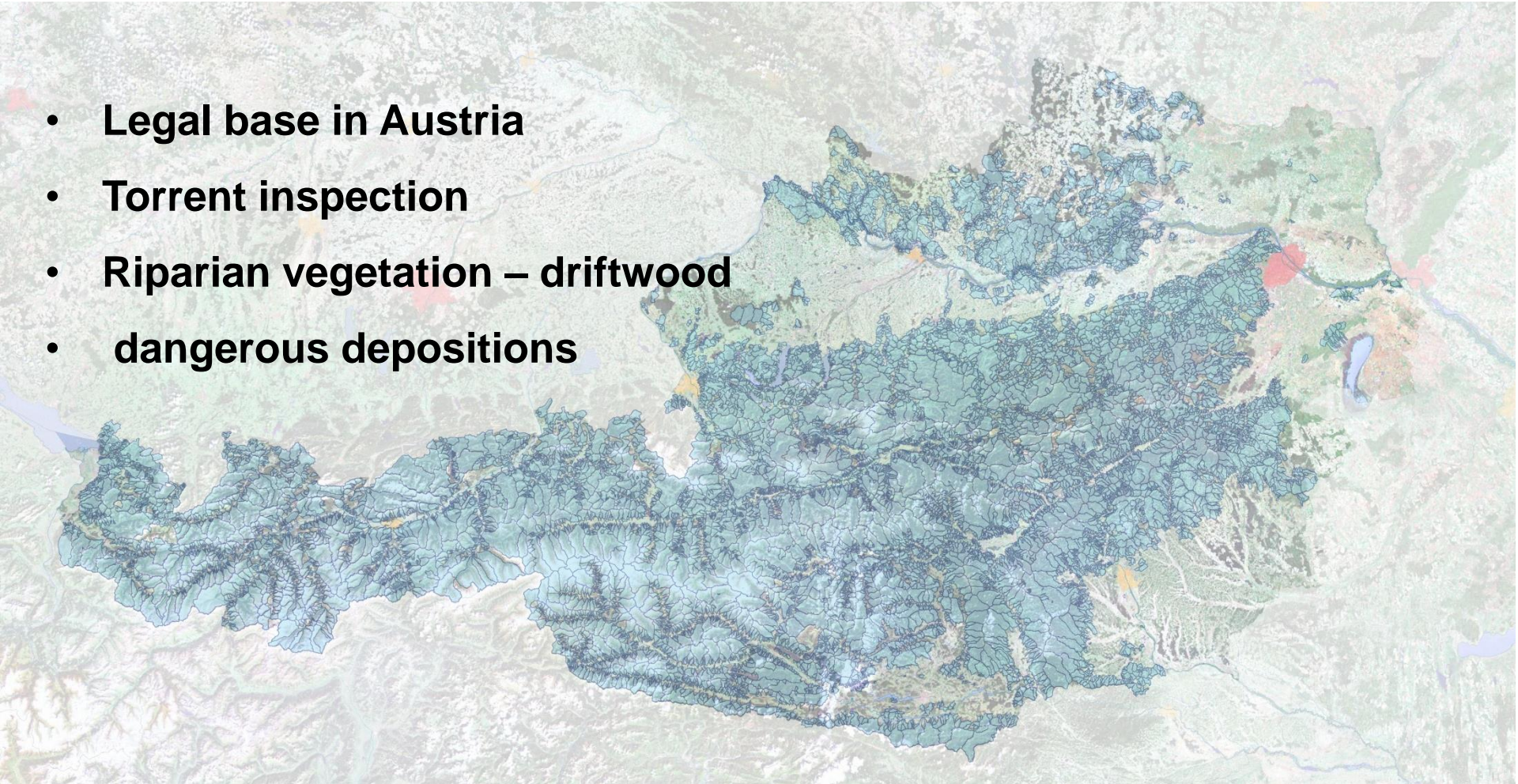


# Critical conditions (flow obstacles) in torrents

DI Felix Schiestl  
DI Thomas Schaller

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- Legal base in Austria
- Torrent inspection
- Riparian vegetation – driftwood
- dangerous depositions



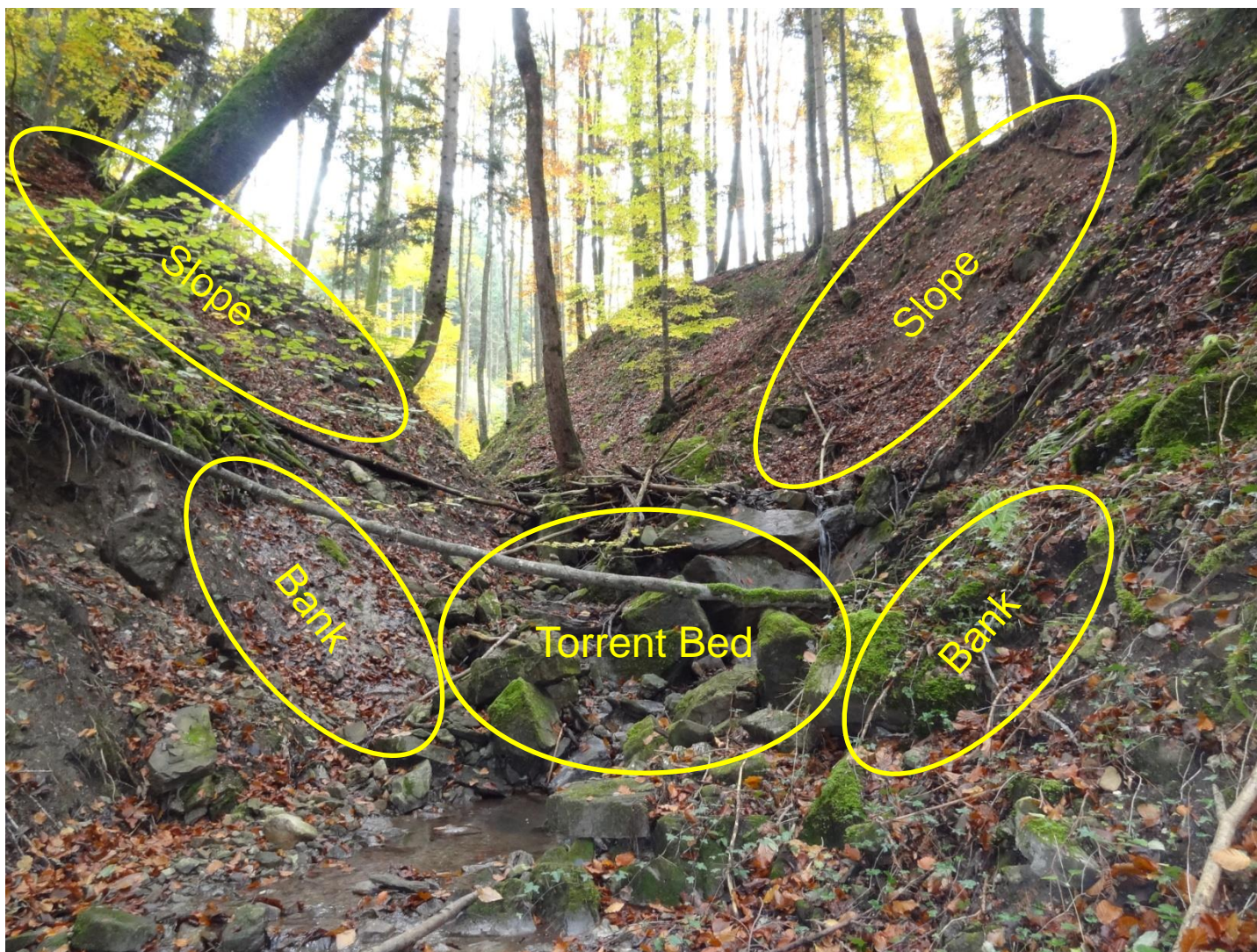
# Legal Basis in Austria

## **NEW since Nov. 2023!**

According to the Forestry Act §101, every municipality with a **torrent** flowing through its territory is obliged to **monitor** the **torrent** and its tributaries and to survey or have surveyed the **sections** within its territory that **are known to be dangerous at least once** a year, preferably in spring after the snow has melted.

The recognisable, possible flood discharge area should be assessed.

# Assessment Area

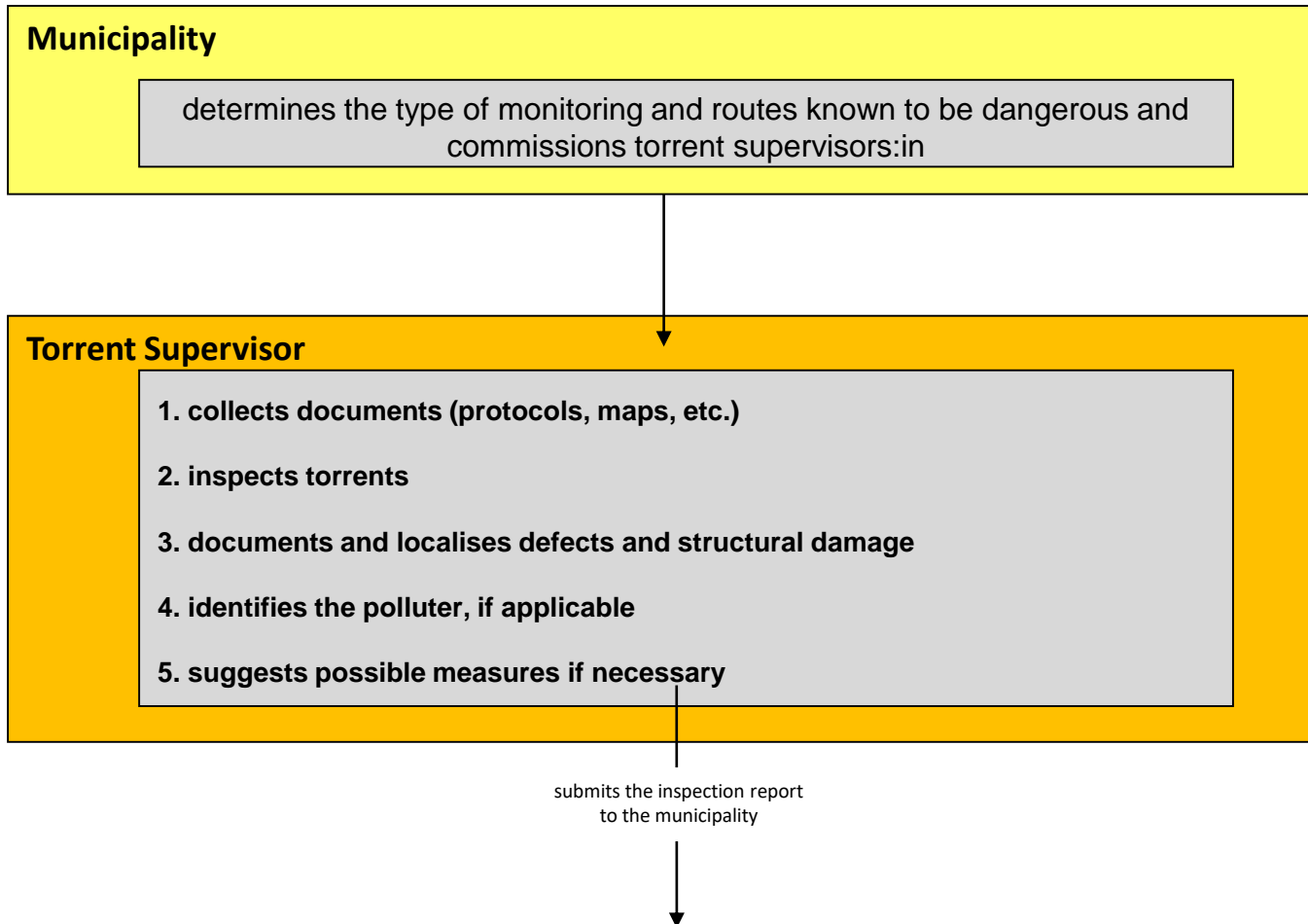


# Area of Assessment

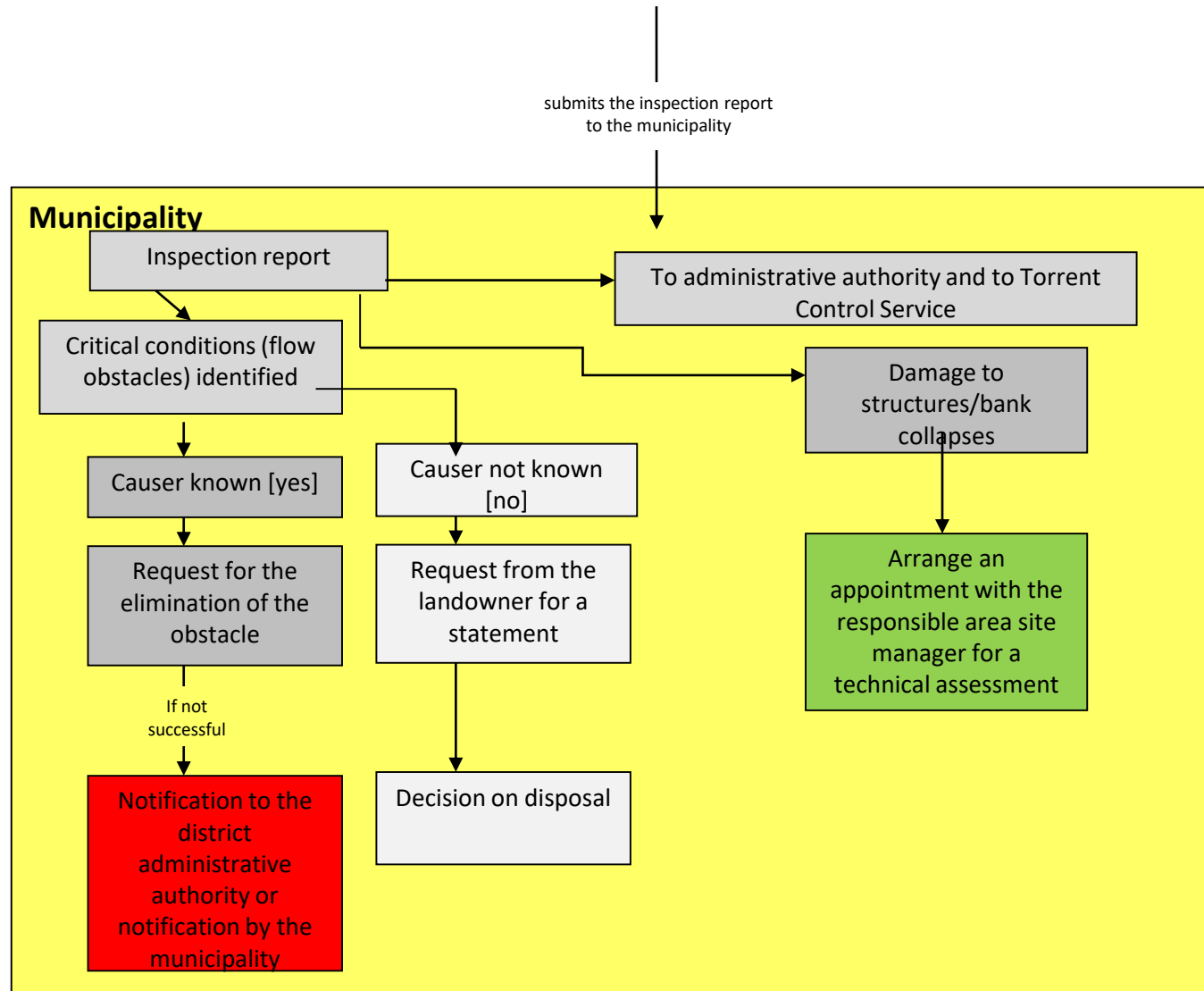
The **removal of any obstructions found**, in particular the presence of wood or other objects obstructing the watercourse, must **be arranged** immediately.

The municipality must **report** to the **authorities** on the **results of the investigation**, any measures taken and their success.

# Workflow of the torrent inspection



# Workflow of the torrent inspection



# Principles of assessment

## Pay attention to the essentials!



**1. discharge obstacles: dangerous deflection or damming in the event of flooding**

**2. objects that can be removed**



# Principles of assessment

## Pay attention to the essentials!



3. artificial or naturally occurring changes to the normal flow of water

4. objects at risk of slipping or falling

# Principles of assessment

## Pay attention to the essentials!

### 5. obvious damage to hydraulic defence structures



# Principles of assessment

**However, not every observation is a critical condition!**



- **Principles for the assessment**

- I. Is a stream outburst possible as a result of the critical condition/obstacle and does this have far-reaching consequences or even affect residential areas?
- II. Are there protective structures in the surroundings and could their function be negatively affected by the critical condition/obstacle?
- III. Is there a risk of blockages directly on site or downstream, e.g. at bridges etc.?

# Deposits and reduction of the discharge profile



## Stream outburst:

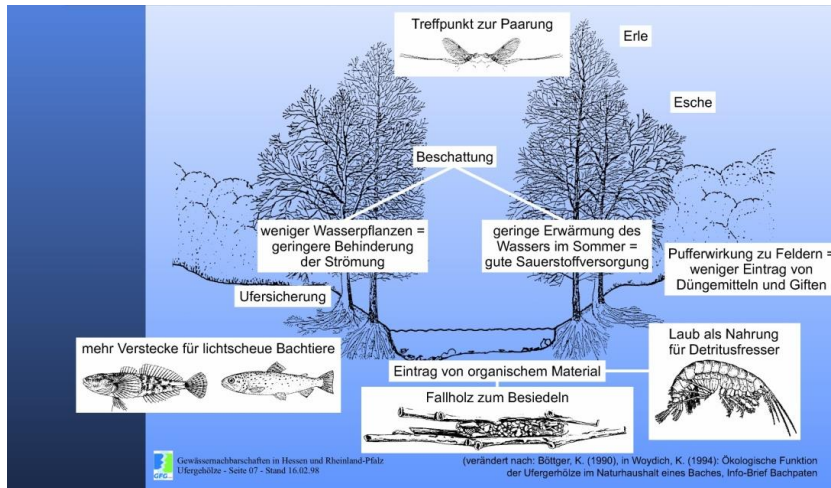
The discharge profile of a torrent has a too low discharge capacity during a flood event, so that overflowing can occur and the stream breaks out of its original streambed



## Blockage:

Temporary blockage of the drainage cross-section of a torrent by driftwood, debris or other material (also manmade objects like cars, silo bales etc.).

# Riparian vegetation and driftwood - Positive effect



**Ecological importance:** creates habitat for numerous animal and plant species. Also supports the natural flow dynamics and morphological development of watercourses.

**Protective effect:** the rooting of the banks and the above-ground plants protect the banks against erosion. In wider sections of the stream, debris and driftwood can be filtered out by the forest.

# Riparian vegetation and wildwood - Negative effect

## Driftwood:

- is a collective term for ‘deadwood’ (i.e. the wood already lying in the stream) and green wood that is freshly carried in during a flood event
- However, driftwood also poses a risk, particularly for urban areas, due to clogging or destructive effects.

# Driftwood

- Clogging lead to the accumulation of water and debris runoff and builds up instable dams. In the event of a **dam (clogging) breach**, the formation of debris flows and an increase in the discharge peak can be caused.
- Trees that slide down the slope or fall into the channel due to windthrow or slope failure can dam up water during heavy rainfall, break open and trigger a runoff surge that far exceeds the normal flood discharge.





# Riparian vegetation and wildwood - Negative effect

- Impairment of the **function of protective structures** (e.g. blockage of the bottom outlet, etc.). Partial or complete blockage of open-crown bedload retention barriers and flood retention structures
- Trees growing into the drainage profile can lead to backwater and **stream bursts** and subsequent **inundation**.



# Why is driftwood such an important topic?



© Bavarian State Forest Service





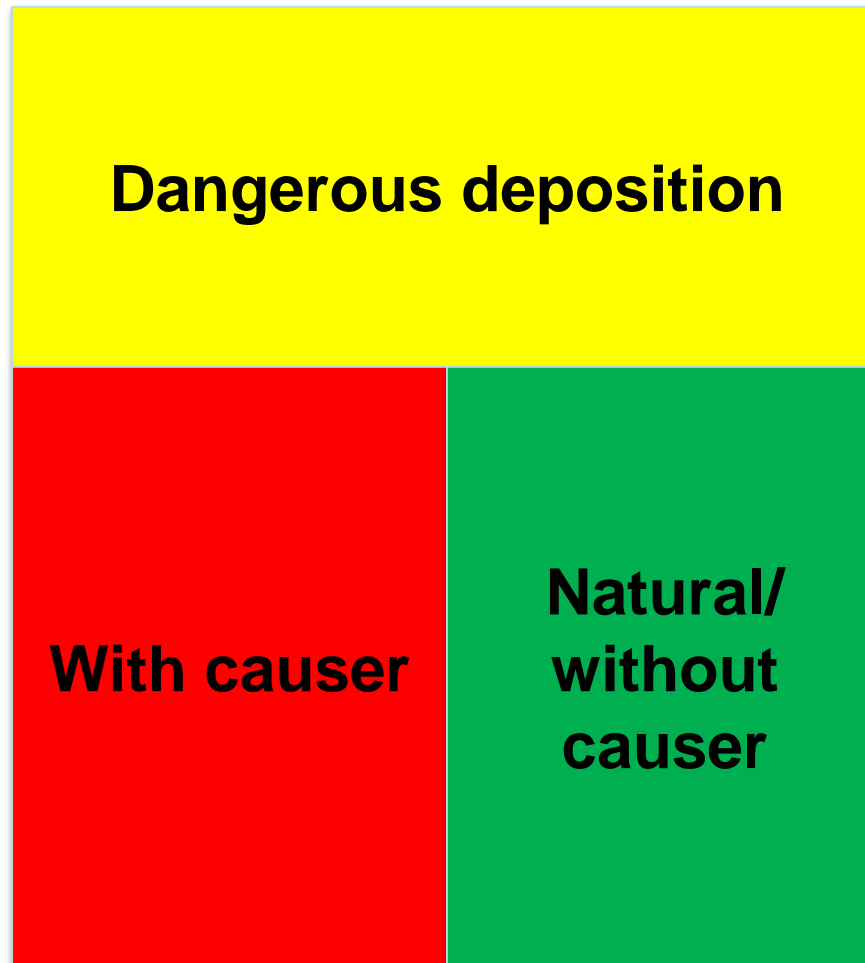






By consistently avoiding or removing driftwood, major damage can be prevented very efficiently with little effort!







# Dangerous Wood Deposition – with Causer!

## Deposits after logging



After forestry work or road construction, wood, pieces of treetop or branch material often remains in the area of the channels. This slash is a frequent and often underestimated source of danger. When cable cranes are used with processors, the branch material is often stored in large branch piles under the road. This is a real source of danger near torrential channels.

Felled wood can be mobilised here by heavy rain and slope failure cause blockages at stream crossings or similar.

# Dangerous Wood Deposition – with Causer!

## Deposits after logging



### **Causer, obligor:**

forest owner, owner of the riparian property, authorised user, log buyer, owner of the property from which the wood originally came.

**The obligation to remove the wood always applies to the person authorised to dispose of the wood** (the person who owns the wood).

**Costs:** since there is usually a clear polluter, they must bear the costs.

# Dangerous Wood Deposition – with Causer!

## Wood storage



In the course of utilisation, wood (logs, poles, whole trees) is stored in the floodplain.

Storage can be ‘temporary’ (max. 1 week in direct connection with felling work) or ‘permanent’ (storage of wood chips for drying, wet storage after beetle infestation...)

# Dangerous Wood Deposition – with Causer!

## Wood storage



### Causer, obligor:

forest owner, owner of the riparian property, authorised user, log buyer, owner of the property from which the wood originally came.

The obligation to clear the land always falls to the person **entitled to dispose of** the wood (the owner of the wood).

# Dangerous Wood Deposition – with Causer!

## Wood storage



### Measures:

If the flow profile is already so severely affected by the occurrence of a small (annual) flood event that a creek breakout and the associated consequential damage is to be expected, and the weather forecast predicts heavy rain for the coming days, the felled wood is to be immediately removed by the person responsible.

The same procedure applies to 'permanently' stored wood as to slash.

# Dangerous wood deposition – without causer (naturally)

## Potential reasons:



1. Avalanche
2. Snow break
3. Wind throw
4. Bank failure or lateral landslide

# Dangerous wood deposition – without causer (naturally)

## Obligor



The party obliged is, in principle, the forest owner or the owner of the riparian property. If the wood comes from neighbouring properties and has drifted onto the property of the stream or has come here by avalanche or gravity, the obligation to clear the wood falls on the owner of the parcel of land from which the wood comes.

However, in most cases it will be difficult to oblige the ‘polluter’ to clear the debris, as a **reasonableness limit** applies.

In special cases, funding programmes from the torrent control service or the state forestry services can be used for the processing.

# Vegetation as an obstacle to discharge

## Obstacle / potential clogging



Especially in the case of small and medium-sized torrents, the flow cross-section of the channel can be severely restricted by unfavourable bank vegetation, so that in the event of heavy rainfall, a direct stream outburst and consequent flooding can be caused or debris jams can be more easily enabled.



# Vegetation as an obstacle to discharge

## Obstacle / potential clogging



### **Obligor:**

Forest owner, owner of the riparian property

### **Measures:**

In easily accessible sections of the shore, the landowner/neighbour (in the case of public water property) can usually be motivated to maintain the riparian woody vegetation on a voluntary basis. The wood then usually goes to the party that carries out the maintenance.

# Vegetation as an obstacle to discharge

## Obstacle / potential clogging



### Measures:

If the riparian vegetation is in a regulated section of the stream, the **consensus applicant** (municipality, water cooperative, road administration, etc.) is generally responsible for maintaining the functionality of the approved construction.

# Unstable growth (slopes) / impending entry of driftwood



If instable trees, that threaten to fall into the stream and slide down, are found during the inspection, the landowner/neighbour should arrange for their preventive removal.

# Unstable growth (slopes) / impending entry of driftwood



## **Obligor:**

Forest owner, owner of the riparian property

## **Measures:**

In the case of easily accessible sections of the bank, the landowner / neighbour (in the case of public water property) can usually be motivated to maintain the riparian woody vegetation on a voluntary basis. The wood then usually goes to the party carrying out the maintenance.

The wood is more useful while it is still on the stump.

# Vegetation as an obstacle to discharge

## Riparian Mangement



1. New vegetation on the bank must be ensured (cane shoots etc.)
2. Trees growing directly in the stream bed should ideally be cleared.
3. Remaining rootstocks with stalks can still have the same negative effect.
4. If it can be assumed that the rootstock that would normally remain can also slip into the stream bed, it should be cleared.

# Vegetation as an obstacle to discharge

## Management of Retention Basins



An expert for torrent and avalanche control has to assess whether the vegetation is permissible.

1. Plant cover consisting of grasses and low, flexible shrubs increases the erosion resistance of slopes.
2. Pay attention to local scour holes that attack the dam body. This results in open areas in the dam which are quickly further eroded.
3. When trees with strong roots die, current channels can develop in place of the rotted roots.
4. Forested retention areas have less retention volume and can become clogged.

# Obstruction to streambed

## Sedimentation / Aggragation



### Bedload/debris

Bedload transport is a key characteristic of mountain torrents.

Deposits in and outside the torrent often result in sedimentation with far-reaching consequences.

A channel cross-section that is sufficiently large in and of itself can thus very quickly be overloaded, causing extensive damage.

Sedimentation is to be considered critical, especially at stream crossings.

# Obstruction to streambed Sedimentation / Aggragation



## Debris/scree

### Causer, obligor:

Mostly purely natural phenomena, in which case there is no polluter.

If there is a polluter, it is not always the landowner, and in the case of material deposits, it is often not easy to determine.



# Obstruction to streambed Sedimentation / Aggragation



## Bedload/screes

If the bedload accumulation/deposition occurs in a regulated river section or near bridges, the consensus applicant (municipality, water cooperative, road maintenance authority, etc.) is generally responsible for maintaining the functionality of the approved structures.

# Obstruction to streambed Sedimentation / Aggragation



## **Waste (pollution)**

can also have a negative impact on runoff (erosion of the banks due to warping of the stream, debris jams, etc.) and also constitute a violation of the Forestry Act and the Waste Management Act.

## **Polluter, liable party:**

The polluter who caused the deposit does not always have to be the landowner; in the case of material deposits, this is difficult to determine.

# Obstruction to streambed Sedimentation / Aggragation



## Waste (Pollution)

### Measures:

If a polluter can be identified, they must also bear the costs of disposal/removal.

If no polluter can be identified, the municipality must eliminate the problem in its own area of responsibility.

# Obstruction to streambed Sedimentation / Aggragation



## Shrub and green waste

Shrub and, in particular, green waste do not usually pose an immediate risk of flooding, but they can also have negative consequences:

- Humic acids can damage riparian vegetation by acidification, preventing plants from growing and making the bank more susceptible to erosion.
- Clogging of narrow points such as pipework etc.

# Obstruction to streambed Sedimentation / Aggragation



## Shrub and green waste

### Polluter, liable party:

The polluter who caused the deposit does not always have to be the landowner, and in the case of material deposits, it is difficult to determine.

### Measures:

If a polluter can be determined, the general procedure due to water law applies.

If no polluter can be determined, the municipality must eliminate the nuisance within its own sphere of influence.

# Obstruction to streambed

## Built-in structures



Artificial structures and built-over section can also cause extensive damage if they are improperly constructed or poorly maintained

If these can have hazardous effects, they must be documented in any case.

### **Polluter, obligor:**

builder of the structure, landowner (including legal successor!)

### **Measures:**

If a polluter can be identified, the general procedure due to water act applies.

If no polluter can be identified, the municipality must, in the worst case, eliminate the problem within its own jurisdiction.

# Obstruction to streambed

## Built-in structures



### **Buildings, bridges, walkways:**

In the case of buildings, bridges and walkways, the building inspection department or building authority should be consulted in order to determine the appropriate measures.

# Obstruction to streambed

## Built-in structures



### Damming, Rakes

Small amounts of debris can often be removed by the person who created the damming (obstacle).

Only when the problem is recognised will the solution be sustainable.





# Obstruction to streambed

## Built-in structures



### **Water diversion, water discharge**

Above all, direct and unprotected surface water discharged into embankments can have far-reaching consequences, such as triggering bank breaks, etc.

Discharge pipes can be carried away and act like driftwood.

### **Measures:**

In such cases, the general approach due to water act applies.

# Obstruction to streambed

## Built-in structures



### **Water diversion, water discharge**

Above all, direct and unprotected surface water discharged into embankments can have far-reaching consequences, such as triggering bank breaks, etc.

Discharge pipes can be carried away and act like driftwood.

### **Measures:**

In such cases, the general approach due to water act applies.

# Bank raptures



Bank raptures are a natural process in mountain torrents and **typical of mountain torrents**.

However, bank raptures in extremely unfavourable places or cracks that are noticeably **atypical** or particularly large for the individual mountain torrent must be documented and reported to the municipality.

The municipality can request a professional assessment by an expert of the locally responsible torrent control service.

# Bank raptures



Pointed overloading of the bed load, as well as bed load impacts caused by large bank collapses, often lead to sedimentation with far-reaching consequences. A channel cross-section that is sufficiently large in and of itself can thus very quickly be overloaded, causing extensive damage. When it comes to slope failures, the cause of the landslide should be clarified (e.g. introduction of surface water, road drainage), as there may be a polluter here as well.



"Strange! According to the description, is there supposed to be a torrent barrier here?"

"Never mind – I'll find it anyway!"

***Thanks for your kind attention!***

