus utilising the 3.60 m difference in altitude between *Leine* and *Ihme*. The plant is still in operation (Röhrbein 2009; LHH 2019a).

Besides that protection activity, dykes, dams, and walls have been built after the hazardous floods in 1808, 1909 and 1946. During the most hazardous flood in February 1946, 1666 hectares of land have been flooded up to 3 m high. This happened only some months after the end of the Second World War. Only three persons died, but there was enormous damage in the city that was still suffering from having been heavily bombed. Especially the municipal archives were flooded and lost a larger number of valuable documents (LHH 2019a).

2. Flooding and Flood Protection in Hanover's History

"Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist." (Holling 1973: 17)

What does that mean for a city region? “Urban resilience refers to the ability of an urban system – and all it is constituent socio-ecological and socio-technical networks across temporal and spatial scales – to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity.” (Meerow et al. 2016: 39, 45)

What does this mean for resilience regarding flooding? On the one hand, societies have understood that the traditional water management strategy to get rid as quickly as possible of stormwater and to protect the land against flooding is not feasible any longer because it is expensive and leaves the problem to the downstream municipality, thus creating the need for ever-increasing expenses for protection measures. On the other hand, central European urban planning must react to the fact that heavy rain events will increase while the amount of rainfall per year will not change (Kuttler et al. 2017). Today’s strategy is (1) to retain and if possible drain or evaporate/transpire as much rainwater as possible within the built-up areas (by e.g. green roofs, green open spaces, protecting or reclaiming floodplains), (2) to identify optional areas that may take over or substitute functions at risk in other areas, (3) to identify areas that may be flooded in a controlled way if necessary and (4) include protection of key areas. Resilient cities are, on the one hand, robust against and on the other adaptive to hazards from flooding (Jakubowski et al. 2019). Disturbance or even damage is accepted to the degree that does not compromise desired functions in the long run, thus preventing these functions from disappearing due to hazards from flooding. The disturbance is a part of development rather than an obstacle to it (Folke 2006: 258). “A management approach based on resilience [...] would emphasize the need to keep options open, the need to view events in a regional rather than a local context, and the need to emphasize heterogeneity.” (Holling 1973: 21)

There are three types of hazards from flooding resilient cities should be able to cope with. These include firstly flooding from running waters, secondly flash floods from heavy rain (that are likely to increase due to climate change, s.a.), and thirdly storm floods from the sea. The first two must be dealt with in Hanover,

whereas the third is irrelevant as Hanover is not (yet) located at the coastline.

Good governance for resilience, therefore, takes place, especially on the regional level. It focuses on spatial planning, whose task it is to identify optional development opportunities (supported by strategic environmental assessment), negotiate land-uses and moderate processes.

3. Regional Governance in Hannover

In 2001, the Hanover Region was legally founded as a unique new administrative body for better governance by integrating the Hanover County with the Greater Hanover Association (competent for regional planning, economic development and public transport) and competencies from the Capital City of Hanover and the federal state of Lower Saxony. The capital city is now one among the 21 municipalities within the region (Frohner & Priebs 2001). Multilevel governance has been reduced. Thus, all competencies in the regional level are now gathered in one administration, which is responsible e.g. for regional planning, water management, climate protection and adaptation, regional landscape planning. Since a couple of years, a central team for the coordination of climate protection (*Klimaschutzleitstelle*) that reports directly to the head of a department exists within the Department of Environment, Planning and Building. They are responsible for coordinating all-climate protection and adaptation activities within the region, while the original competence for e.g. flooding has remained with the sectoral team within the service environment. Besides, the region founded the Regional Climate Protection Bureau also in 2001, a public enterprise that informs and consults the population, house owners and small and medium-sized enterprises and shows up paths to subsidise appropriate actions.

4. Flood Prevention in the Hanover Regional Plan [1]

Spatial planning is an integrative and independent task and thus must help implement flood prevention. This is a principle according to the Spatial Planning Act (*ROG*) since 1989 and also laid down in the Water Management Act (*WHG*).
Spatial planning and water management must cooperate to guarantee flood management. This includes protection and reclamation of natural flooding areas, prevention in potentially flood-prone areas and retention of water within the land of

[1] The author is grateful to Dr. Wolfgang Jung and Mark Herrmann from the Hanover Region administration for valuable input for this chapter.

the entire river catchment area. Flood prevention by spatial planning especially includes protecting and reclaiming land for floodplains, retention areas and other discharge areas.

Regional plans must designate the intended open space structure, which includes open spaces for flood prevention. Therefore, regional planning in Germany designates priority and reserve zones for flood prevention.

To implement flood prevention in the Hanover Region, natural flooding areas (HQ 100) are identified and protected by sectoral planning of the lower water authority of the Hanover Region and by the Lower Saxon agency for water affairs, coast protection and nature conservation (*NLWKN*). The regional planners have then designated the already decreed flooding areas, in which a flooding event is expected statistically once in 100 years (HQ 100), as “priority zones flood prevention”. Spatially significant proposals and actions within these areas can only be permitted, if they are in line with water retention, especially if flooding retention is not compromised, alternative sites outside flooding areas are not available and the interests of upstream and downstream municipalities are complied with.

The designation as a “priority zone flood prevention” shall protect decreed flooding areas against conflicting proposals and land-uses, especially against further land consumption by development. These open spaces shall be kept free of housing and sealing because natural running waters and their floodplains in these areas have a high capacity to store. stormwater To prevent damage, new building zones in these areas must not be permitted. The lower water authority (not the municipality) may decide upon exemptions.

The boundaries of these priority zones are aligned at those of the already decreed flooding areas that can be affected by a flooding event likely to occur once in 100 years (HQ 100) according to federal and state water management law. The boundaries are generalised because of the different scales of sectoral and spatial planning (1:5,000 vs 1:50,000). More exact sectoral planning data must be, therefore, considered in all permits for spatially significant proposals and actions.

Recent flooding events in Germany show that changes in frequency and intensity must be expected as planning risks. To completely avoid flooding has proven to be both insecure and expensive and is thus neither effective nor sustainable (Grünewald & Schanze 2011: 31). Therefore, the EU Floods Directive has been transposed into national law in the Water Management Act such that risk areas are identified and mapped in flood hazard maps. These classify risk areas according to flooding events with high, intermediate or low probability and the vulnerability of the land-use.

Decreed flooding areas shall guarantee stormwater run-off without damage and protect the required retention areas for an intermediate flooding event. In case of extreme flooding events (flash floods), areas beyond this may be flooded. For an effective flood risk management and climate change adaptation, areas that can be flooded at lower risk shall be designated as "reserve zones flood prevention" to prevent risks from potentially occurring extreme flooding events. This is a designation to protect the public welfare and, therefore, it has a higher weight in decision-making in case of conflicting land-use. The boundaries of the "reserve zones flood prevention" are aligned at the flooding event likely to occur once in 200 years (HQ 200). This is again for sectoral water management, since the latter may only designate binding protection areas in case of HQ 100 (cf. Schanze & Greiving 2011: 95).

Figure 1 shows maps of HQ 100 and 200 in the southern Leine floodplain. The map in figure 2 shows the priority and reserve zones for flood prevention in the regional plan (Region Hannover 2016). The provision of objectives and intentions under the heading open spaces, water management, in the text statement includes (Region Hannover 2016, ch. 3.2.4[1]):

- 06 Stormwater sewers shall be separated from foul water sewers. Rainwater shall be drained with priority if groundwater protection does not contradict. [intention]
- 07 Flood prevention actions shall be foreseen to prevent flooding damage. A natural development of surface waters and floodplains shall be pursued. Retention shall be improved by targeted action like backward relocation of dykes, disman-

1 Translation by the author

tling of river training or construction of retention areas. Reclamation of natural retention areas shall have priority over the construction of retention areas. Land-use planning shall especially consider keeping free of retention areas that can be reclaimed. [intention]

- 08 Decreed flooding areas must be kept and protected with their function as natural retention areas. “Priority zones flood protection” are designated in the map statement to guarantee flood prevention. Within these areas, all spatially significant proposals and actions must be compatible with the purpose of flood prevention. [objective]
- 09 To prevent risks, areas less probably to be flooded (at a statistical interval of 200 years) are designated in the map statement as “reserve zone”. [intention]

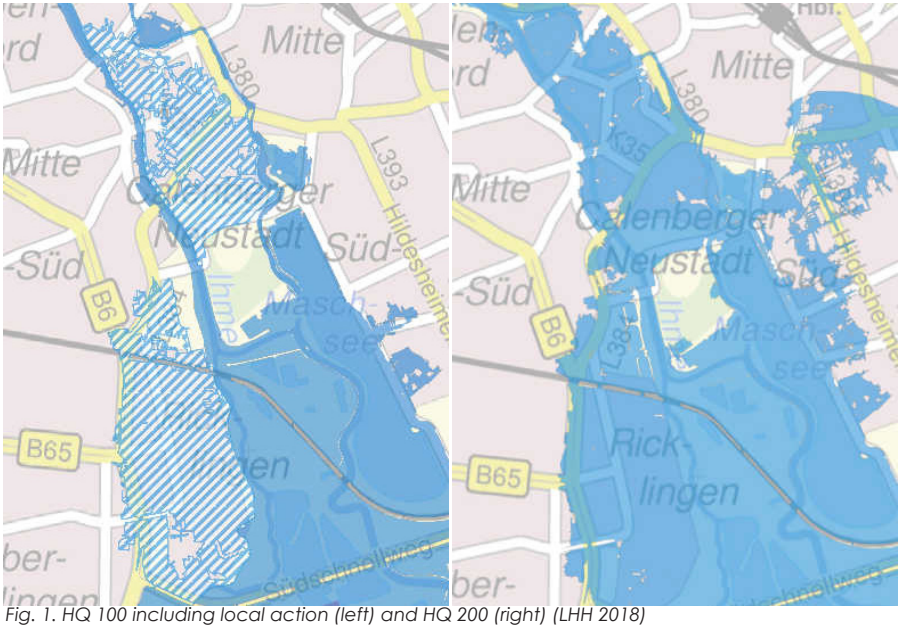

Fig. 1. HQ 100 including local action (left) and HQ 200 (right) (LHH 2018)

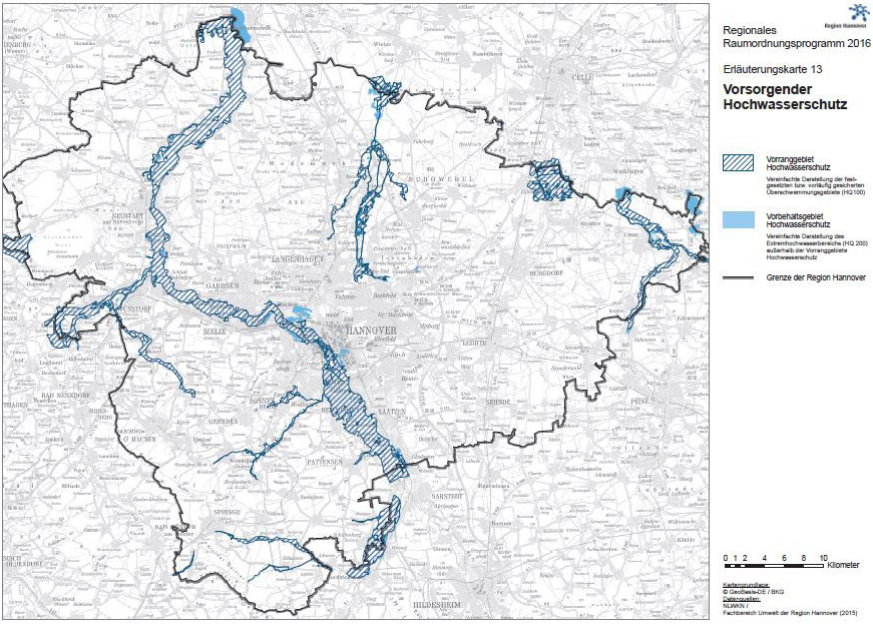

Fig. 2. By map flood prevention of the regional plan with priority and reserve zones (Region Hannover 2016)

This means that priority zones constitute planning objectives that must be complied with in sectoral and local land-use planning, whereas reserve zones are planning intentions that must be taken into account only. But water management authorities may invest in preventive action in these areas, whereas spatial planners may support and moderate the process (cf. Schanze & Greiving 2011: 95).

The implementation of spatial planning objectives and intentions into action is the task of municipalities and sectoral planning. Therefore, it would be logical for the Capital City of Hanover to set up a new preparatory land-use plan or basically update the existing one. However, this happened in 1975 for the last time and since then there have only been a large number of amendments to the plan regarding small areas. The stock taking data and the predictions on which the plan is based are completely outdated.

5. Flood Prevention by Urban Planning in Hanover

The Capital City of Hanover has set up a number of informal development strategies instead, among which there is a Local Action Programme 2017 on flood prevention, adopted in 2006. The programme focuses on three fields of action, which meanwhile have been implemented (LHH 2019b):

1. Excavation of the Ihme floodplain between *Spinnereistraße* and *Lavesallee* to enlarge the water profile and retain runoff. There has been a landscape architecture competition to find a flood-resistant multifunctional design and to use flood resilient tree and shrub species. The population first protested against cutting of a large number of trees, but has now accepted the area and is happily using it for daily recreation.
2. Widening of the *Benno Ohnesorg* Bridge to eliminate an existing bottleneck. The old bridge had not been wide enough to let HQ 200 pass completely. Additionally, there had been an accommodation berth for a passenger ship next to the bridge that might have led to the ship blocking the water passage in case of a flood. The berth has been dislocated and the bride replaced by a larger one that is also capable of accommodatin a barrier-free tram stop.
3. Closing of a gap in the dyke in *Ricklingen* to protect the neighbourhood.

The city has created a central coordination unit for flooding protection in 2015. Their tasks include the analysis of recent flooding events, the analysis of weaknesses, the optimisation of the system of flooding protection, and the information of the population. Other competent local authorities that are cooperating with the coordination unit include: the fire brigade, the service civil and underground engineering, the urban service drainage, the service environment and urban green, and the service urban development and planning (LHH 2019c). The city has also set up an adaptation strategy to climate change (LHH 2017, cf. Schmidt in this book). This strategy includes eight fields of action, three of which are relevant here, including flood protection, rainwater management and handling of heavy rain events, and roof greening.

6. Conclusion

Due to using a geographical and hydrological opportunity, the city centre of Hanover could be protected from flooding very early. Having protected flooding areas on the regional level and implemented a local action programme, relatively few built-up areas a still flood-prone at HQ 100. At HQ 200, however, and also taking into account the probable increase of flash floods, a number of neighbourhoods must be better prepared and should become more resilient against flooding.

A general update of the preparatory land-use plan accompanied by a strategic environmental assessment that will include natural risks could constitute an element of good governance for a more resilient city. The existing preparatory land-use plan is based on social, economic and environmental data and predictions from the 1970ies. It has been incrementally changed more than 200 times without questioning the basic conception. To cope with HQ 200 events within the built-up areas, it may be necessary to change existing binding land-use plans in the affected areas. Suitable prescriptions for dealing with flash flood within building stock include roof greening, canal network adaptation, retention basins, temporary retention, e.g. on sports grounds and reconstruction of streets to serve as emergency waterways (Kuttler et al. 2017). However, prescribing most of these within existing building stock will require public financing or subsidising private owners. This needs to be funded by climate adaptation programmes on the national and state levels.

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