# Aspects of two aesthetically designed small dams for urban areas

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Aesthetics of dams should be an integral part of a design elaboration, especially in urban areas. Achieving elegance and harmony in the design while finding a stringent technical solution is a challenge, but can be striking and allows a dialogue with its surrounding environment. Two examples of recently built flood retention dams ins Switzerland herewith briefly introduced will emphasize fundamental demands to achieve a pleasant design.

The retention dam on the Jonenbach river in the outskirts of Affoltern am Albis is constructed as an earthfill dam for technical and aesthetic reasons. The 16.5 m high dam is curved and has upstream and downstream slopes of 1:3. The concrete works - culvert and spillway - are integrated in the earthfill dam. A good integrative landscape design ensured a decent integration of the dam into the Jonental valley, a construction playground and vegetation adapted to the location (site-specific and biodiverse grass vegetation). The removal of the existing Jonental road and the revaluation of the Jonenbach river turn the retention area into an attractive close to nature recreation area.

The flood retention scheme Hegmatten protects the city center of Winterthur against extreme flood events of the river Eulach. The flood retention dam consists of a bottom outlet to damp the incoming flood peaks. In case the capacity of the retention dam is reached, an open emergency spillway chute is provided on top of the dam crest to avoid uncontrolled overtopping. The scheme is carefully integrated into the urbanized landscape.

Significant rehabilitation works were done to revitalize various creeks and culverts. The confluencing Riedbach creek was relocated to its historic location 150 years ago. Several ponds were created, while endemic hedges and trees were planted. The project provided finally a significant conservation area.

The article will introduce the above briefly described small dams and highlight aesthetic design aspects specifically implemented. These should be considered as a state-of-the-art for other dams to be built in urban areas.

## 1. Thoughts on aesthetics of dams

Only a few articles deal with the aesthetics of dams. According to Kreuzer (2013) geometric proportions impose order, which is recognized as desirable and beautiful. Order manifests itself by repetition, parallelism and orthogonality. Disorder on the other hand allows the observer to experience a certain contrast and guidance. Kreuzer outlines as well that appropriate scaling and the perception of a structure in its environmental context are important.

In general, aesthetics is usually subjective and difficult to assess neutrally.
Nevertheless, with the continuously increasing land demand for housing, industry and commerce, rural areas are under pressure. Areas for the preservation of our ecological diversity, the pursuit of agriculture or for recreational purposes, outside the urban agglomerations, are decreasing and becoming rarer.

It is therefore to be considered what contribution can be made in order to design dam and retention areas for flood protection, which demand extensive areas, aesthetically, while coping with the increasing activities within rural landscapes. Often, a greater creative freedom is achievable without neglecting the necessary technical requirements for these structures. The two examples successfully implemented and briefly described within this paper will indicate aspects how to achieve pleasantly designed flood protection structures.

In addition to the design principle described by Kreuzer (2013) a successful implementation requires to incorporate the following principles, if applicable:

- the preservation of ecological diversity,
- the aesthetic demands of the landscape and its perception,

- the need for space for recreation and leisure activities,
- serviceability of the dam structure for public and environment.

## 2. Flood retention scheme Hegmatten

### 2.1 Project description

The flood retention area is located in the adjacent catchment area of the creek Riedbach. Therefore the flood peaks of the Eulach have to be diverted by means of a 390 m long underground channel, which spills the flood peaks from an existing Eulach flood channel into the retention dam area. The junction at the flood channel comprises of an overflow spillway which allows to divert 50% of the incoming flood peaks. The flood retention dam is ca. 1.4 km long and approximately 3.5 m high above existing terrain. The maximum height is 11 m. The total direct and indirect project costs amounted to 33 Mio. CHF. The effective construction period was 2 years (Aemmer, 2018).

*Figure 1: View on the flood retention area after impounding (visualization, Nightnurse Images ©)*

## 2.1 Aesthetic aspects

*Figure 2: North damm with terraces*

Due to the flat topography, the flood retention area requires extensive land area. It is located in the middle of a sports airfield, a sports complex, with numerous soccer fields and cultivated land. The retention area is separated on its southwest side by a dam body up to 12 m high (so-called “south dam”). Towards the north, the height of the dam steadily decreases due to the naturally rising terrain (so-called “north dam”).

The north dam runs parallel to the existing sports facility and a hangar for small aircraft. This northern dam was positioned and designed allowing access by heavy vehicles to the aircraft hangar and the sports facility, which are led over the dam body. Since the north dam also runs parallel to the existing soccer fields, three rows of seating elements for the spectators was integrated well within the dam body (Figure 2).

On the north side of the retention room, the water is retained by the existing slightly sloping terrain. The terminating dam body is visually unnoticeable, the retention space is well integrated into the existing landscape. In terms of scaling only a minimal rockfill body above existing terrain was sufficient to allow for the required retention volume. Even part of the existing runway was integrated in the dam body by means of gradually increasing terrain modelling.

*Figure 3: View on ponds within the flood retention area*

The embankment dam surface offers an ecologically valuable ruderal area (open gravel area), whiles parts of the retention area inhibits numerous ponds as sanctuaries for endangered species (Figure 3). The sanctuary attracts as well many recreation seekers. Thus, the inclusion and upgrading of the already existing attractive natural and recreational areas serves as an added value for the project (Figure 4).

*Figure 4: The flood retention dam emphasizing the city boundary of Winterthur.*

Ecological goals and recreational uses can lead to areas of conflict. These can be reduced with a minimum of functional elements and certain order in landscaping. Creating a meaningful road network and deliberately placing of "furniture" a "visitor guidance" was implemented. Visitors are directed by special pathways to designated areas close to the ponds. Areas reserved exclusively for nature are defined by natural barriers, e.g. by the positioning plants in a disordered manner and adequate selection of plant types.

Due to technical and aesthetic reasons, the retaining dam Hegmatten was designed as an embankment dam. The minimum slopes were intentionally selected to be flat requiring a slope of 1: 3 both downstream and upstream. The selected scaling allows to minimize the perception of a technical structure in its rural environment.
On these dams, as well as in the tributary channel, dry to fresh grassland were created which contribute to the ecological diversity of this retention area. By means of a "direct greening" from neighbouring nature sanctuaries of the city of Winterthur, rare plants and animal species got resettled.

Since the dam is still to some extent exposed in the slightly hilly landscape, it instinctively attracts people. From the dam crest the entire retention area can be overlooked. Therefore, just below the dam crest, a footpath was implemented, which frequently is used. The walkability of the dam contributes to the fact that the dam body is not perceived as a disordering element in the landscape. Such a convenient serviceability of the dam emphazises an intensified "nature experience" and thus ultimately to a better acceptance of this landscape-defining new technical structure.

*Figure 5: Detailed view on ponds within the flood retention area*

## 3. Flood retention dam Jonenbach

### 3.1 Project description

The flood retention dam on the Jonenbach river allows to reduce the maximum outflow on the lower river to 17 $m^3/s$ up to a 100 years return period flood, a discharge which can be safely passed by the existing river channel within the village further downstream. In rare occasions of heavy rainfall and a discharge of more than 5 $m^3/s$, the retention dams starts impounding. The reservoir on average will only be full every 100 years, thus the water level will reach the emergency spillway crest level (Figure 6). The filling and emptying of the reservoir is expected to last no longer than a few hours. Vegetation in the retention area therefore will not be affected severely. The emergency spillway is built for the maximum discharge of 116 m3/s. It is located directly above the bottom outlet and spills the flood discharges within. The location of the reservoir has been chosen according to the geological and hydro geological characteristics of the site (Hochstrasser, 2008).

*Figure 6: View on the upstream dam crest of flood retention dam Jonenbach with a trash rack protecting the emergency spillway*

**2.1 Aesthetic aspects**

The embankment dam Jonenbach is significantly higher than the Hegmatten dam. An integration in the environment and the surrounding landscape is thus more challenging. The dam abutments therefore have been generously curved (Figure 7), while the spillway is covered laterally with backfill material (Figure 8).

To protect the spillway from clogging, a symmetrical arrangement was selected allowing a certain order and orthogonality. It clearly builds a contrast to the carefully integrated dam body, thus enables the observer a decent perception of the technically unavoidable element. The slenderly structure trash rack dissolves the remaining concrete crest of the spillway efficiently (Figure 9).

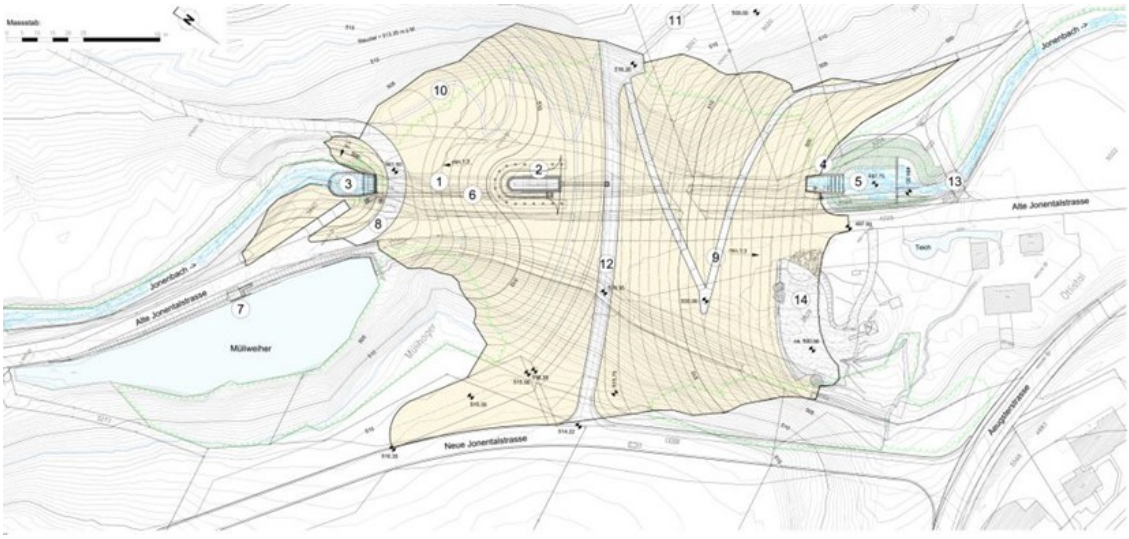


*Figure 7: Plan view of the flood retention dam on the Jonenbach river with the curved abutments on both sides*

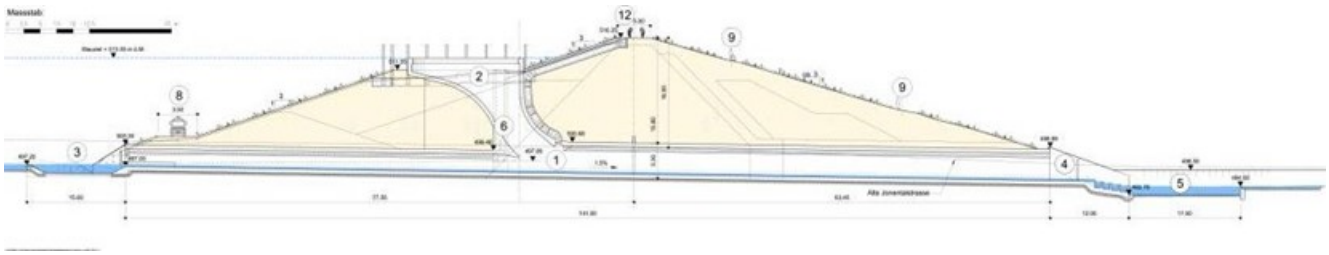

*Figure 8: Longitudinal section through bottom outlet*

*Figure 9: View on emergency spillway structure with surround trash rack (concrete filled steel piles)*

## 4. Conclusions

Thoughts on aesthetics should be integral part of a design assessment of any small dams. (Small) embankment dam surface shall offer an ecologically valuable recreation area, while the selected scaling shall minimize the perception of a technical structure in its rural environment by means of symmetrical arrangement, flat slopes and careful integration of its endings.

### References


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### The Authors


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