Removal of the Krebsbach Dam – Lessons learned after 11 years

Hudiksvall/Sweden, 25.09.2018
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Situated in low mountain range (300 m altitude)

Rock embankment Dam

18.8 m high

Impoundment length: 700 m

Basin: 14.1 km²

Average flow: 0.089 m³/s

Reservoir capacity: 0.5 mio. m³
Krebsbach Dam constructed in 1964 for Uran processing.

Early problems: leak water and other structural deficiencies. --> Sheet pilings drived in 1969

Purpose in 1985 abandoned.

Remained use: Flood protection and hobby fishing.

After 1990 stability problems continued and bottom outlet and pillway too small designed for big floods.

Estimated rehabilitation and operation costs were too high (cost-benefit analysis) and no new purpose could be developed.

Decision by operator “Thüringer Fernwasserversorgung” for removal in 1997!
Introduction

2001: Construction of new spillway due of stability reasons

No experience in Germany with Dam Removal!
--> Pilot character

According to plan approval procedure hearing in 2003 : 53 objections by stakeholders
--> Main concern: abolition of flood protection

EIA and “accompanying landscape conservation plan” approved in 2005.

Removal costs: 1,2 Mio. € (planning costs 250.000 €) --> expansive!

Consider: At same time the last large German dam Leibis-Lichte (100 m high, 500 Mio. €) has been constructed
--> Krebsbach Dam Removal a kind of “compensation“?
Removal Process

Removal started in March 2007

Main Steps:

- Sediment trap built directly downstream of dam.
- Fishes and mussels relocated to other waters.
- Emptying of reservoir
- Widening of bottom outlet to a temporary floodway
- Removal started at left side with a slide
Removal Process

Excavated material reused at left flank within impoundment

Sheet pilings pulled (20 m)

Removal of all operation equipment
--> creation of a meandering trapezoid profile in the valley

Location of bottom outlet
= location for passage of channel
= Construction of a bridge over channel

Biological compensation measures
Removal Process

Flood compensation measures in downstream stretches
Sediment consideration

Average height of sedimentation in reservoir: 30-35 cm

Limited contamination although upstream industrial agriculture

Conclusion of analysis: no special measure necessary, sediment can be released without intervention

Planning: Majority of sediments will be bounded by vegetation
Uniqueness of Krebsbach Dam Removal Project:

Preshaped channel (meander) in the former impoundment!

Length: 1.4 km instead of 700 m!

Otherwise the creek would flow on the right side of the impoundment

Reasons:
1) Flood consideration in downstream stretches.
Existing buildings built after dam construction (60s - 80s).
2) Creation of a valuable wetland landscape through vegetation measures

--> Capacity to hold a 10 years flood (HQ10)!
New preshaped creek channel

Active planting

Annual monitoring done until 2017

Impoundment consideration

Constructed:
6 groynes
8 ramps
2 flood pools
1 connection channel
Impoundment consideration
Development after removal

April 2008 – first spring after removal
Development after removal

July 2008

Vegetation grows quickly
Development after removal

October 2009 - Vegetation grows, but not in the planned way.
Development after removal

2010 Bio-Monitoring

1) More nettles (nitrate in the ground) and Willows/Sallows than expected.
2) 22 species of Macrozoobenthos determined (affected by waste water): Small crab, odonata, mayfly, caddisfly and other new flies → improved biocenosis
Repopulation of fishes started after 2007 from Weiße Elster and tributories (except trout)

Fishes have returned slowly → In 2010: 6 fish species

- Stone Loach (Bachschmerle), Eel and Stickleback (Stichling)
- Less abundance: Perch (Flussbarsch), Prussian Garo (Giebel)
- Only Downstream: Brown trout - 3 times more (2009) and river goby (Gründling)
Monitoring until 2017:

Due to two barriers and to low water quality the biocenosis improved lately; and this by:
1) Fish passage installation at upper downstream barrier (other one half passable)
2) Construction of a waste water treatment upstream
3) Two floods in 2011 and 2013

Predicted decrease of water quality in downstream stretches has not happened. Rather the self-cleaning capacity has upvalued the river classification!

Continuing problem: trapezoid channel in the former impoundment → monotonous/uniform (not enough flat water areas)
→ no natural substrate (alluvial clay instead of sand-grave mix)
In Germany several hundred weirs have been removed since 90s

In summer 2007 the 2nd dam, the **Untere Herbringhauser Dam**, has been removed
→ because of „imminent danger“ with no plan approval procedure!!!

In 2011 survey with 11 provincial dam operators:
• Dam Removal accepted as option
• In case of discussions on future of dams there is usually the seek for new purposes.
• dam reservoirs often considered by dam operators as habitat to be conserved!
• also dam reservoirs considered as tools against floods – after big floods between 1997 and 2005
Summary and discussion

However, recently positive development in Germany!

Only in Thuringia 5 more dams planned or discussed for removal:

- The two dams Roth 2 (9.5 m high) and Haina (7 m) will be removed soon
- The dams Wechmar (11.7 m), Engerda (11.25 m) and Noßbach (11 m) are discussed for removal
- In next year more problematic dams will be handed over to Thüringer Fernwasser
  → many of them may be removed

If in other provinces a similar situation, in next decades dozens of dams (not small barriers) may be removed
These two dams will be removed soon!!!