Bavarian Environment Agency

Check dams: verification of necessity and dealing with obsolete structures

Federal State of Bavaria

content

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1. concept for handling of torrential hazards

content:

„Loseblattsammlung“ torrent

- **A** Introduction LBS torrent
- **B** Master plan torrential endangered areas (WGB)
- **C** Integral torrent development concept (IWEK)
- **D** Planning, design, execution
- **E** Operation, maintenance

2. Hazard analysis – torrential endangered areas

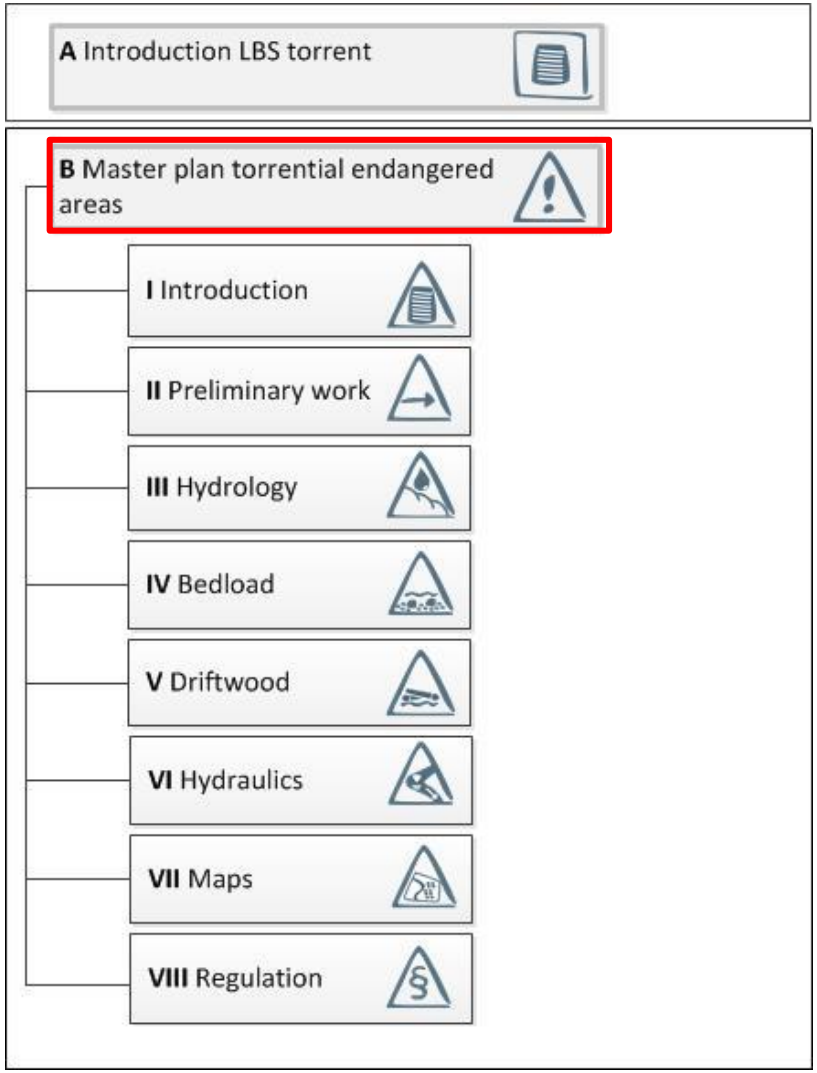
objective:

- the ascertainment of torrential endangered areas is established in the Bavarian Water Law
- the ascertainment has to be executed by watermanagement authorities
- building ban
- traceability, comparability, creation of a standard method

→ establishment of all methods in „Loseblattsammlung“

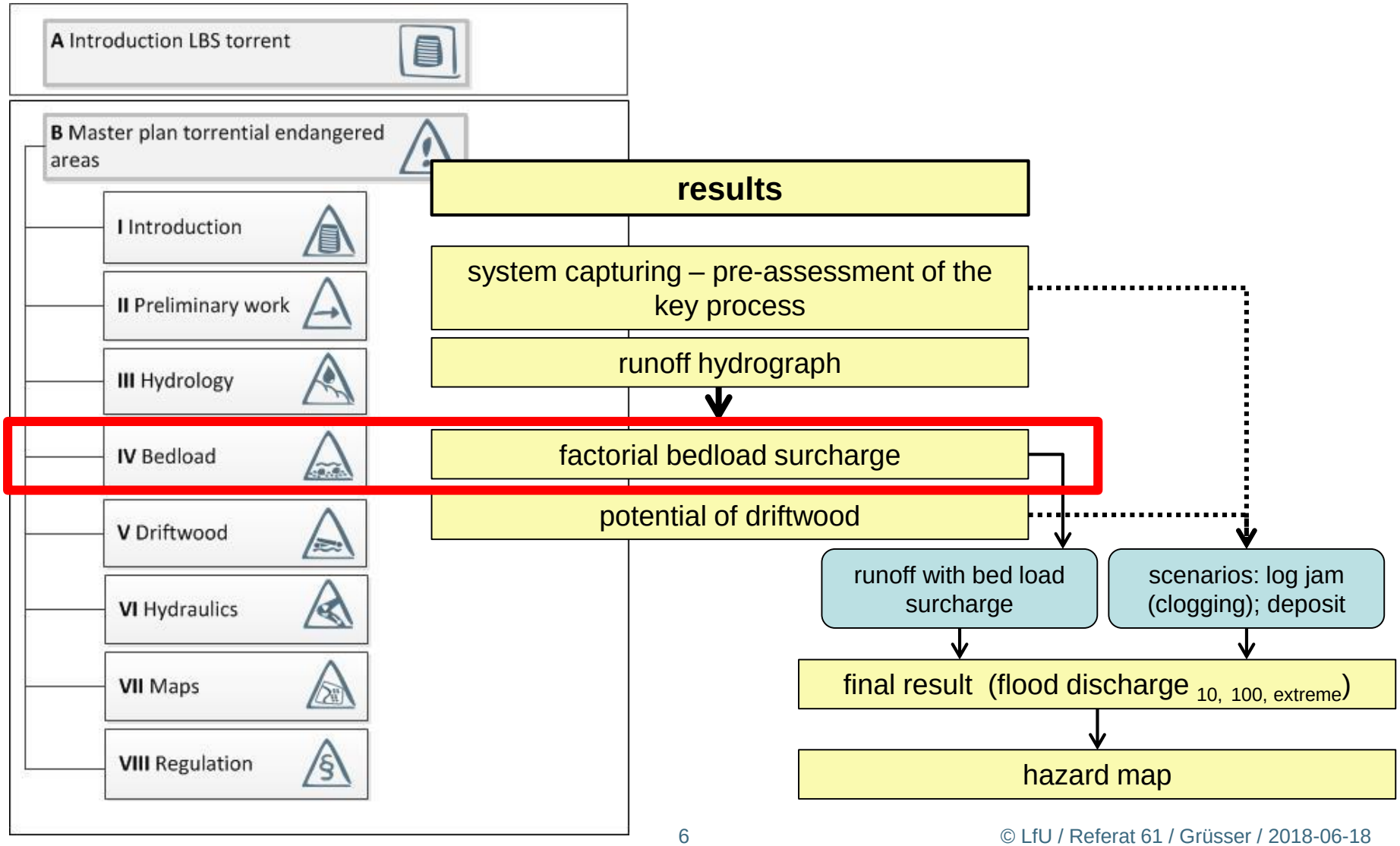
2. Hazard analysis – torrential endangered areas

content of „*Loseblattsammlung*“ torrential endangered areas:



all elements include **specified methods** and **approaches**

2. Hazard analysis – torrential endangered areas



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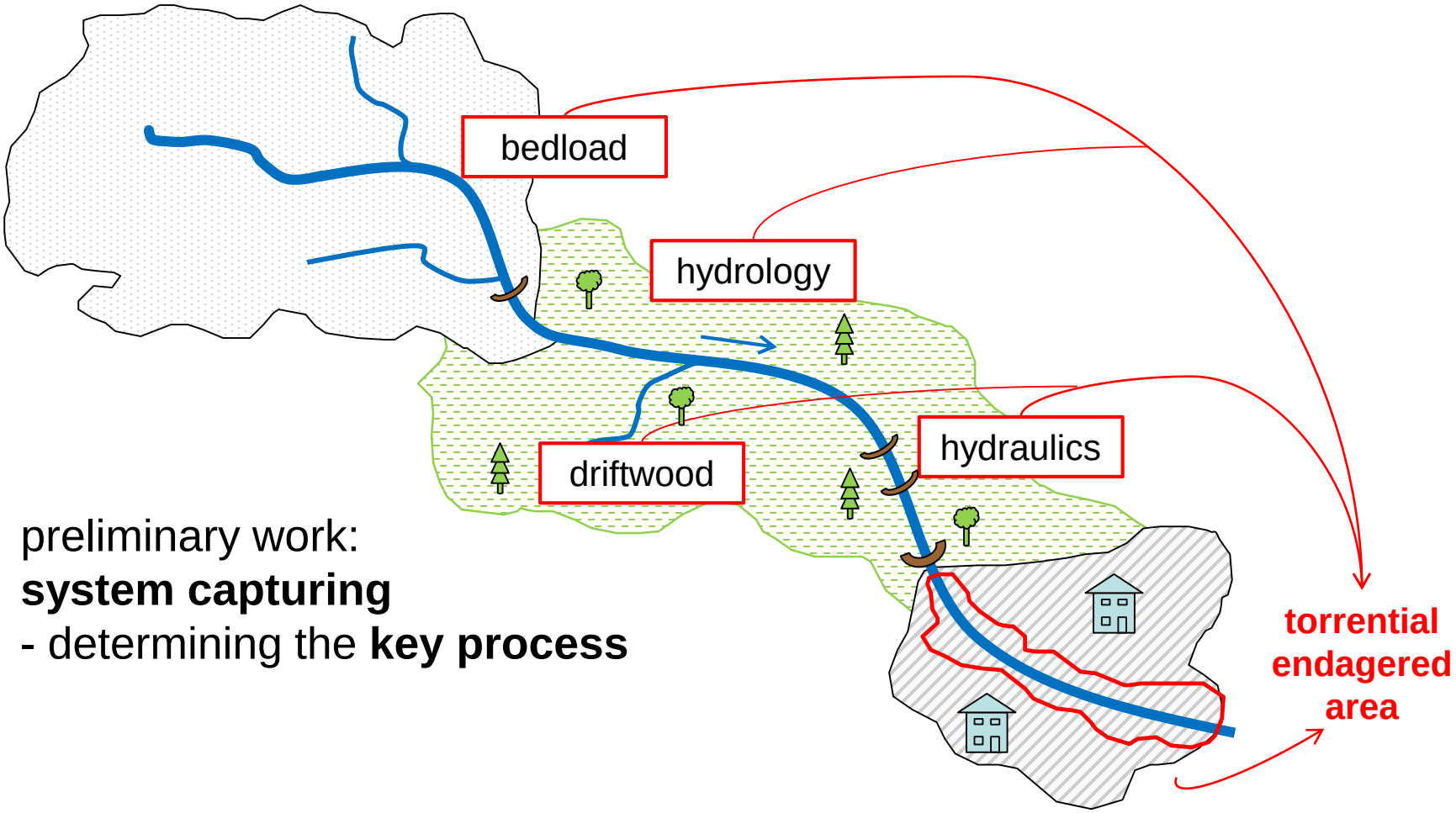


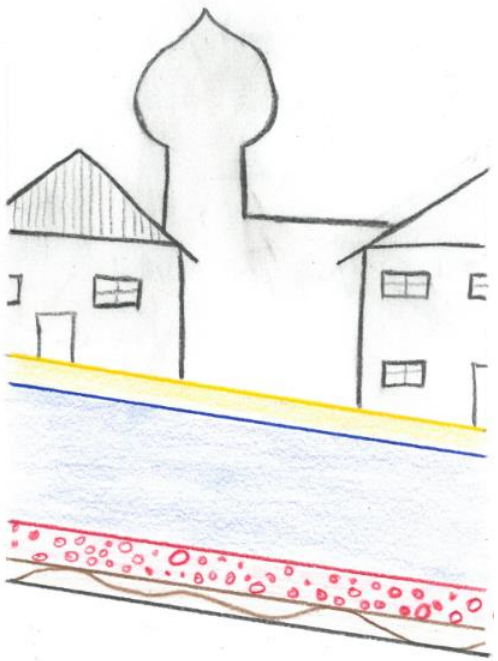
preliminary work:
system capturing
- determining the **key process**

3. Bedload - background

- bedload surcharge
  - moving torrent bed
  - suspended load
  - part of bed load volume
- determination with guided estimates (checklist)

  → increase of design runoff
  + 5% bedload surcharge (at least)

  → considered in channel improvment



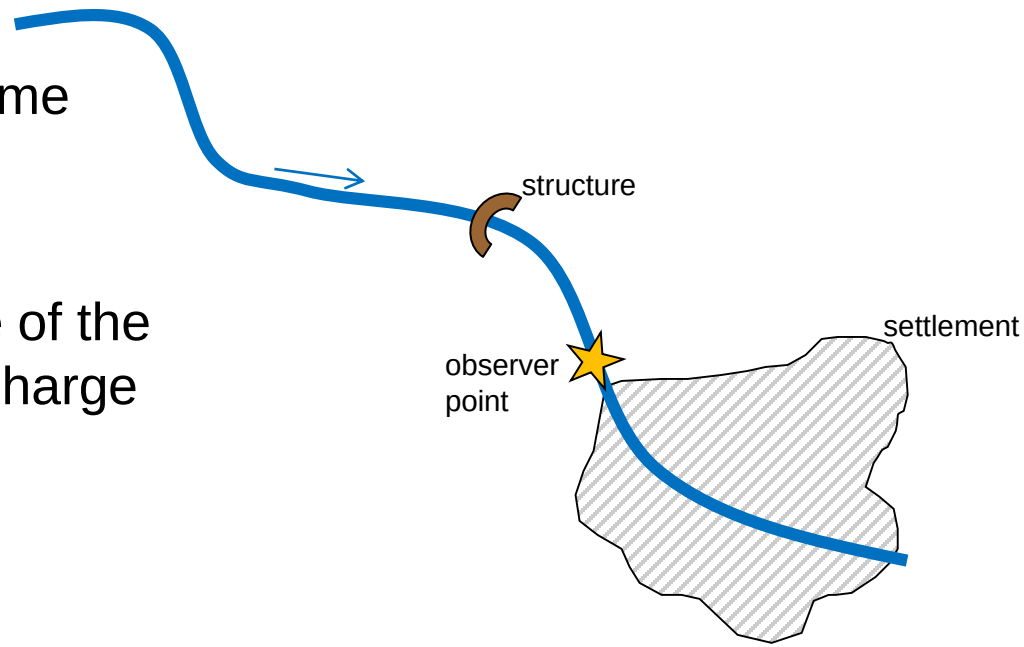
- bed aggradations are taken into account as scenario in the hydraulic model

4. Bedload surcharge – influences

<u>evaluation of structures:</u>

- **function**: retention structures and/or stabilization/consolidation structures
- **location**: the smaller the distance between the structure and the "observer point", the higher the influence of the retention (basin)/ gravel trap on the bedload surcharge
- estimation of total bedload volume and retention volume

→ depending on the influence of the retention (basin) bedload surcharge has to be adjusted



4. Bedload surcharge – influences

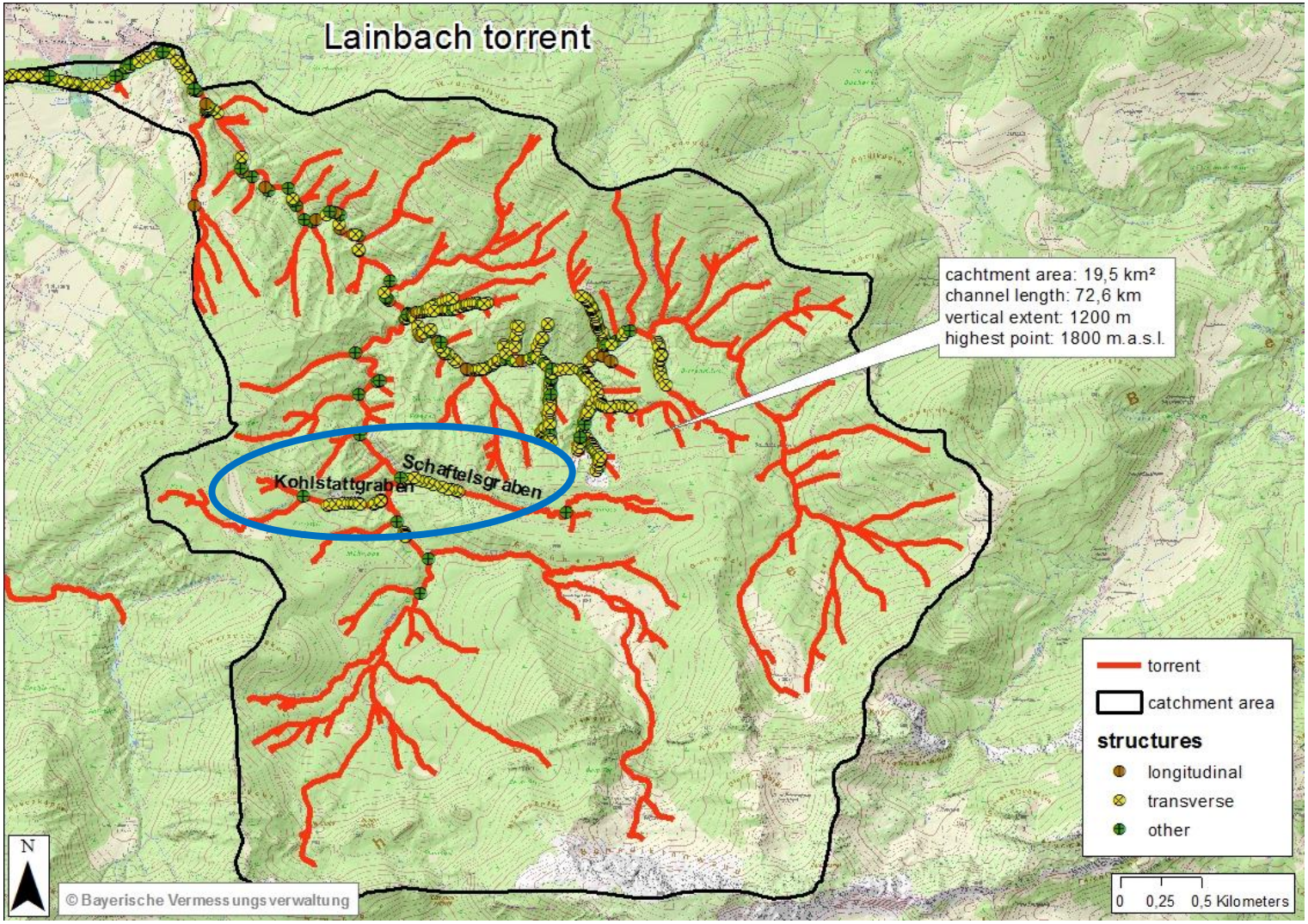
part of checklist

evaluation of catchment properties:

- **process activity**: erodibility
- **vegetation conditions** (eg. (in)stable forest land, natural rejuvenation,…)
- **source of bedload** (main channel)
- **rock classification** in the main channel: thickness of loose material
- **slide deposits** with connection to the main channel/ active slides
- **embankment** state (vegetation, erosion)
- number of **side channels** with **sediment input**
- active sediment-bearing **gullies/ravines**

examples for embankment states

5. Dealing with structures – practical example I



5. Dealing with structures – practical example I

<u>“Lainbach” torrent:</u>

- situation:
  - two side channels with mostly destroyed wooden check dams
  - erosion scars/ gullies
  - bad accessibility

5. Dealing with structures – practical example I

<u>“Lainbach” torrent:</u>

- issues:
  - are the check dams still needed?
    - ➢ are there effects of the check dams on the torrent bed and on the embankment evolution?
    - ➢ are there negative effects due to construction failures?

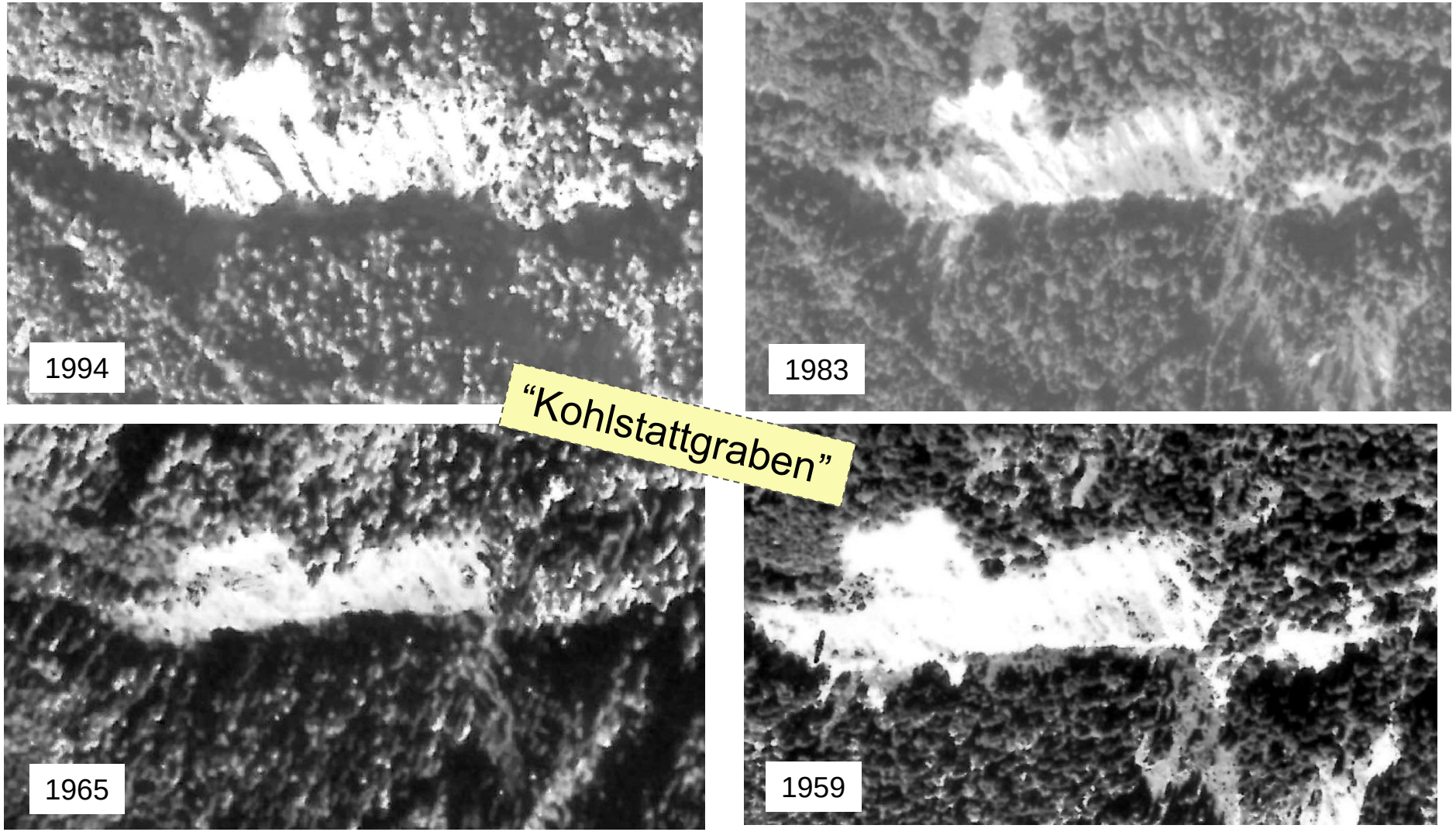
- approach:

  multi-temporal aerial photo analysis (between 1959 and 2015)

5. Dealing with structures – practical example I

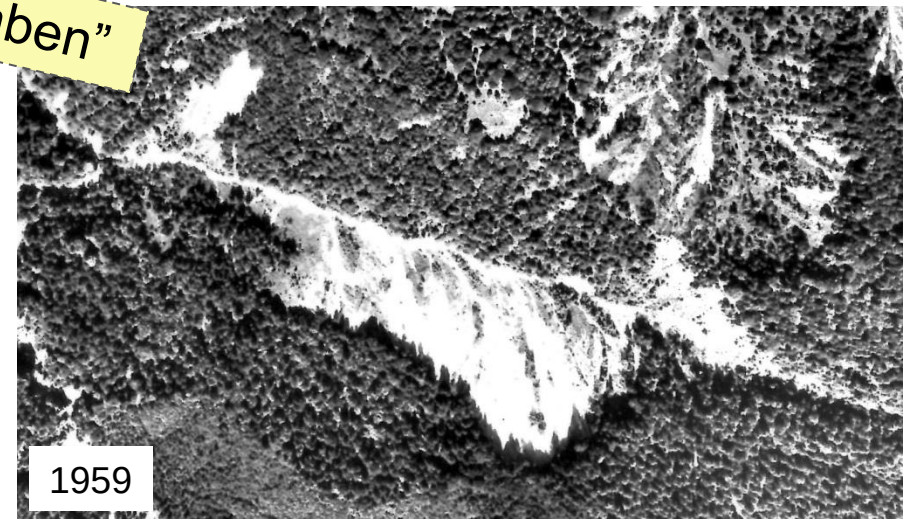
“Kohlstattgraben”

5. Dealing with structures – practical example I



5. Dealing with structures – practical example I

“Schaftelsgraben”

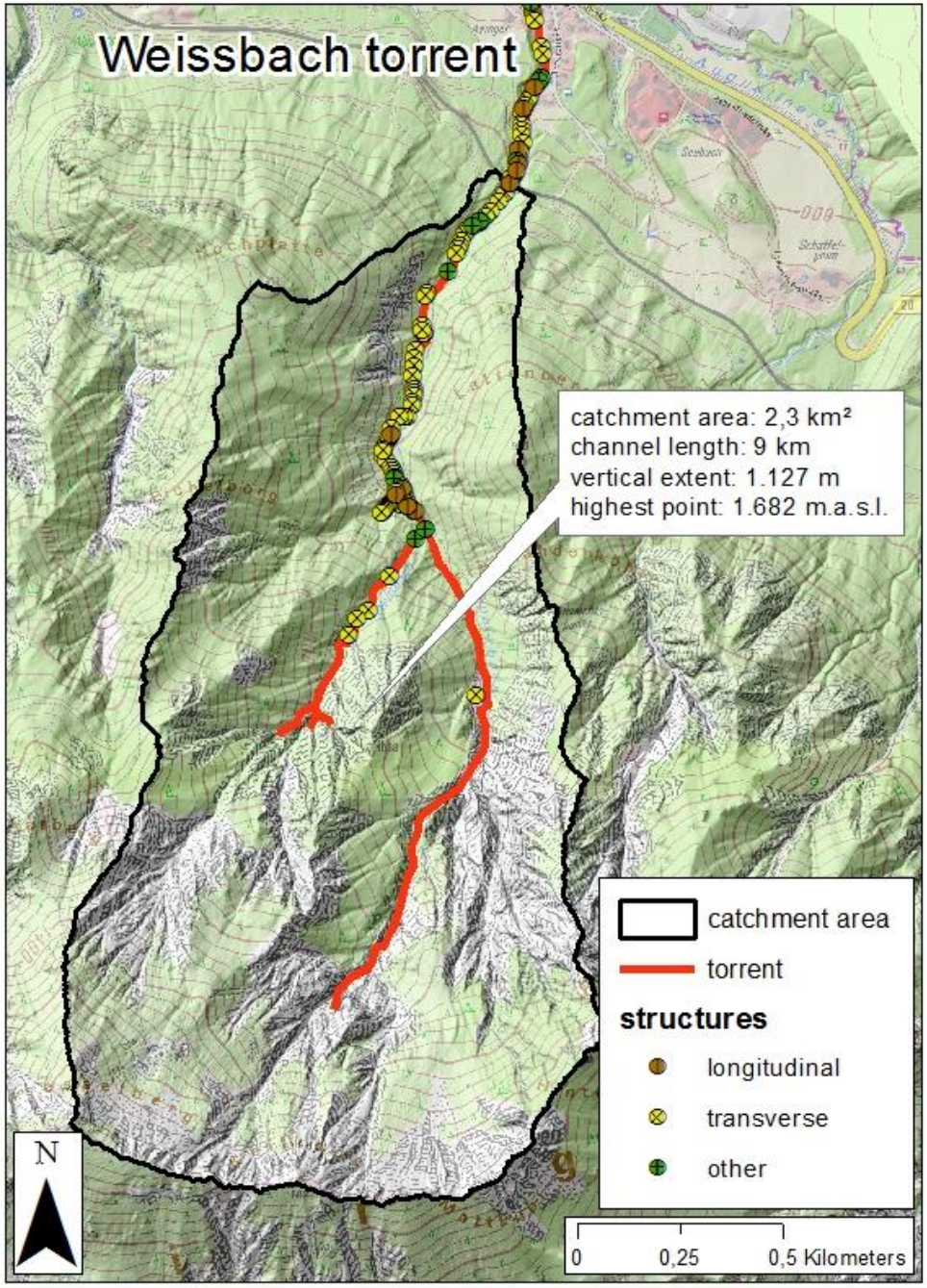


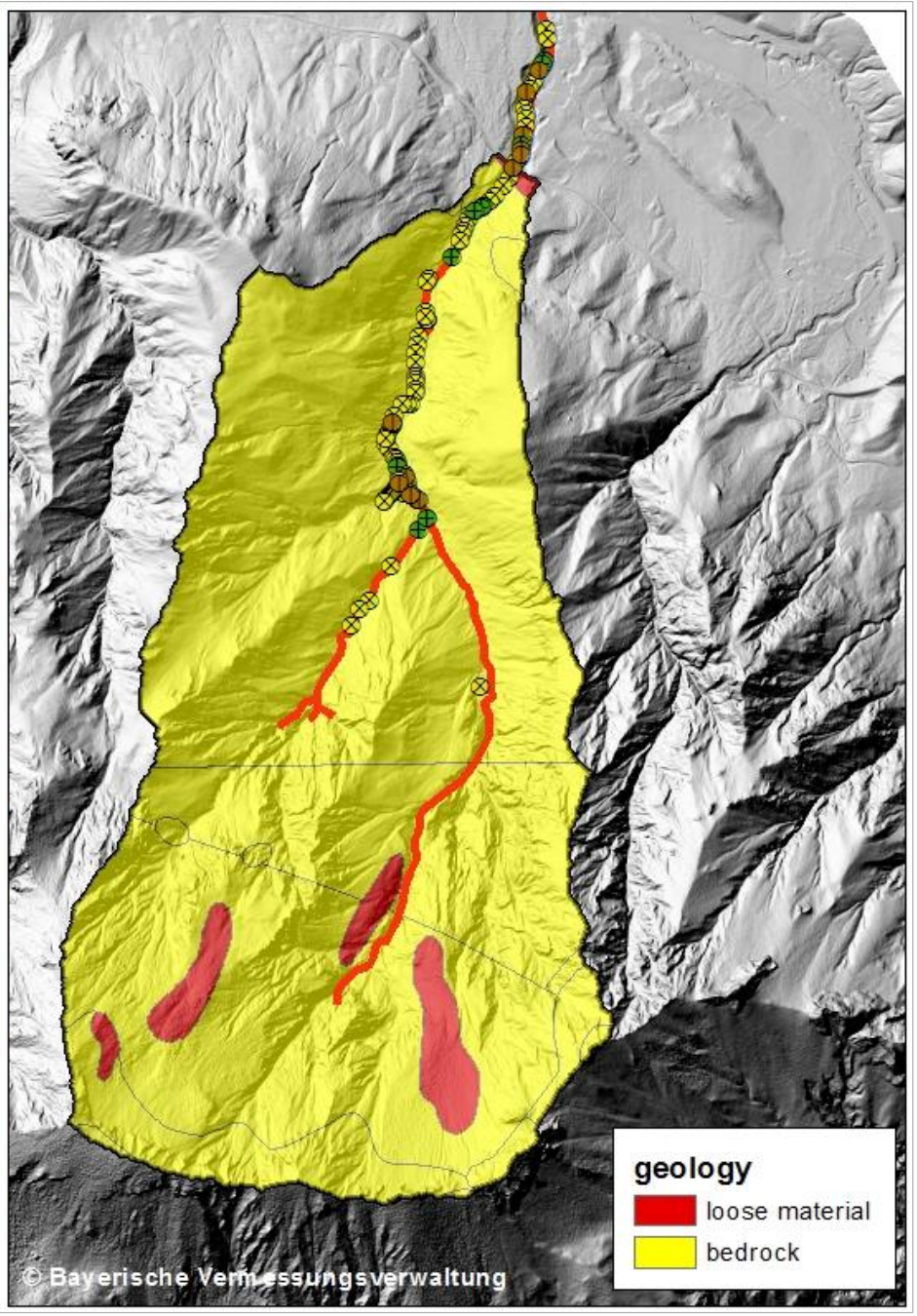
5. Dealing with structures – practical example I

<u>“Lainbach” torrent:</u>

- interpretation:
  - no remarkable development changes (erosion scars, vegetation)
    →check dams could not improve the situation (i.e. reforestation)
    → no degradation due to structure failures
  - big distance to settled areas → minor influence on bedload surcharge

- results and proceeding:
  - reconstruction of check dams will not result in an improvement
    → no benefits of structural measures
  - monitoring measures (focus on failures of the last operative structures
    → effects on overall situation)
  - DoD-analysis (detection of difference) with airborne Laserscan data
    - DTM from 2010 and 2017 (resolution 20 cm)





5. Dealing with structures – practical example II

<u>“Weissbach” torrent:</u>

situation:

- large number of constructions
- side channel with damaged and filled check dam (6.000 m³)
  → bad accessibility

5. Dealing with structures – practical example II

<u>“Weissbach” torrent:</u>

issues:

- in general: is the existing torrent control concept suitable for the entire catchment?

- **especially: how to deal with the damaged and filled check dam?**
  - maintenance necessary?
  - construction failure = debris flow?

5. Dealing with structures – practical example II

interpretation:

- bedrock area:
  - stable torrent bed and embankments
  - only minor bedload supply

  → structure`s aim is hardly understandable

- sediment retention is no longer guaranteed
  → retention basin is now to be considered as bed load supply
  → same or even worse effect as situation without check dam

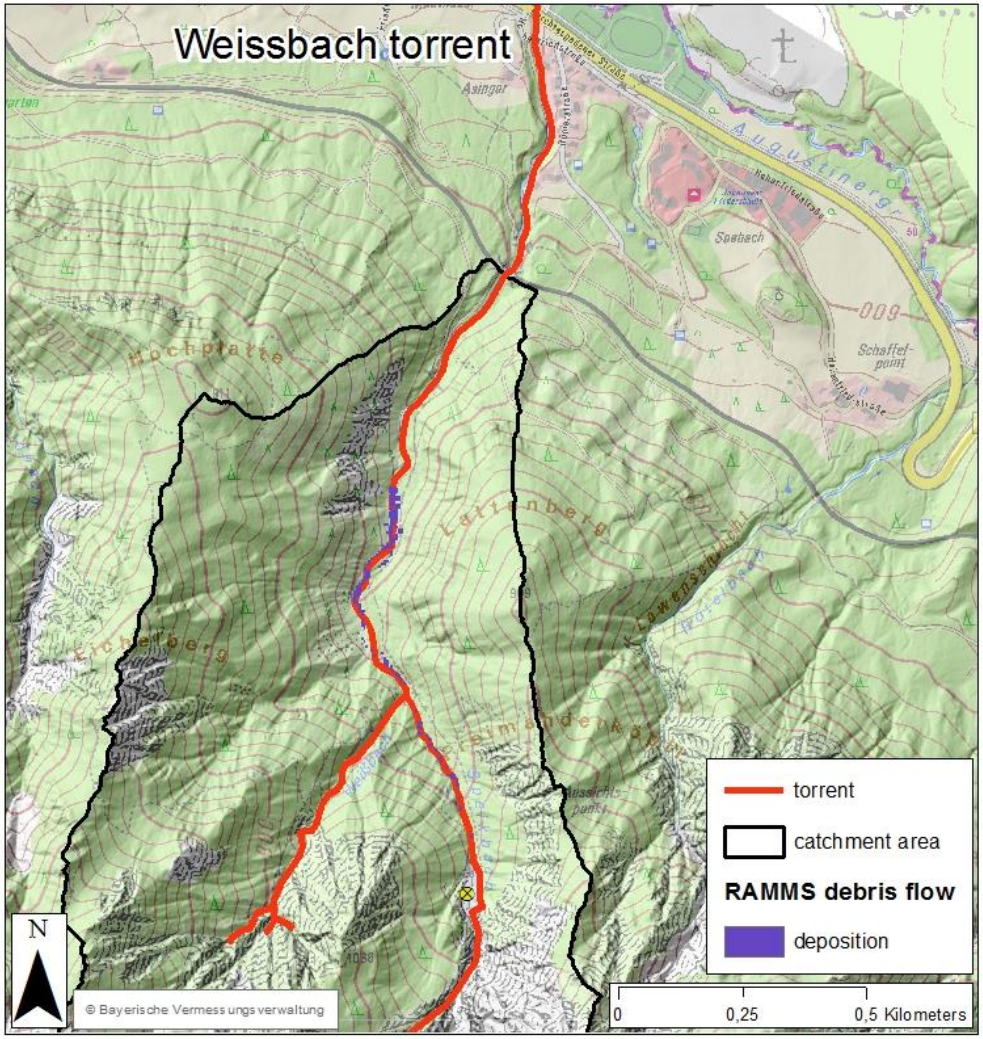
- bad accessibility → expensive maintenance / bedload removal impossible
- reduced sediment transport capability due to energy dissipation in the lower channel sections (drop and pool morphology / check dams)

5. Dealing with structures – practical example II

results:

- RAMMS simulation: potential debris flow does not reach the settlement in case of structure failure / absence of retention structure
  → gradual removal of the check dam
  → basin empties itself gradually

- increased bedload transport during removal period
  → sediment traps further down have to be cleared out regularly



Thank you for your attention

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