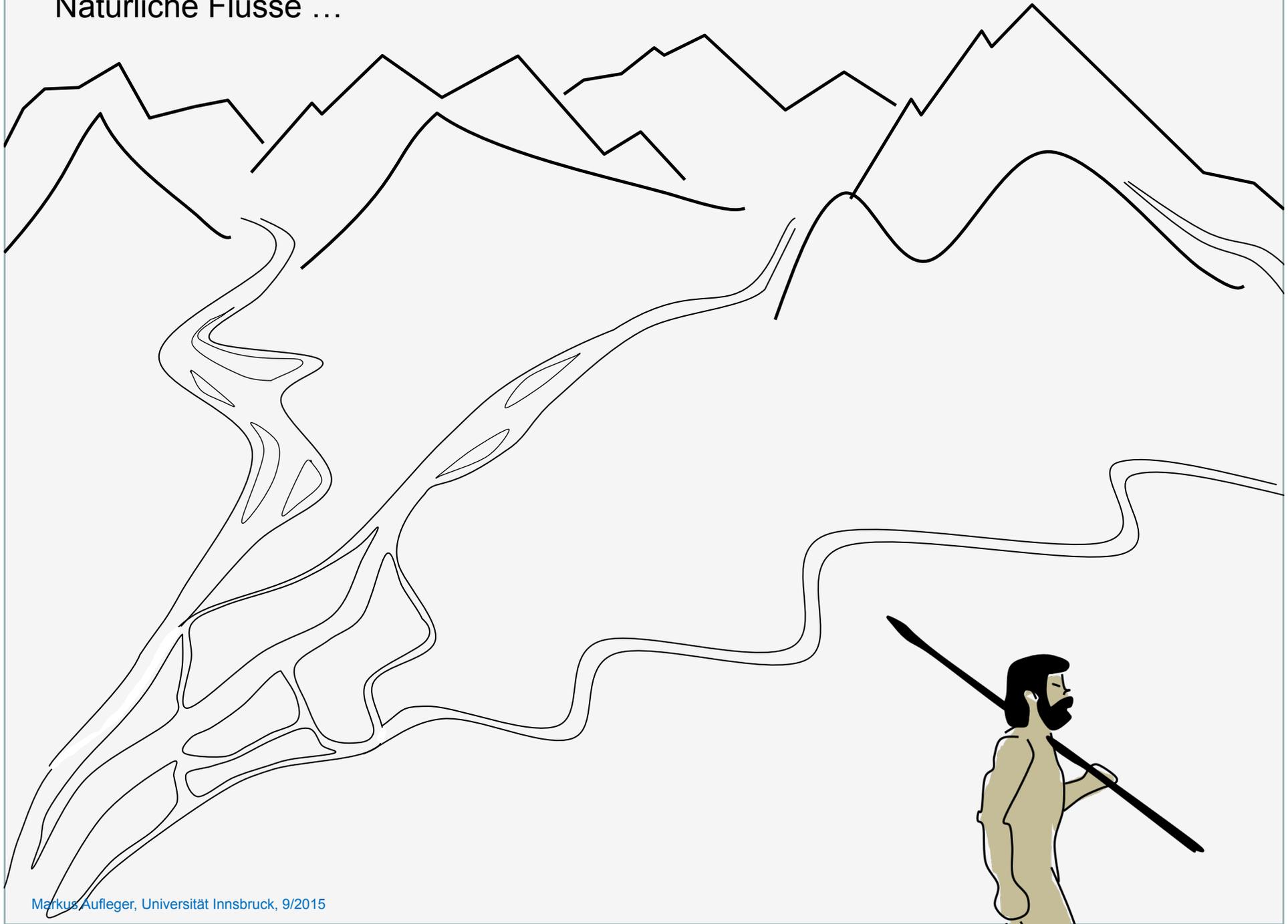


# Gesteigerter Hochwasserrückhalt durch naturnahe Retentionsräume und technische Schutzmaßnahmen

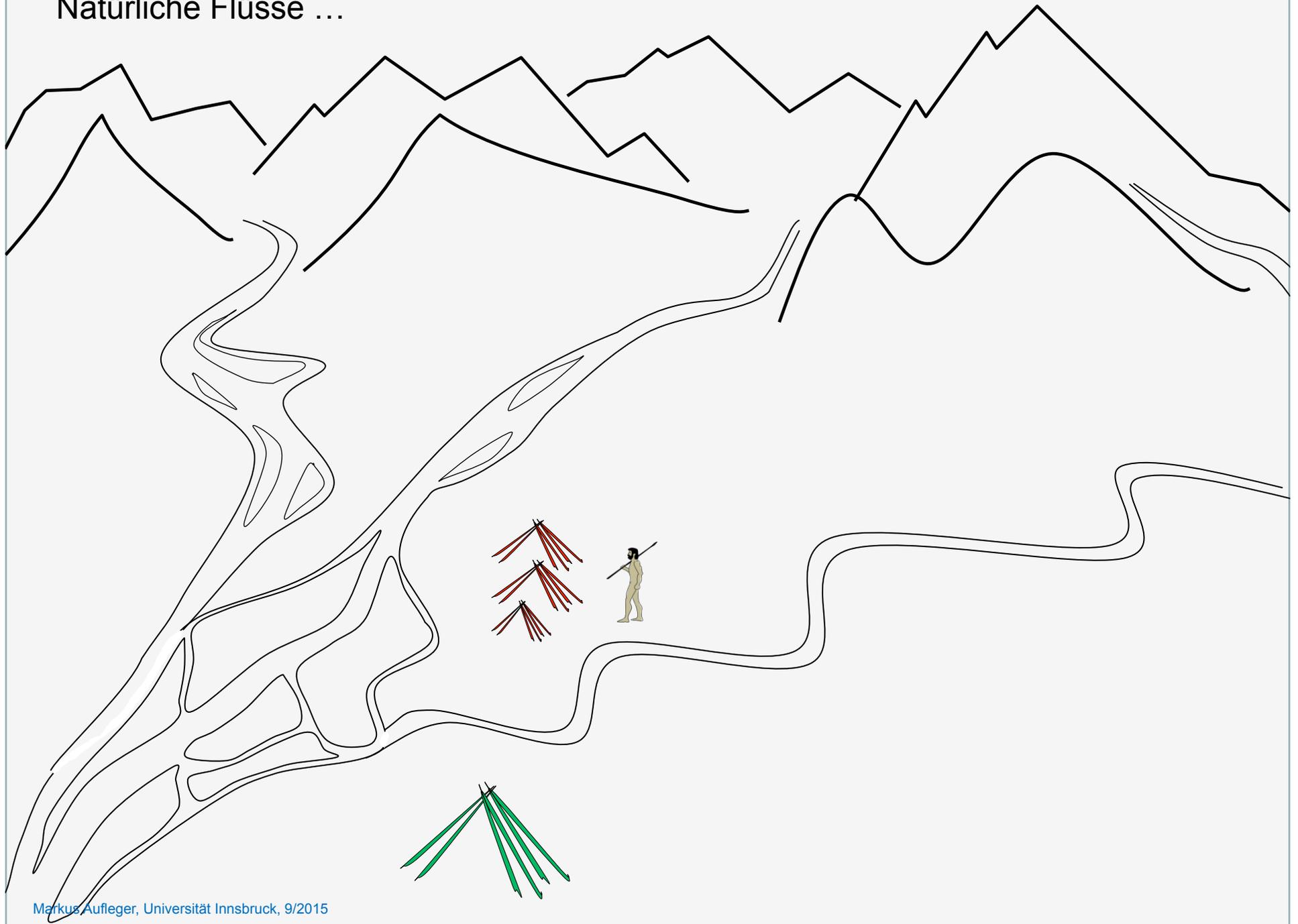
Markus Aufleger  
Münchsmünster, 25.9.2015

so war das ...

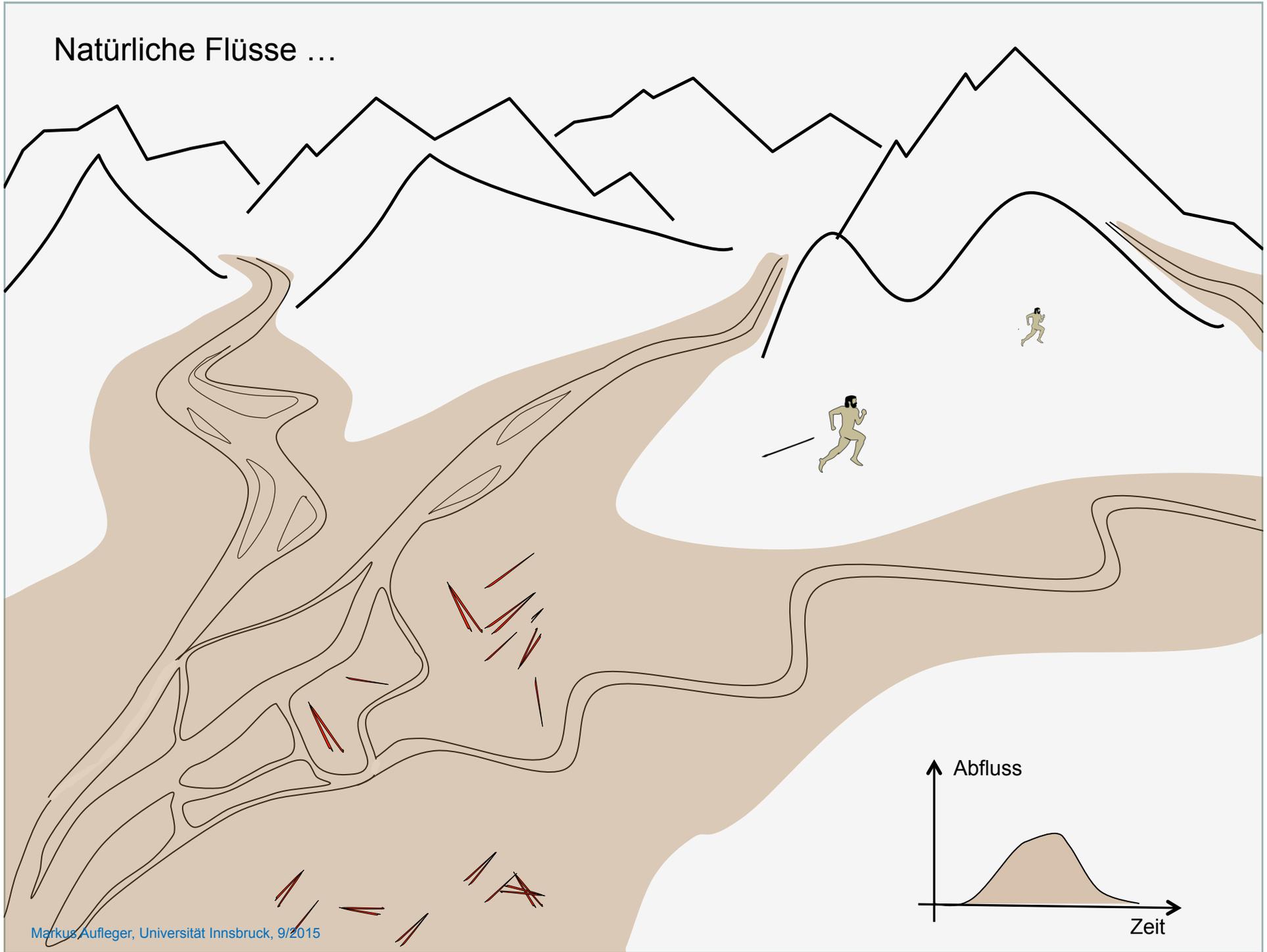
# Natürliche Flüsse ...



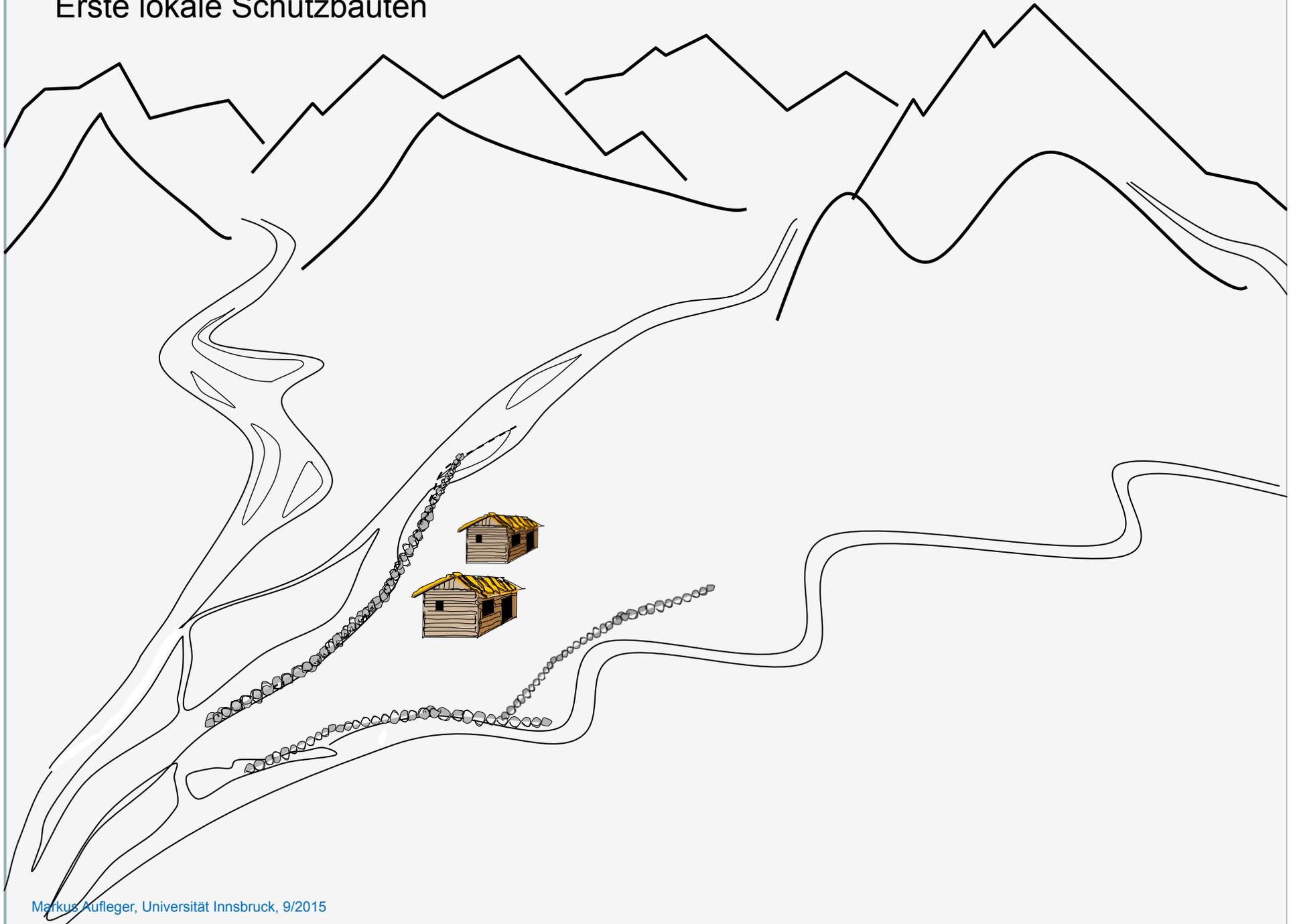
# Natürliche Flüsse ...



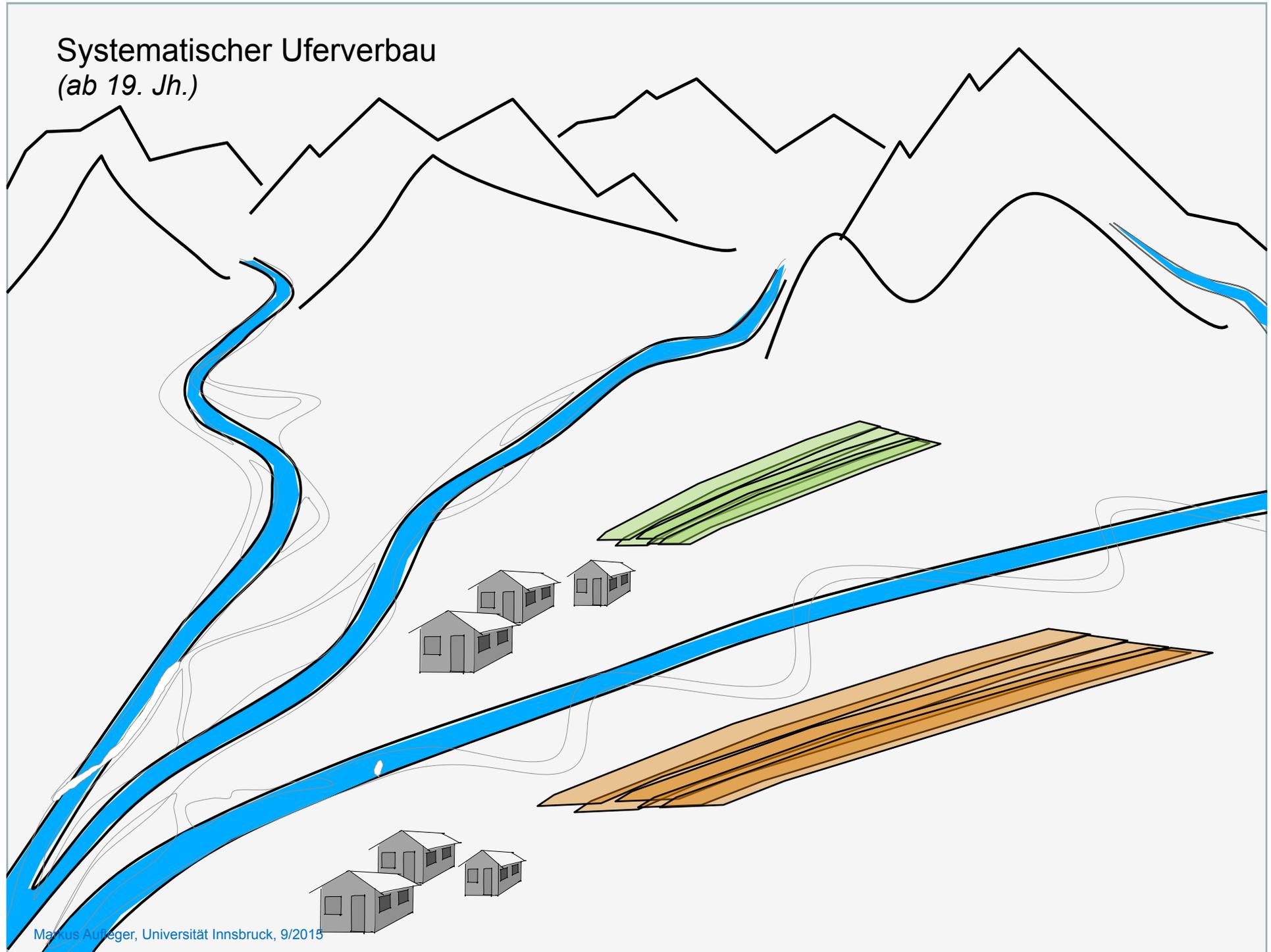
# Natürliche Flüsse ...



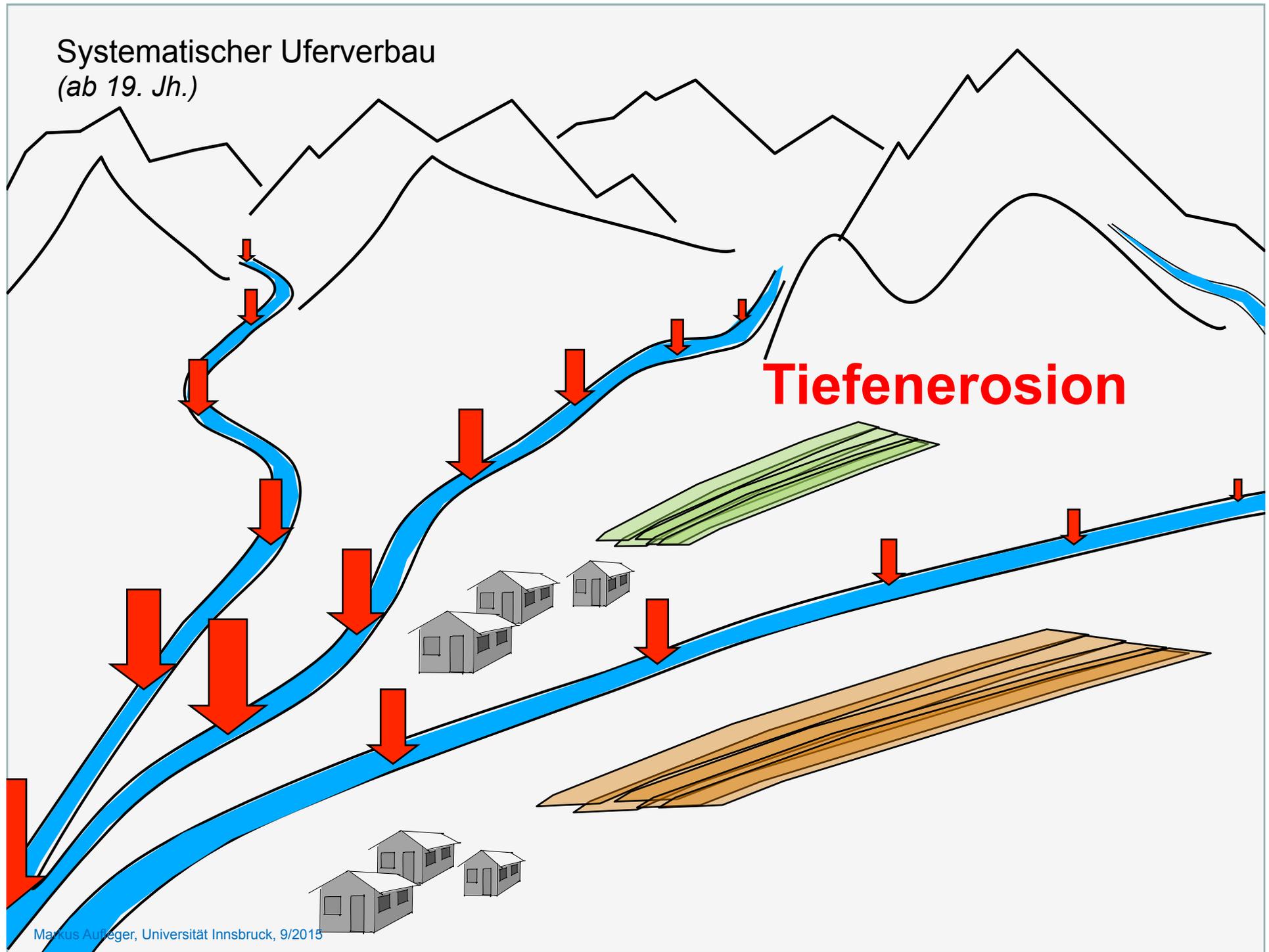
# Erste lokale Schutzbauten



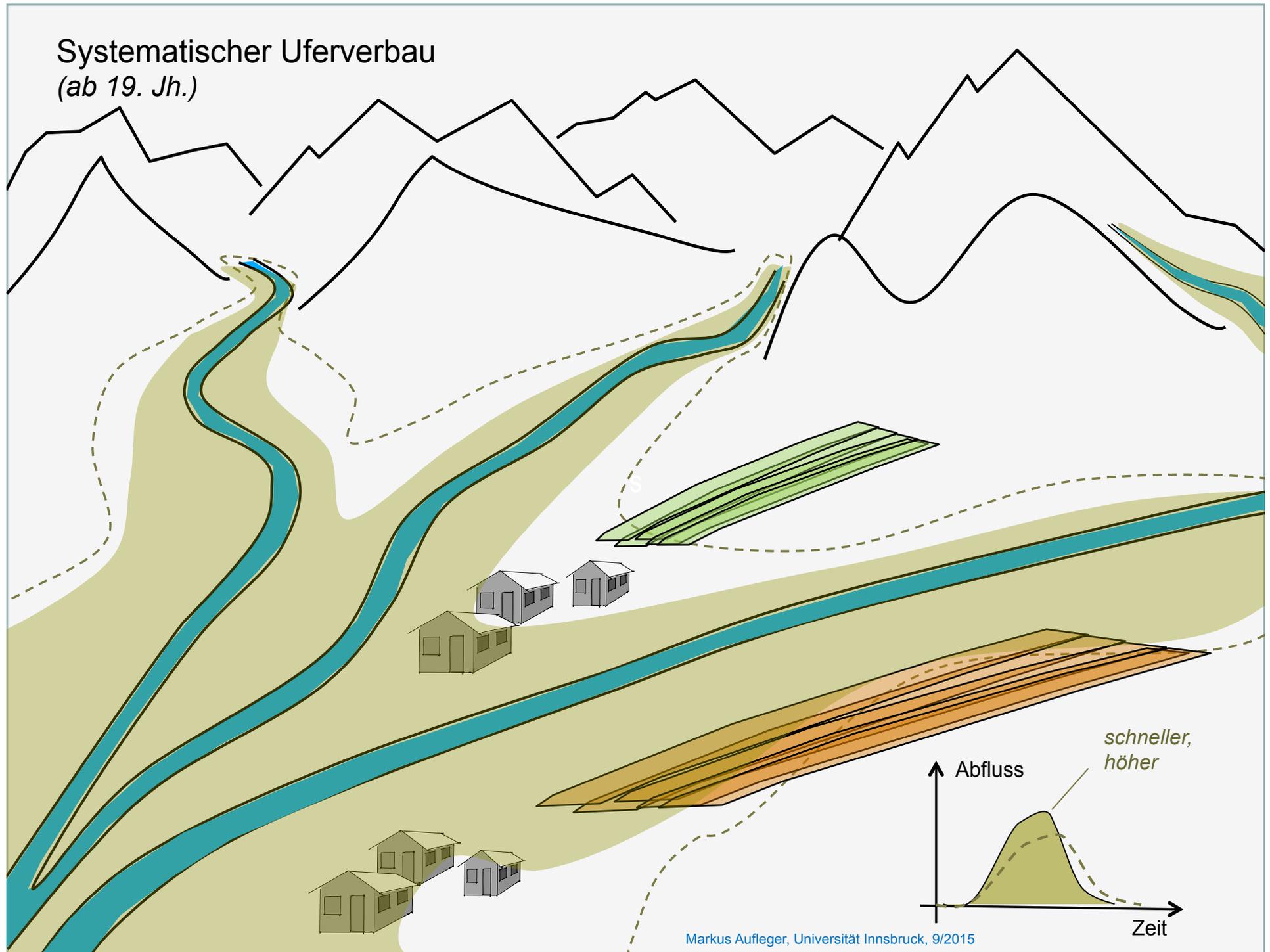
# Systematischer Uferverbau (ab 19. Jh.)



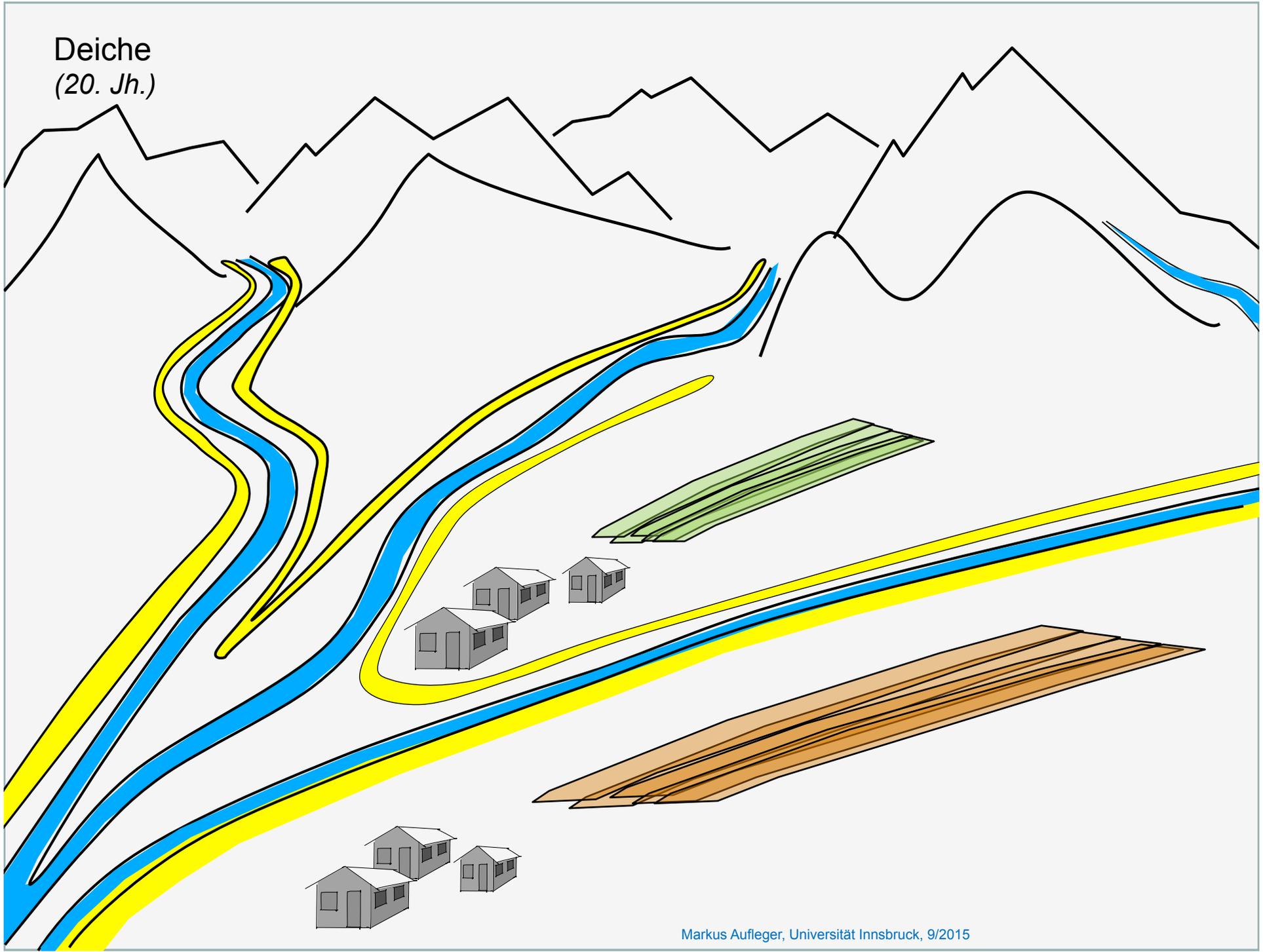
# Systematischer Uferverbau (ab 19. Jh.)



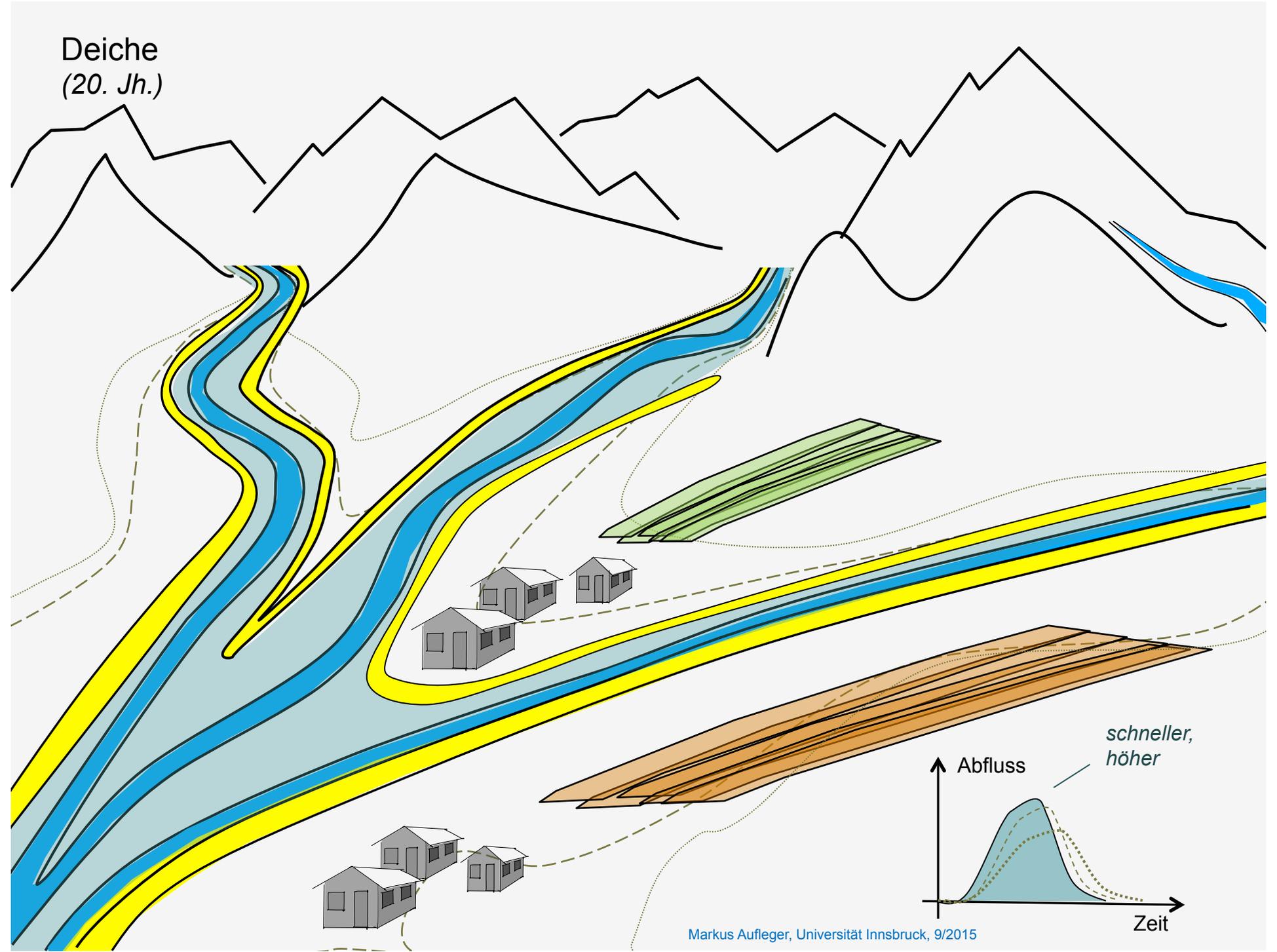
# Systematischer Uferverbau (ab 19. Jh.)



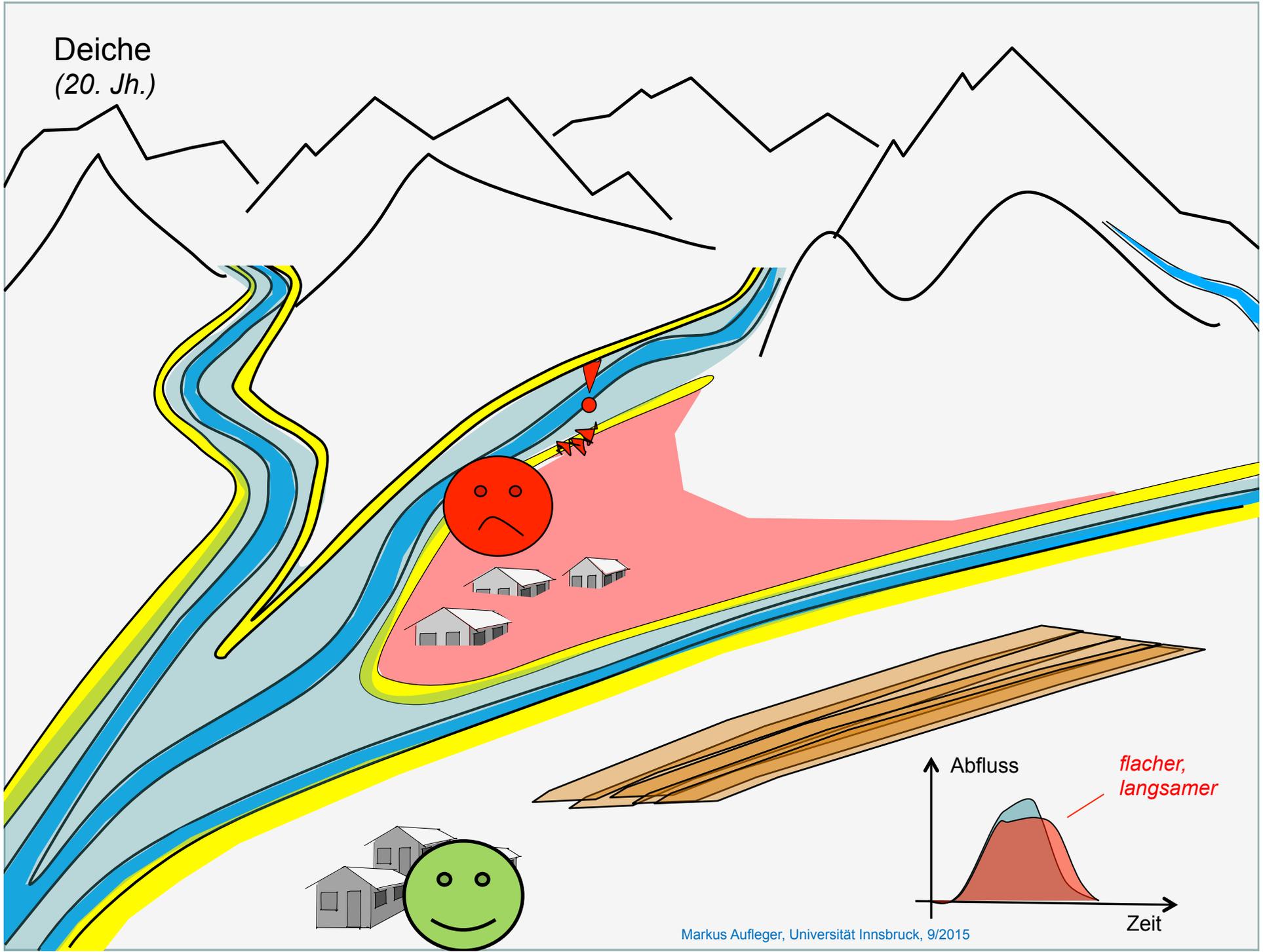
Deiche  
(20. Jh.)



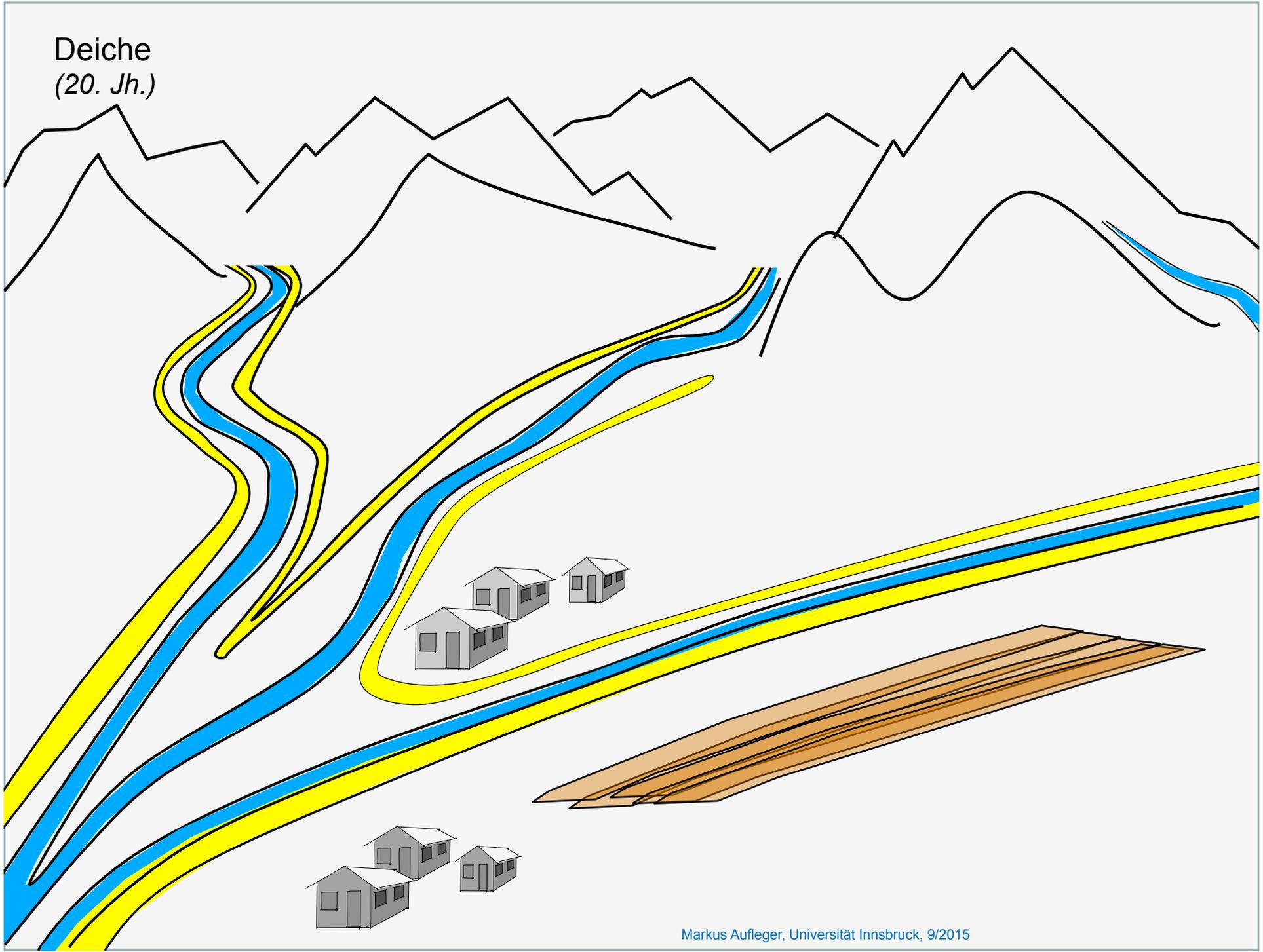
# Deiche (20. Jh.)



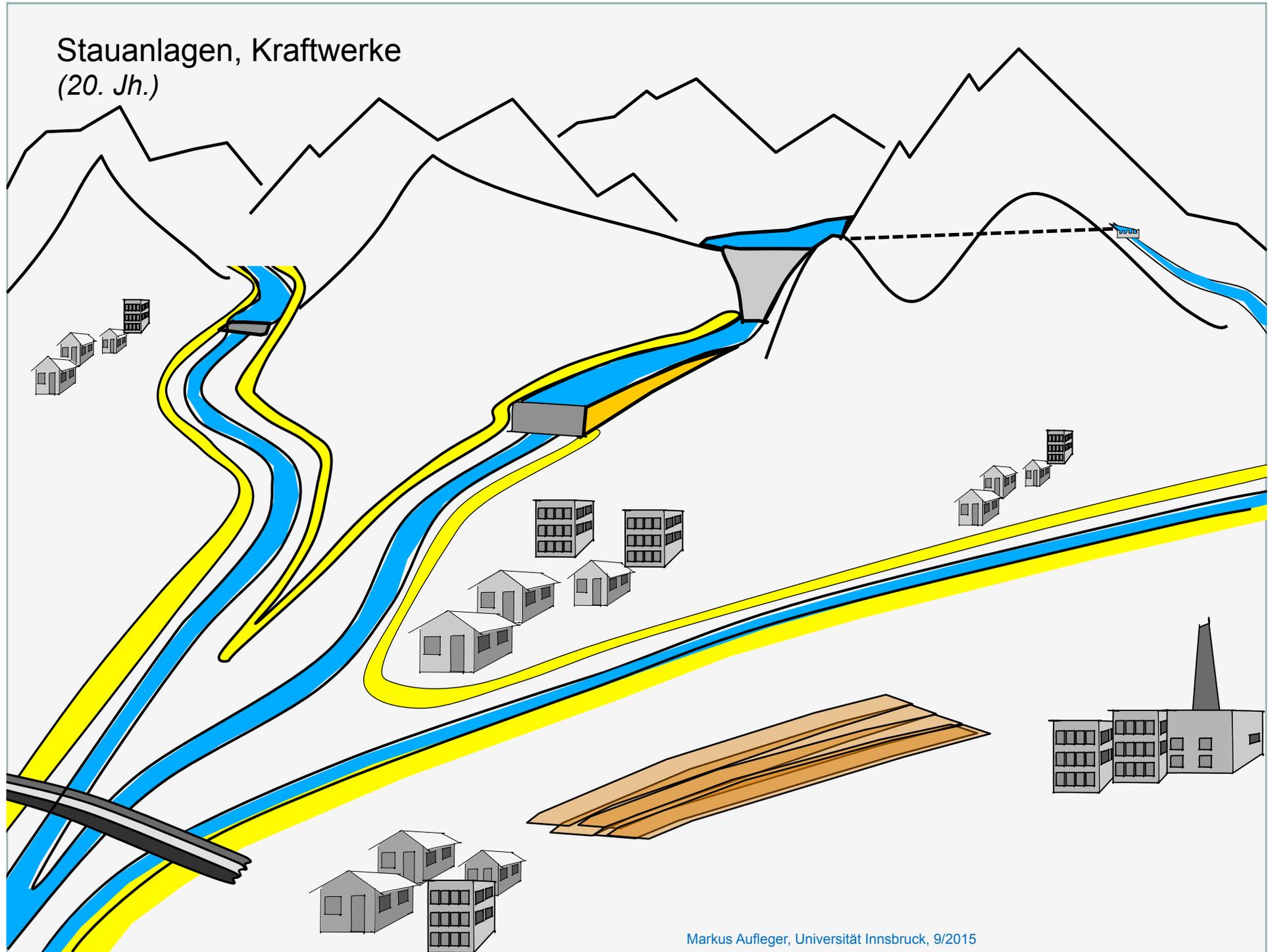
Deiche  
(20. Jh.)



Deiche  
(20. Jh.)

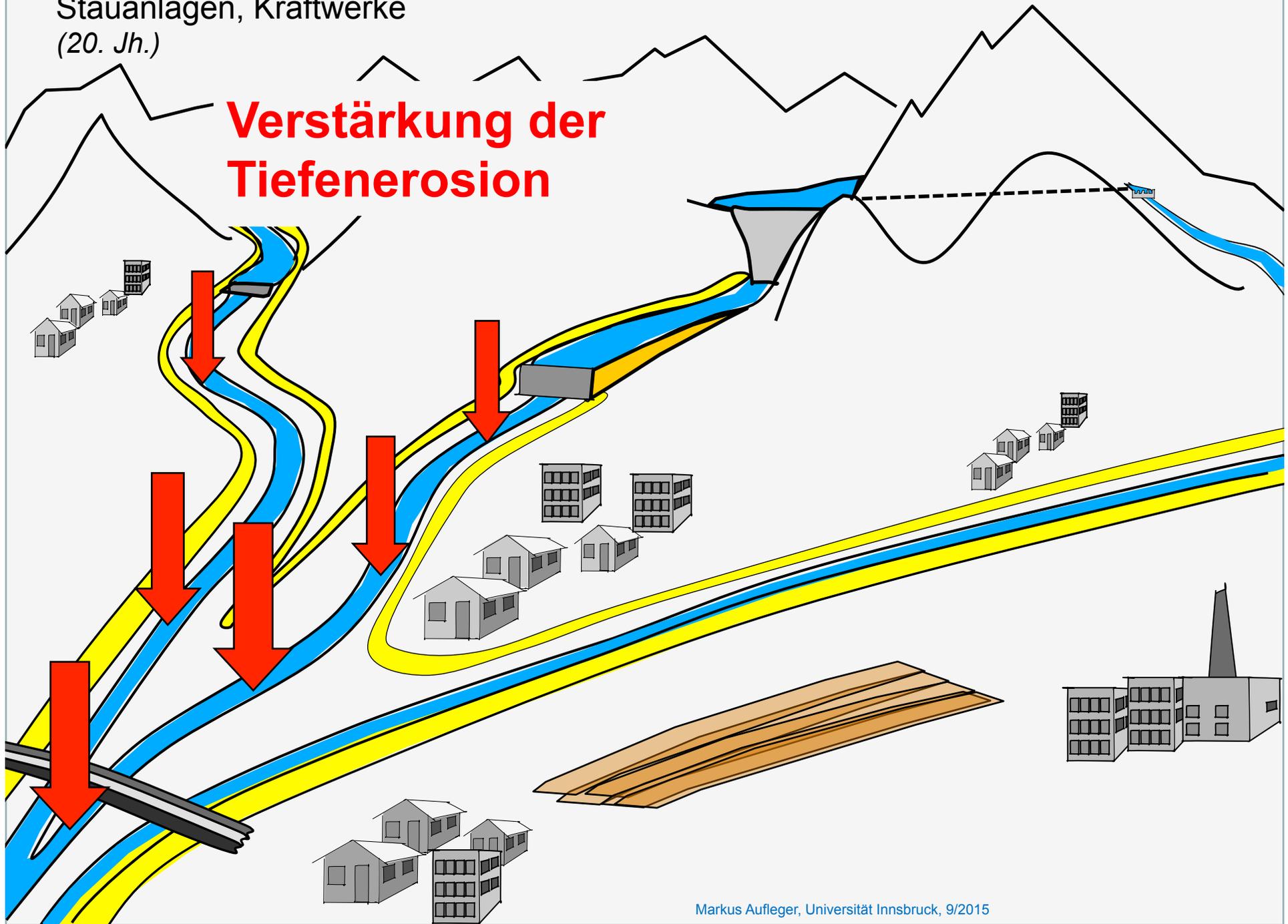


# Stauanlagen, Kraftwerke (20. Jh.)

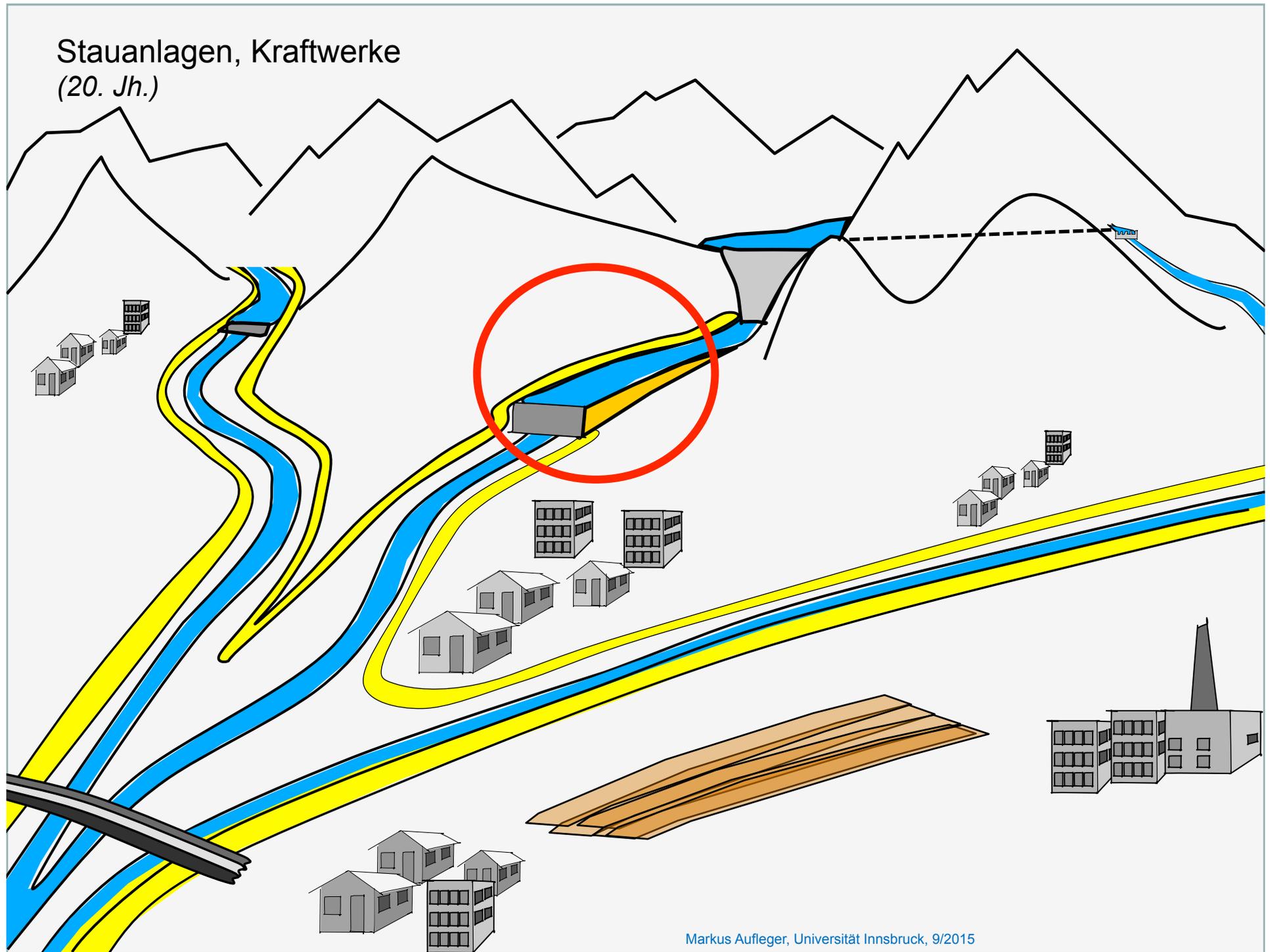


Stauanlagen, Kraftwerke  
(20. Jh.)

# Verstärkung der Tiefenerosion



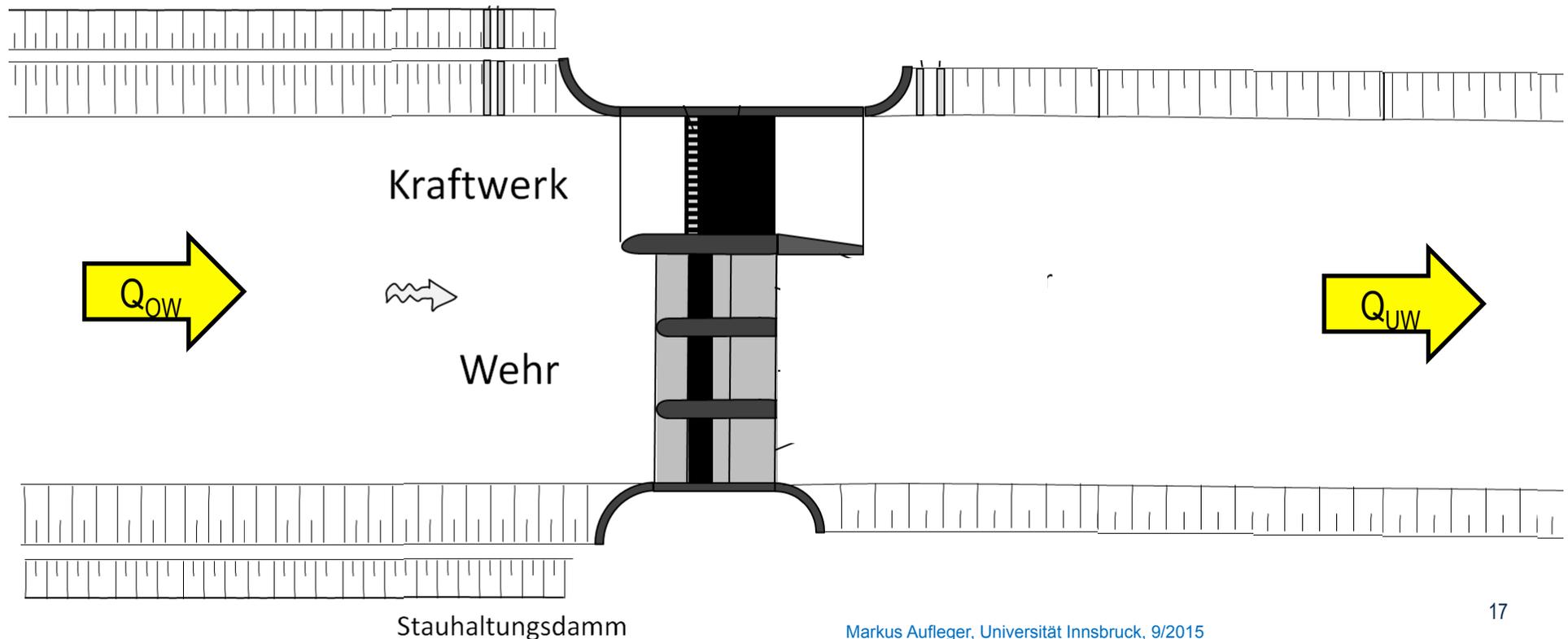
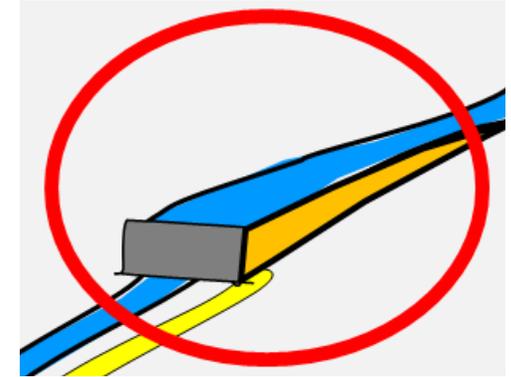
# Stauanlagen, Kraftwerke (20. Jh.)

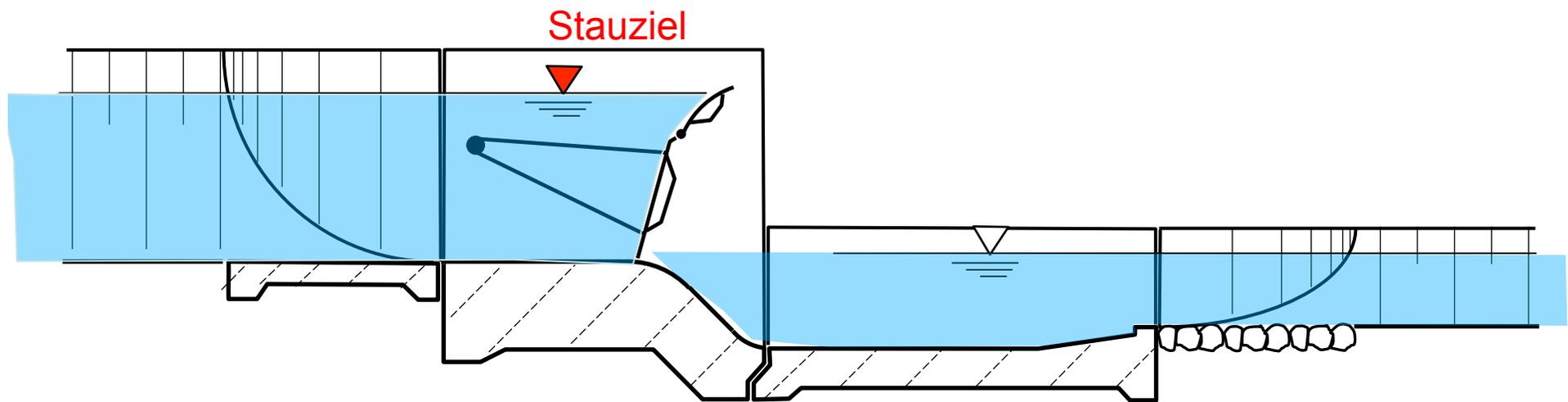


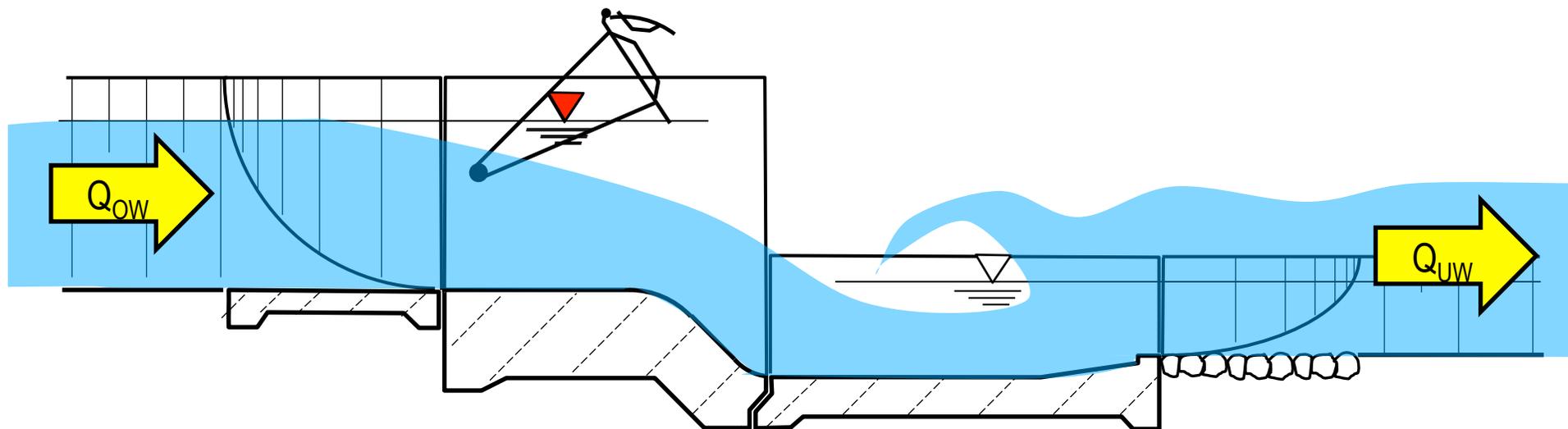
# Flusskraftwerk (Laufwasserkraft)

~ hochwasserneutral !

- abhängig von Betriebsweise (Stauziel)
- Stauhaltungsdämme -> Hochwasserschutz / ggfs. Verlust an Retentionsraum
- Sedimentmanagement -> Sohllage?



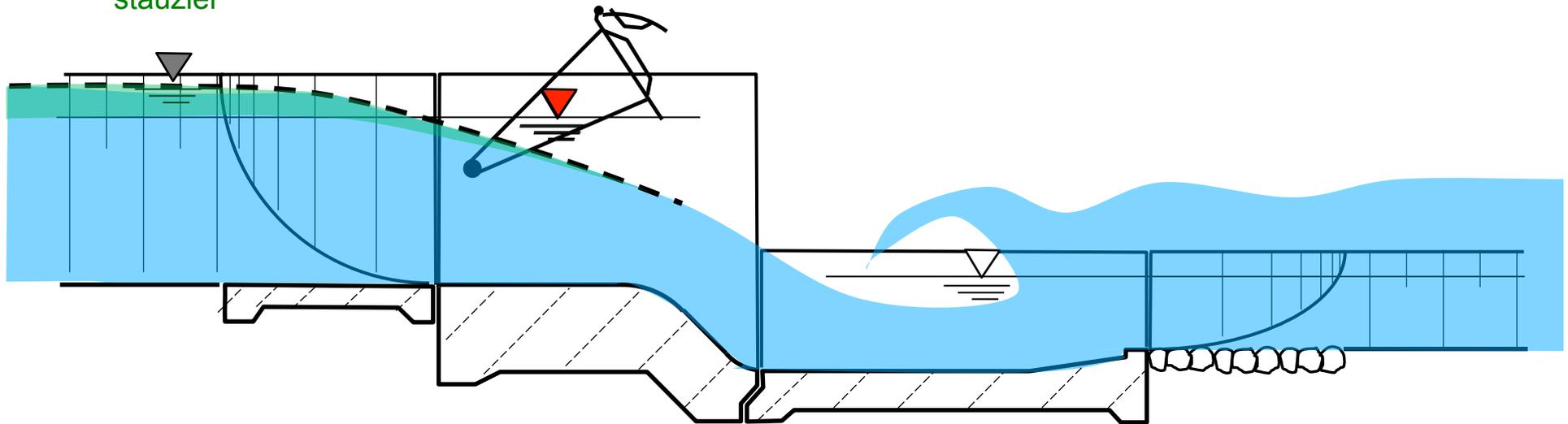




Hohes  
Hochwasser-  
stauziel



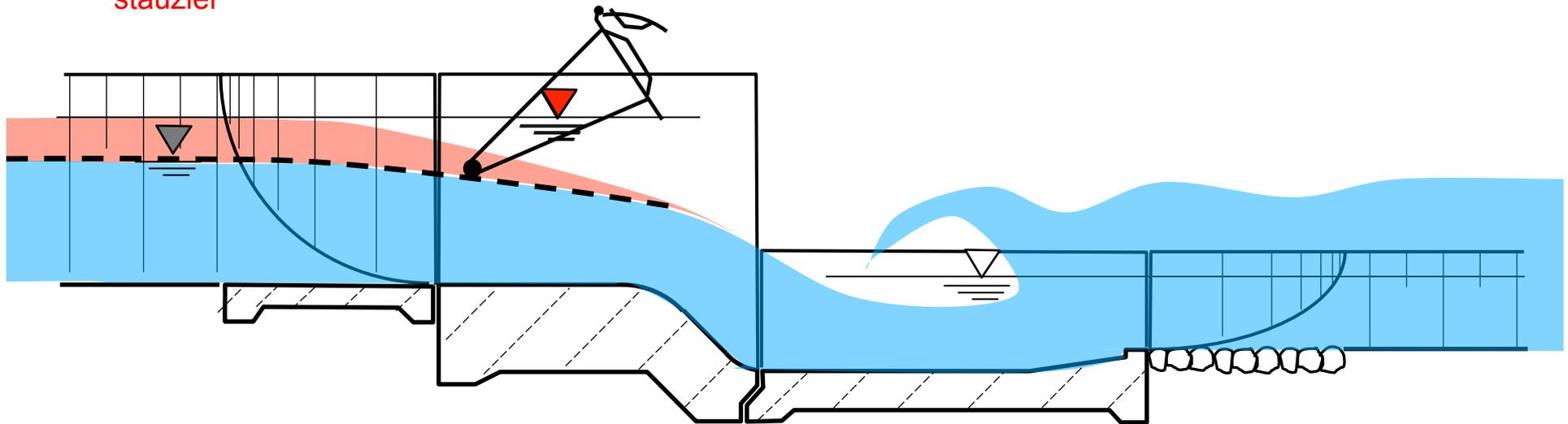
Tendenziell: Dämpfung der HW-Welle



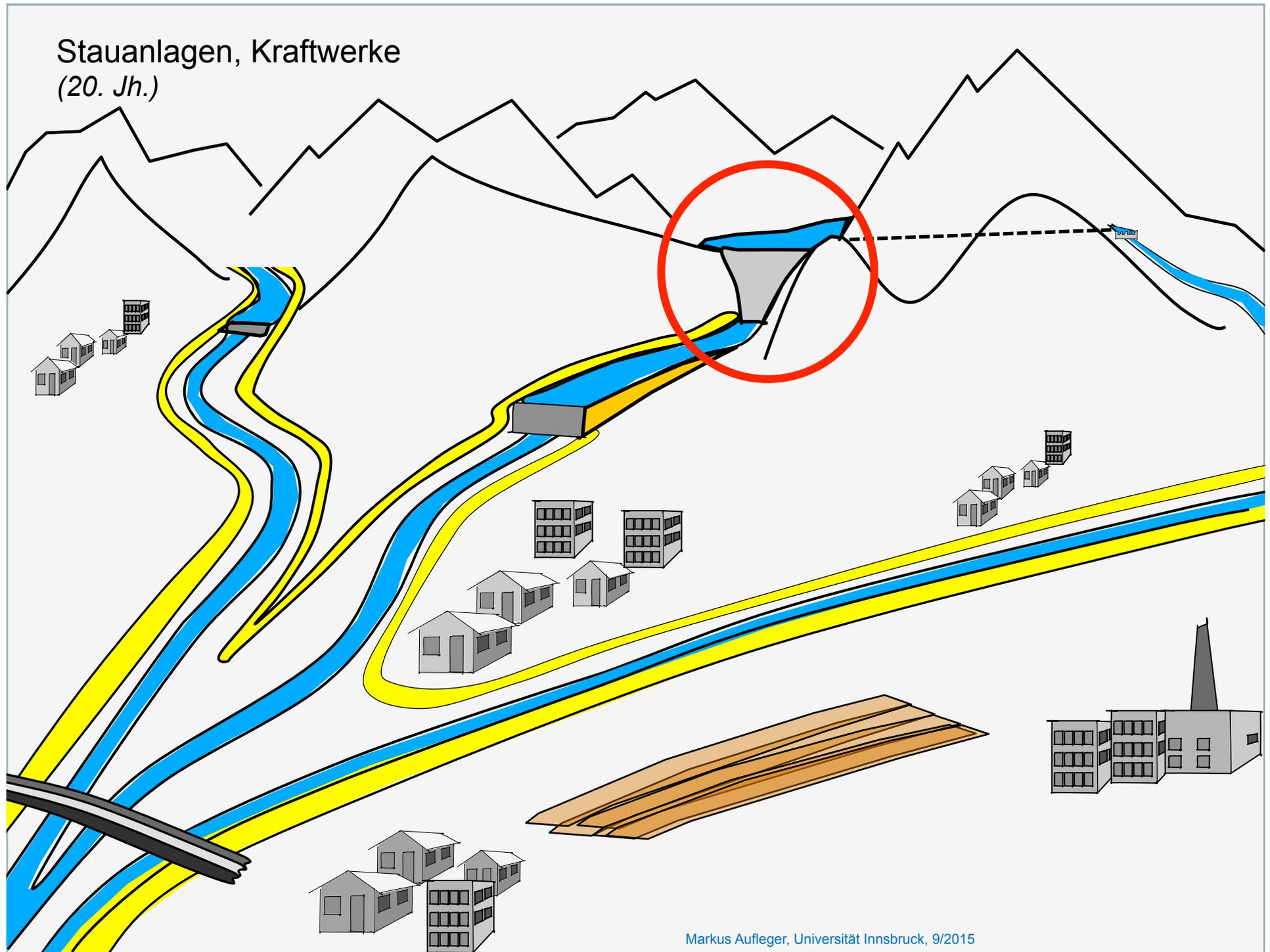
Niedriges  
Hochwasser-  
stauziel



Tendenziell: Beschleunigung der HW-Welle



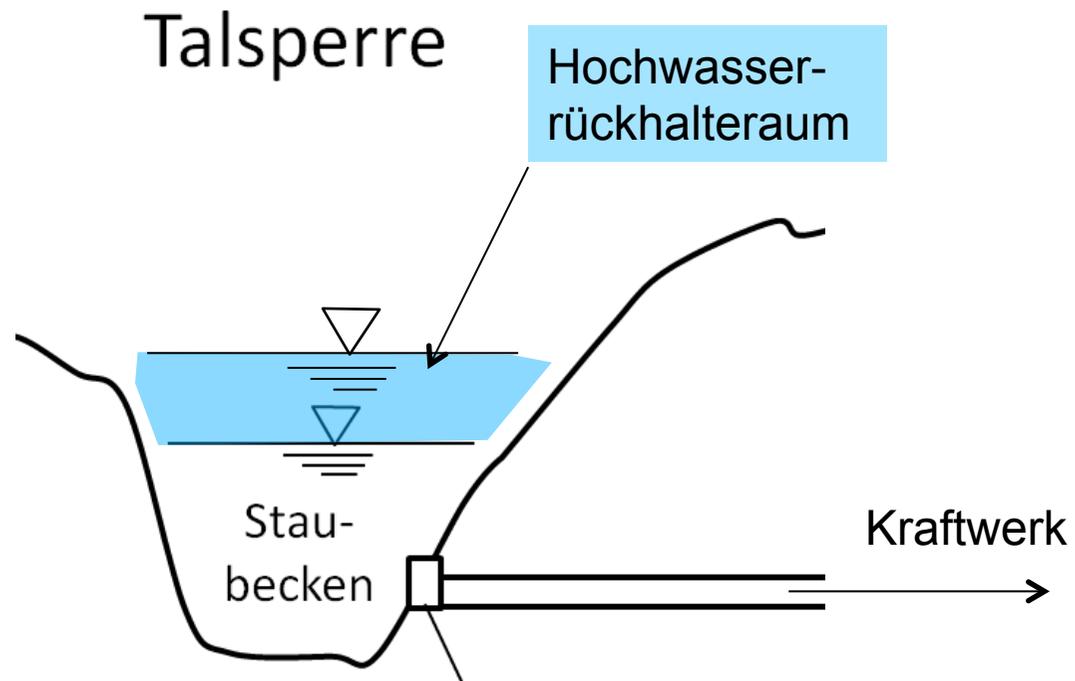
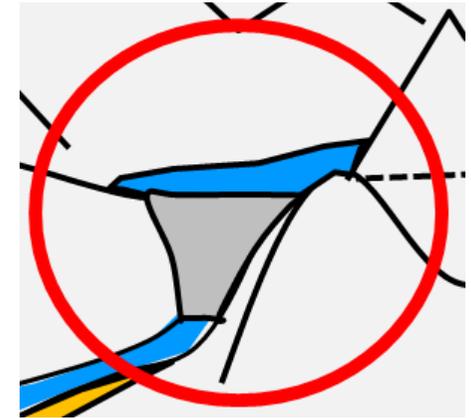
# Stauanlagen, Kraftwerke (20. Jh.)



# Speicherkraftwerk

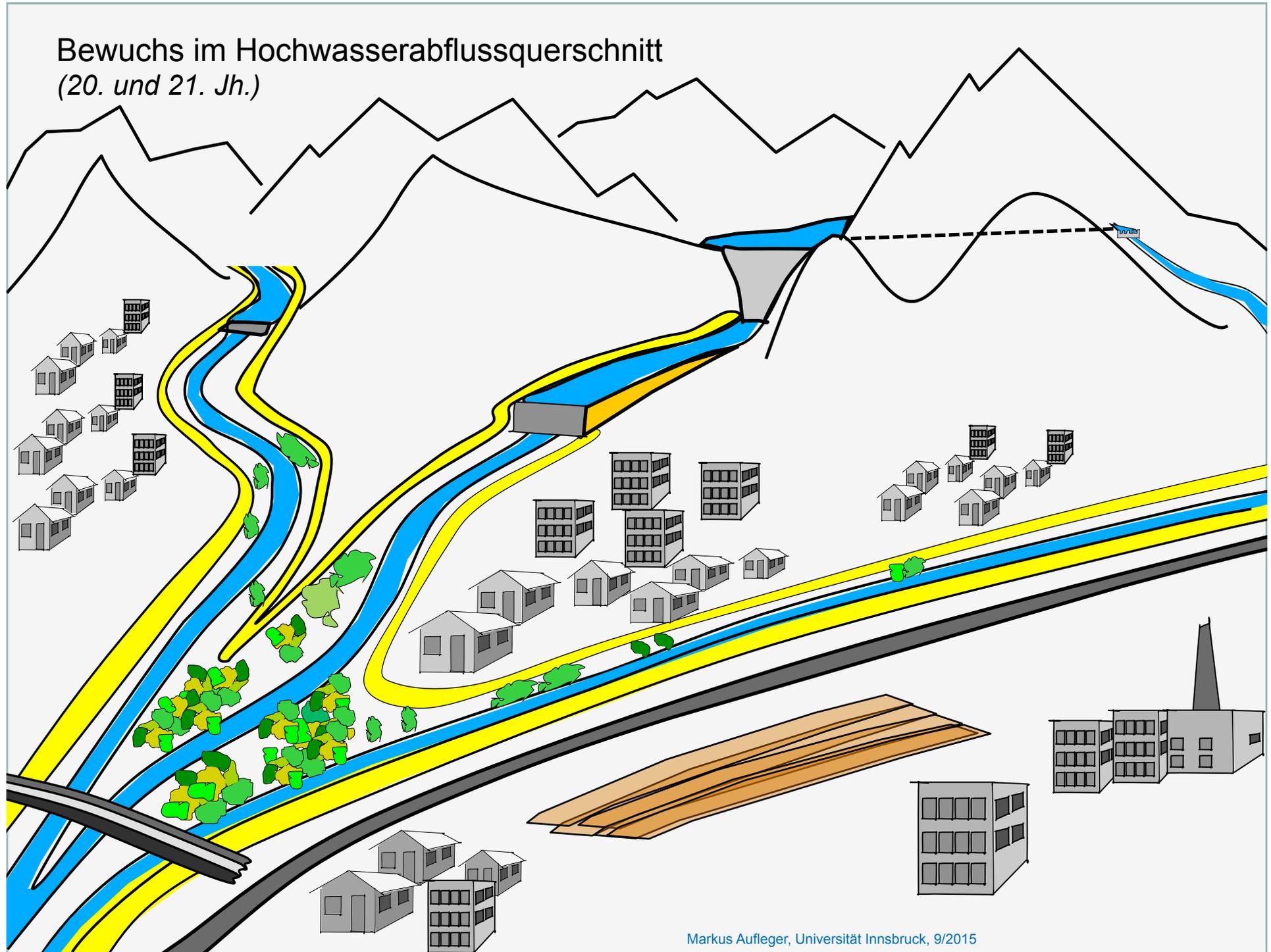
Hochwasserrückhalt !

- abhängig von Betriebsweise (Stauziel)

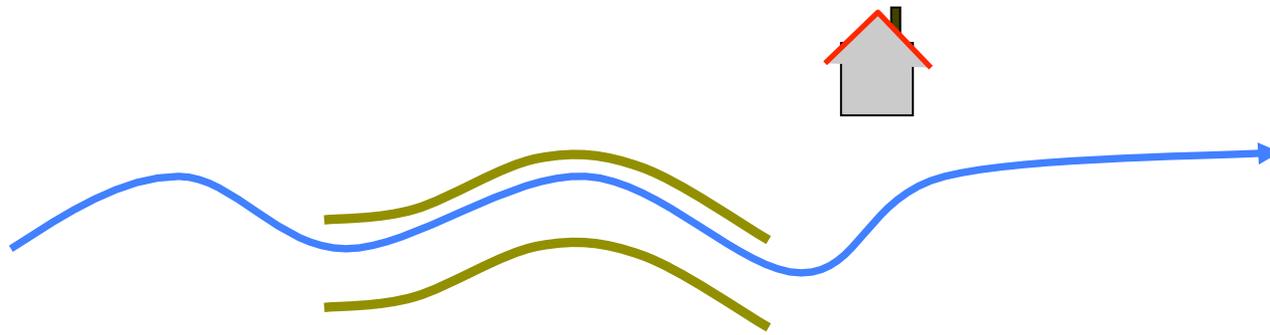




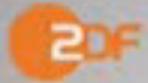
# Bewuchs im Hochwasserabflussquerschnitt (20. und 21. Jh.)



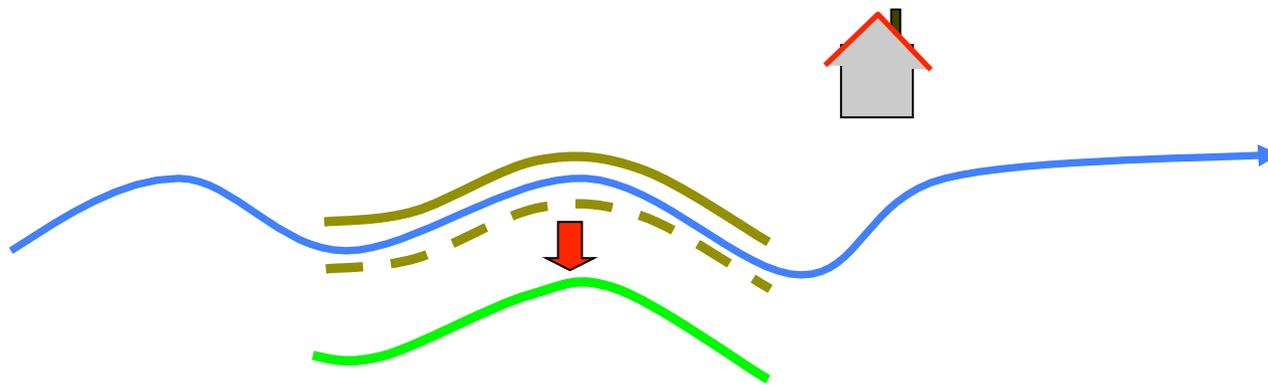
# Hochwasserschutz



# Naturnahe Retentionsräume



 **mo:ma**  
morgenmagazin



*„Breitwasser statt  
Hochwasser“*

<http://www.alphagalileo.org/ViewItem.aspx?ItemId=132379&CultureCode=de>

Elbtalauen bei Lenzen, neuer Damm im Bau



<https://www.landwirtschaftskammer.de/landwirtschaft/naturschutz/gewaesser/else.htm>

## Luftbild der Else während des Umbaus



## Uferrückbau an der Salzach



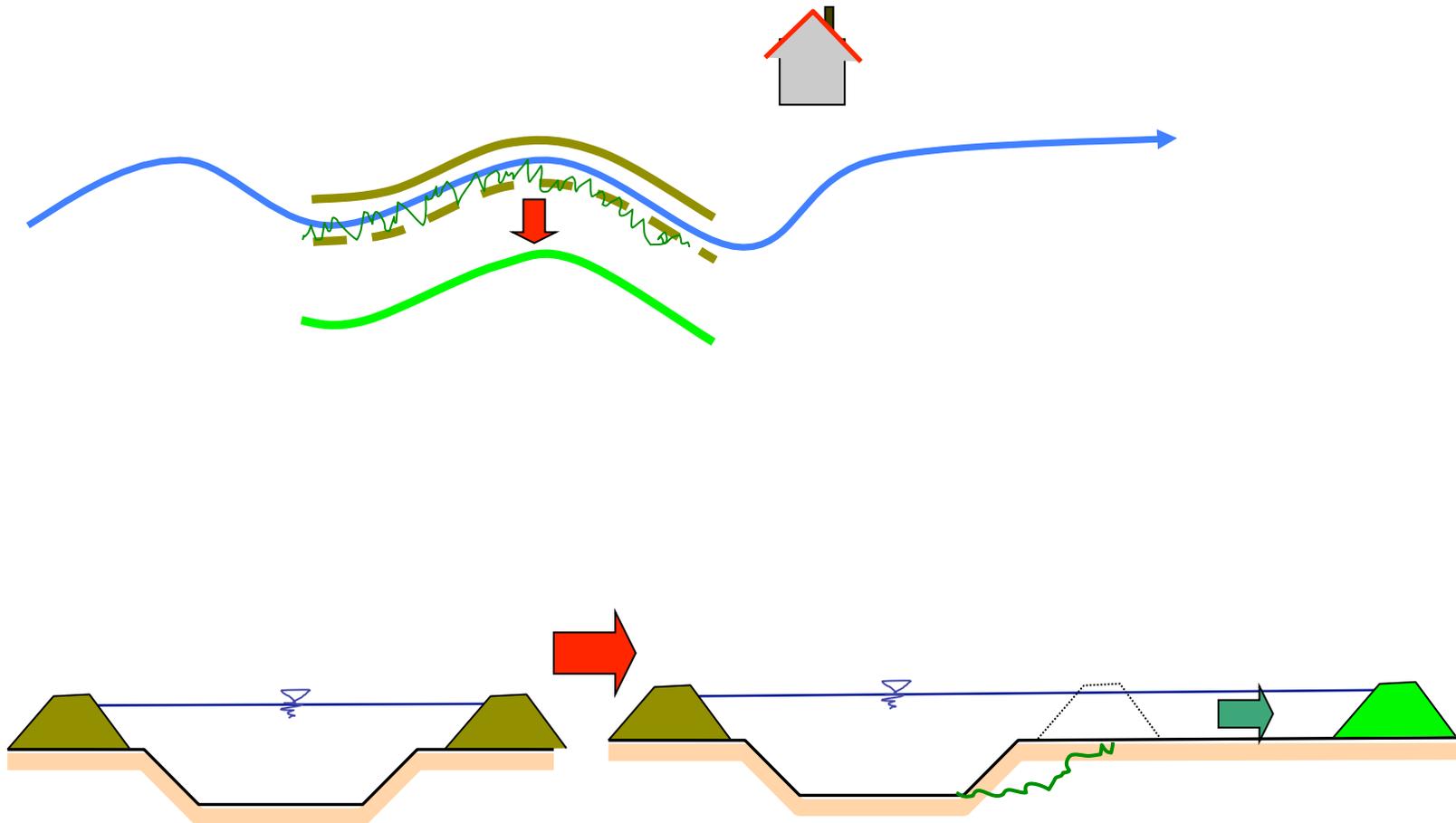
## Uferrückbau an der Thur (CH)



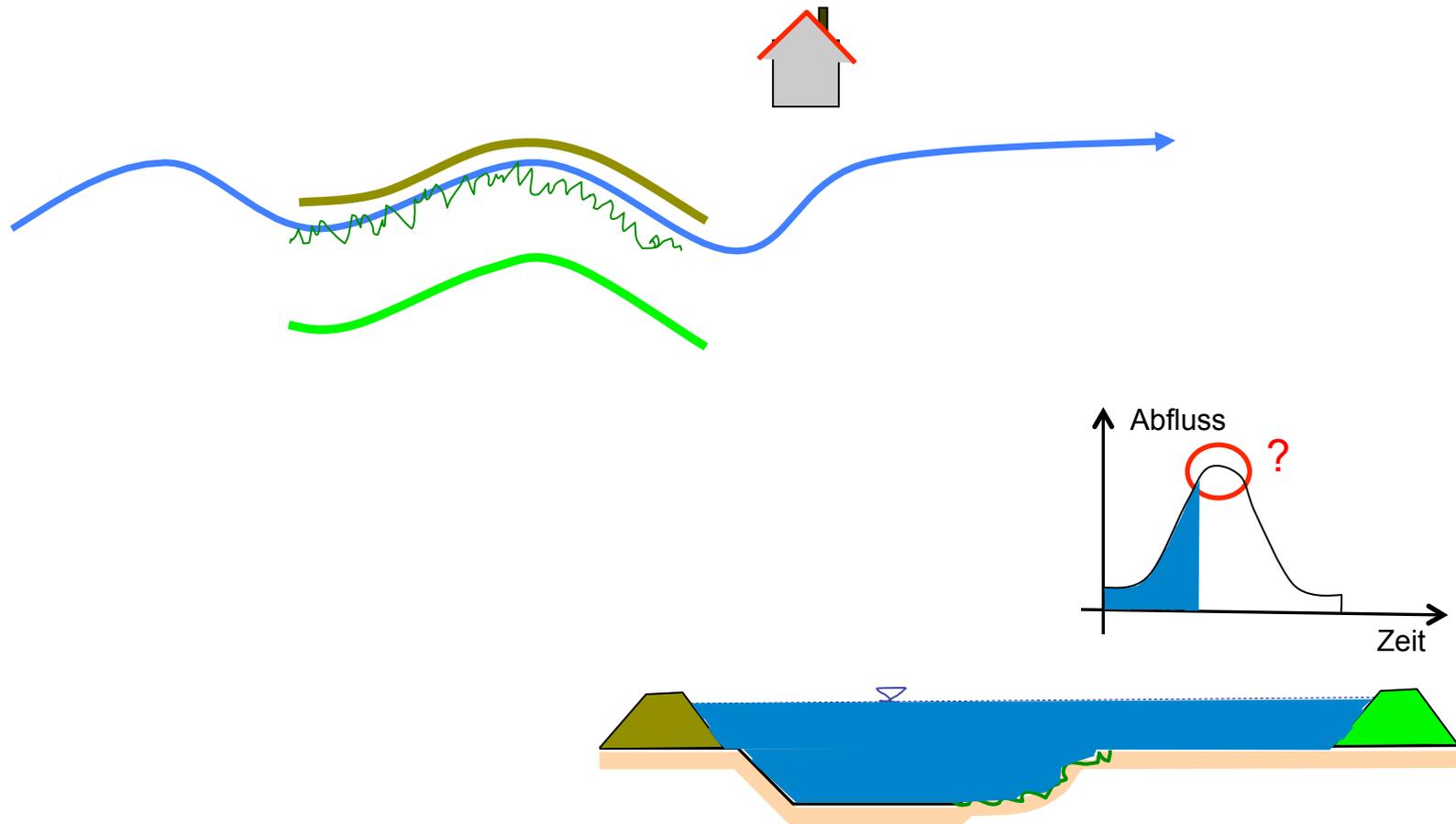
## Eigenentwicklung nach Uferrückbau an der Isar

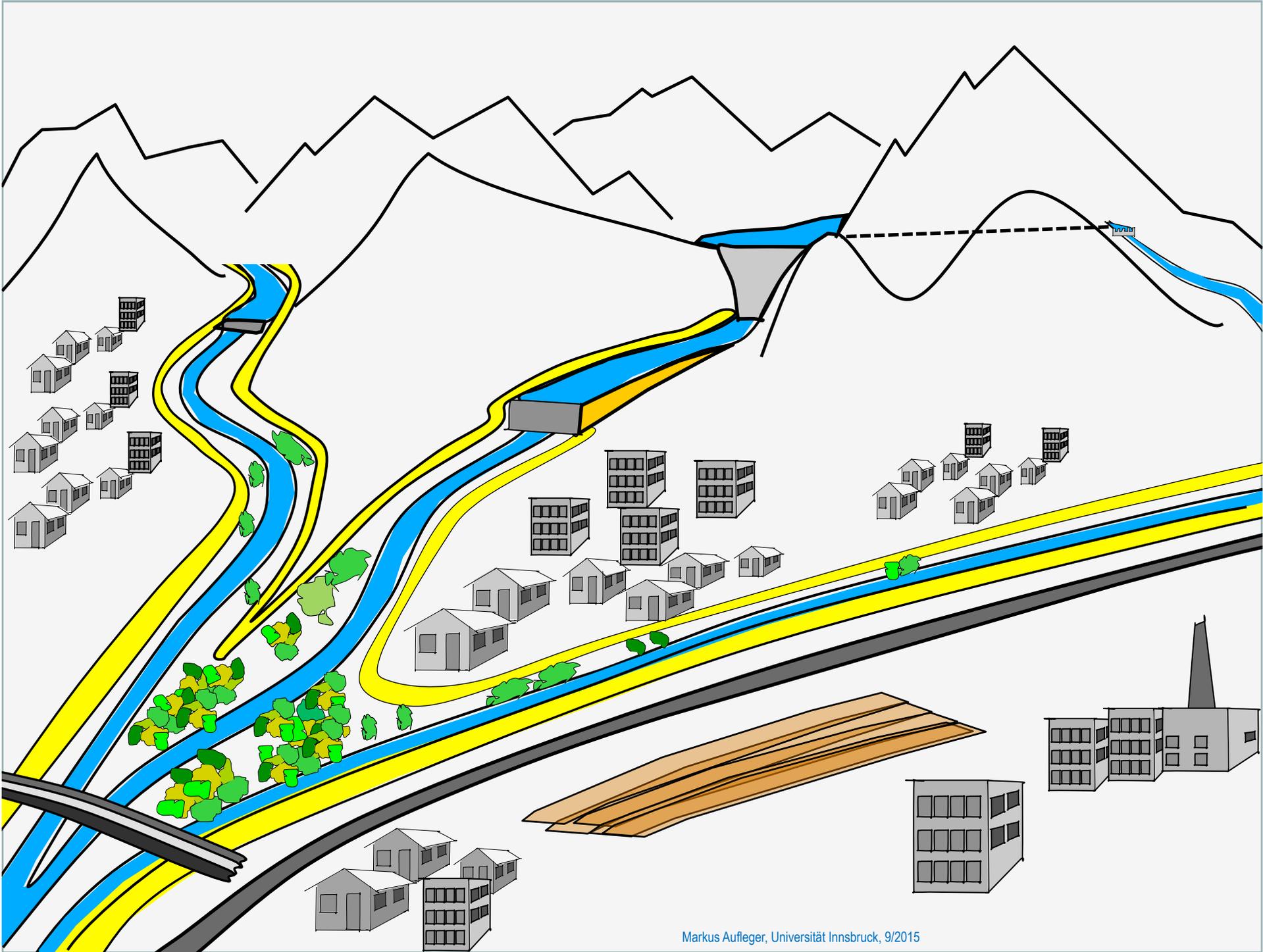


# Naturnahe Retentionsräume

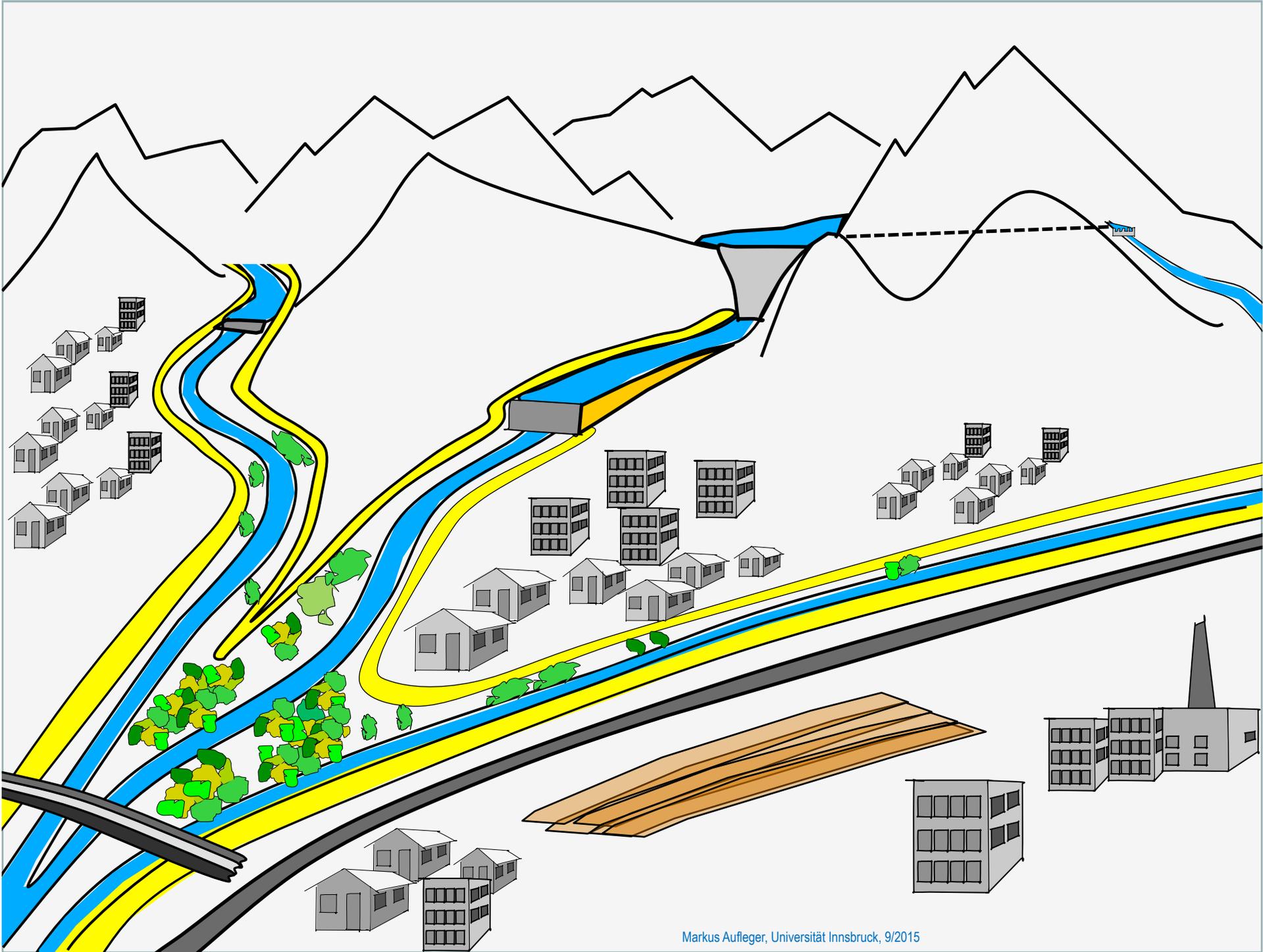


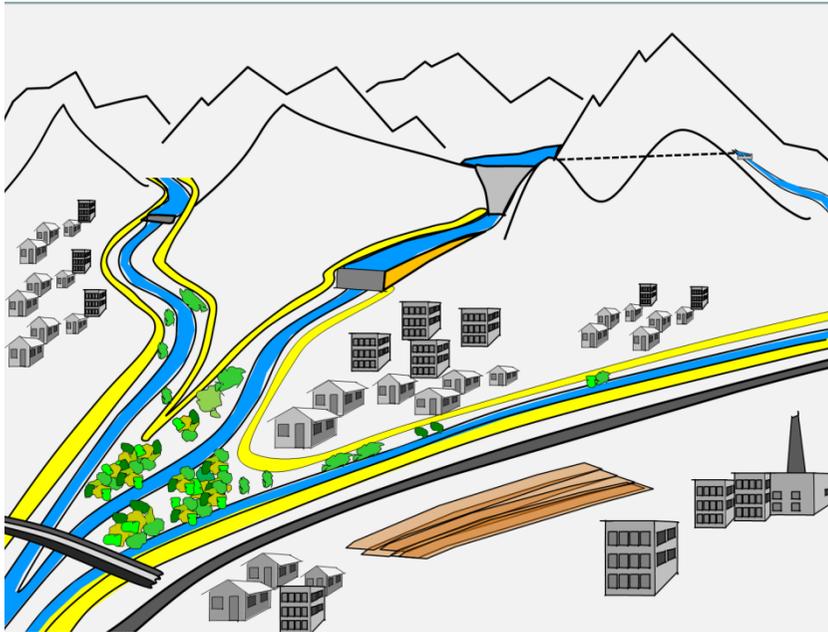
# Naturnahe Retentionsräume



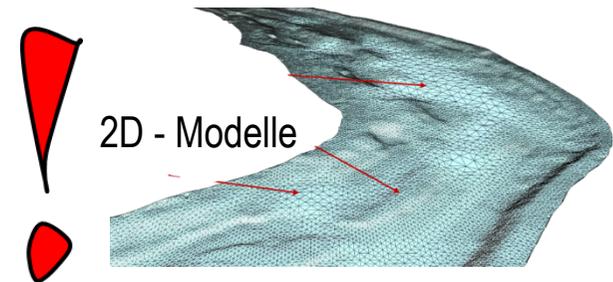






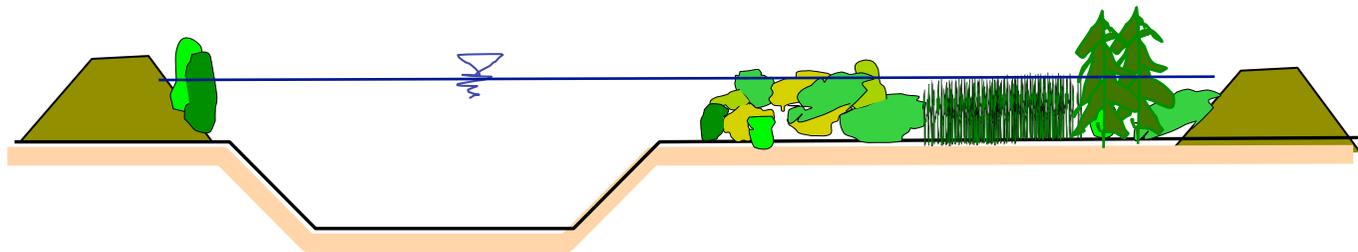
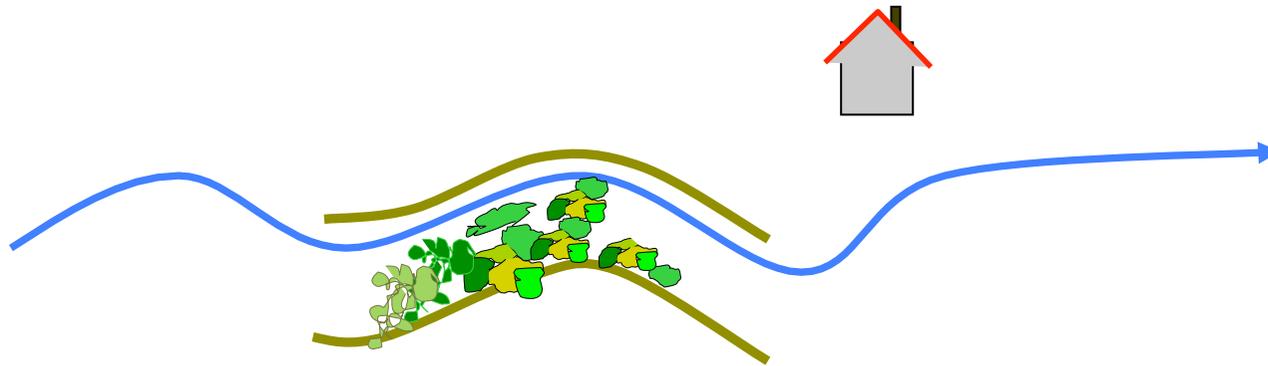


- Viel Platz !
- Großes Volumen [Mio. m<sup>3</sup>] → kleines  $\Delta Q$  [m<sup>3</sup>/s]
- Ökologie !

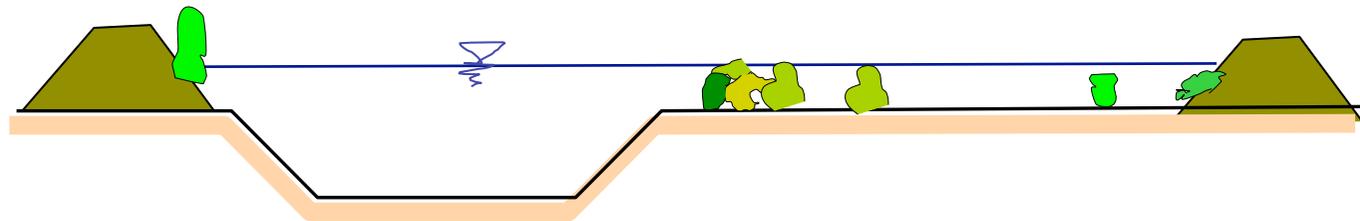
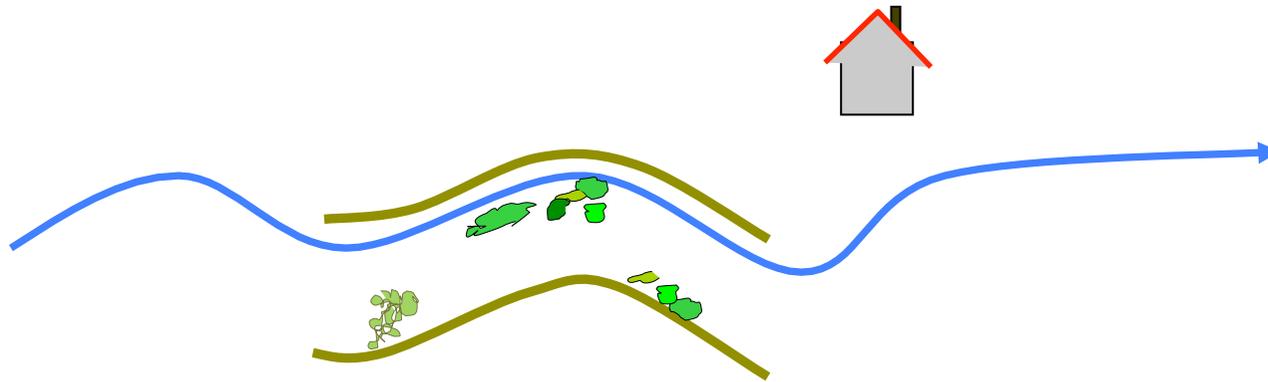


# Technische Schutzmaßnahmen

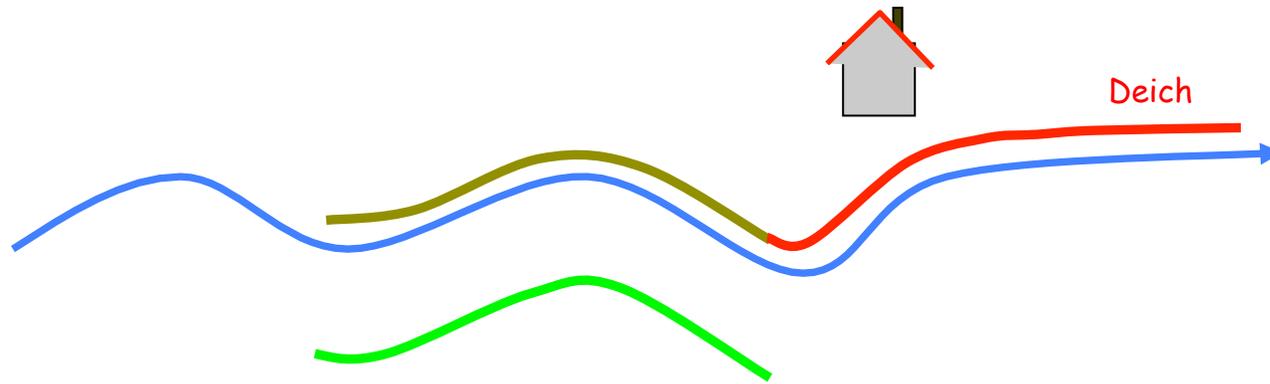
# Erhöhung der Abflusskapazität



# Erhöhung der Abflusskapazität



# Deichbau



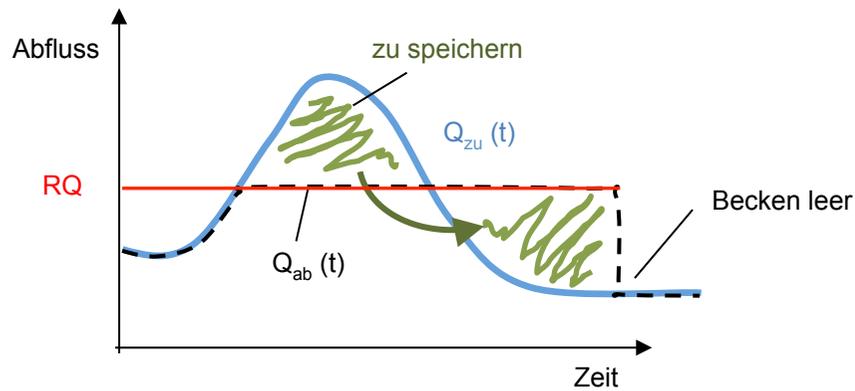
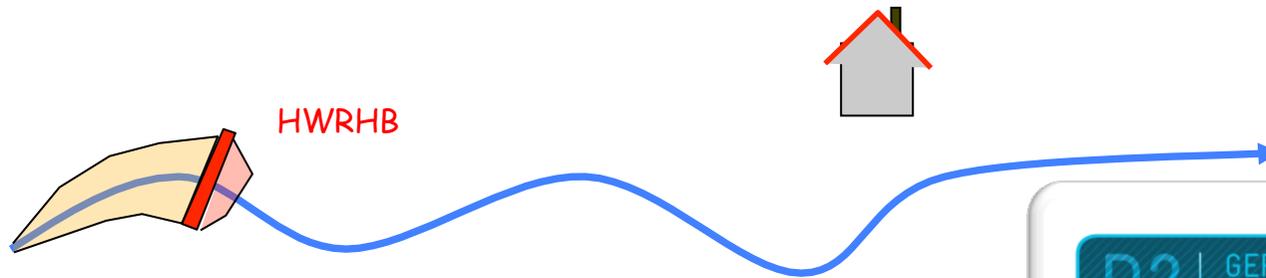
# Objektschutz



Objektschutz,  
Hochwasserschutzanlagen



# Rückhalt im Hauptschluss



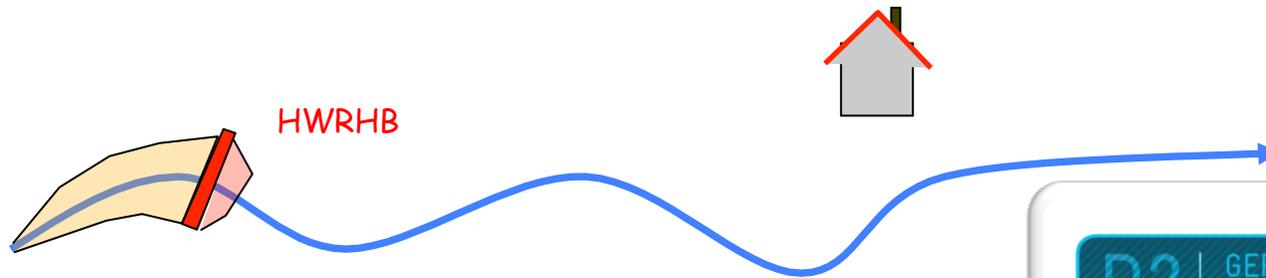
## D2 | GERMANY SYLVENSTEINSPEICHER



MAINTAINED BY: WWA Weilheim  
 RIVERS: Isar, Dürrach, Walchen  
 TYP: Rockfill dam/clay core  
 PURPOSE: Flood protection, energy, recreation, stabilize water flow

Construction Time	1954 – 1959
Height [m]	48.4
Crest Length [m]	180
Surface Area [km <sup>2</sup> ]	6.61
Cross Capacity [Mio. m <sup>3</sup> ]	124
Catchment Area [km <sup>2</sup> ]	1138
Design Flood [m <sup>3</sup> /s]	2012

# Rückhalt im Hauptschluss



Volumen [Mio. m<sup>3</sup>] → ΔQ [m<sup>3</sup>/s]

Sehr hohe Rückhaltewirkung,  
abh. von

- Volumen [Mio. m<sup>3</sup>]
- Steuerung (inkl. Vorhersage)

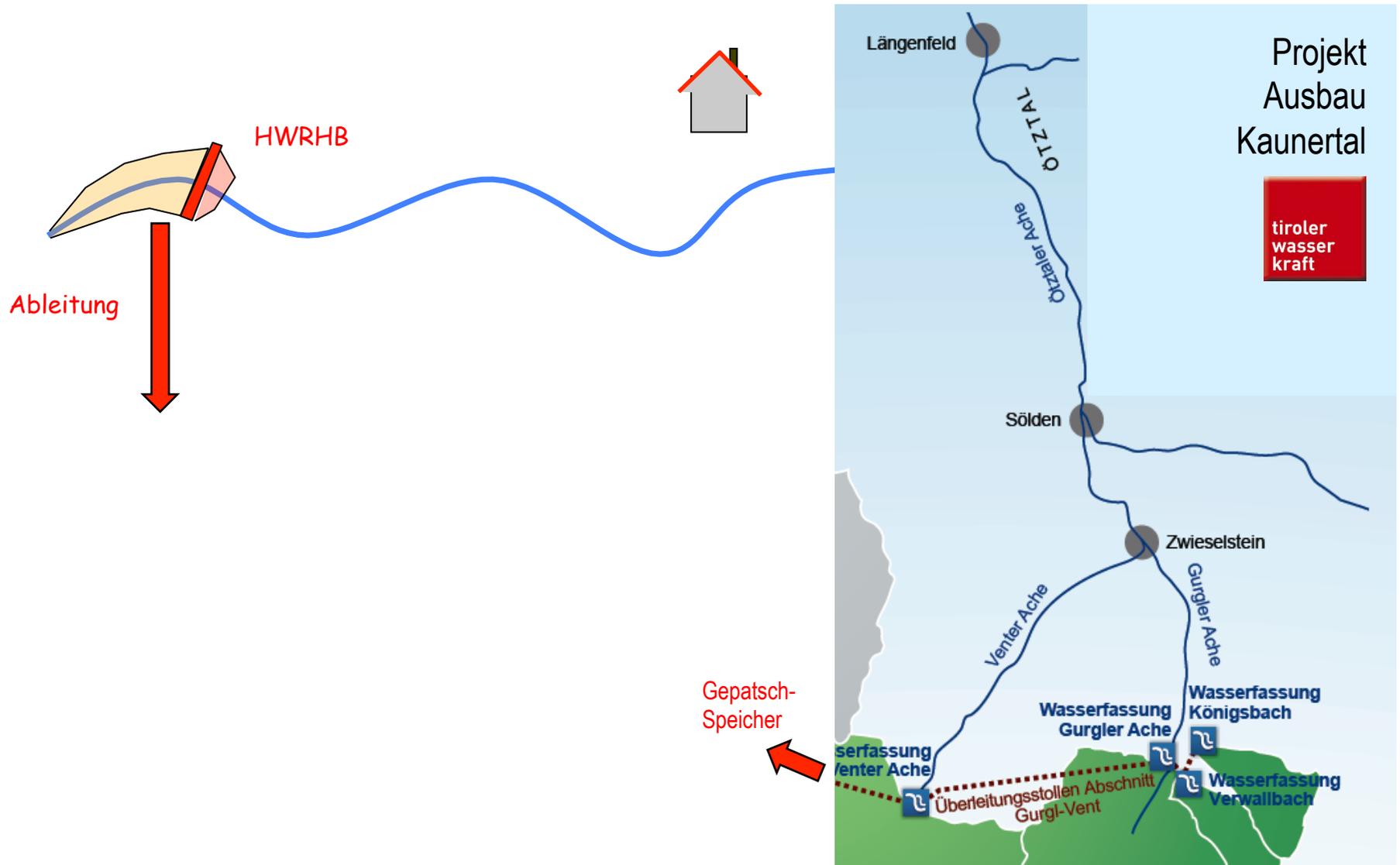
D2 | GERMANY  
SYLVENSTEINSPEICHER



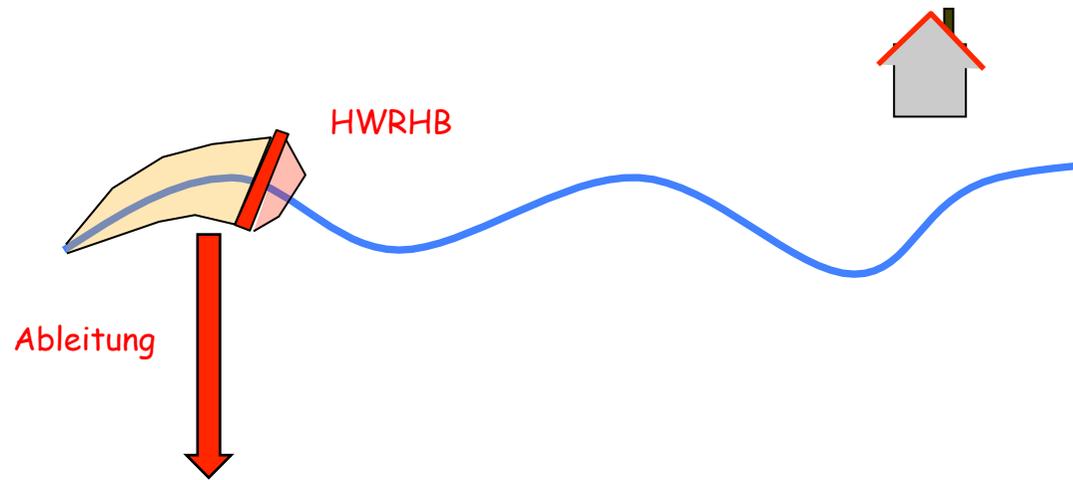
MAINTAINED BY: WWA Weilheim  
RIVERS: Isar, Dürrach, Walchen  
TYP: Rockfill dam/clay core  
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Cross Capacity [Mio. m <sup>3</sup> ]	124
Catchment Area [km <sup>2</sup> ]	1138
Design Flood [m <sup>3</sup> /s]	2012

# Ableitung von Hochwasserabfluss

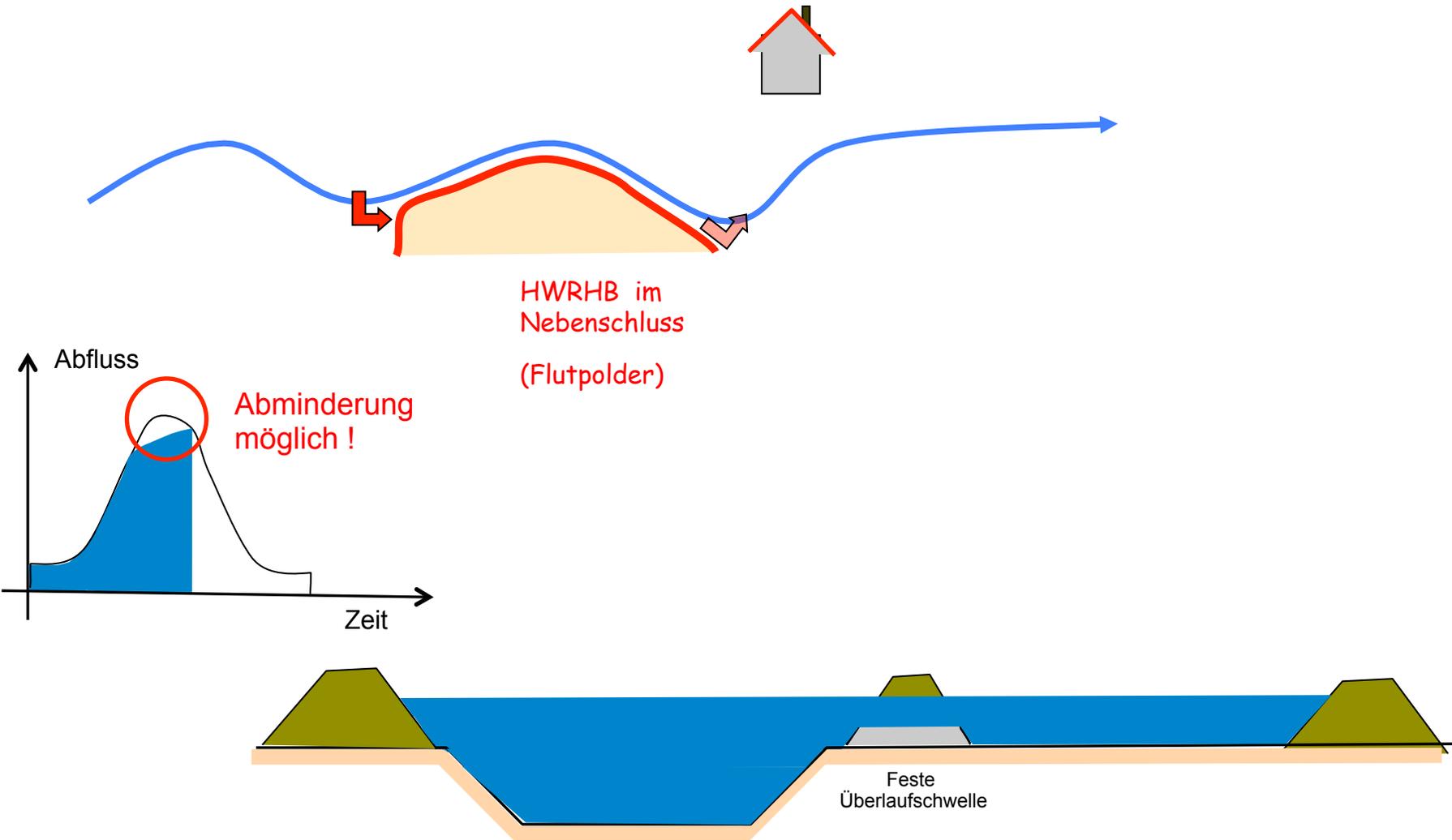


# Rückhalt im Hauptschluss



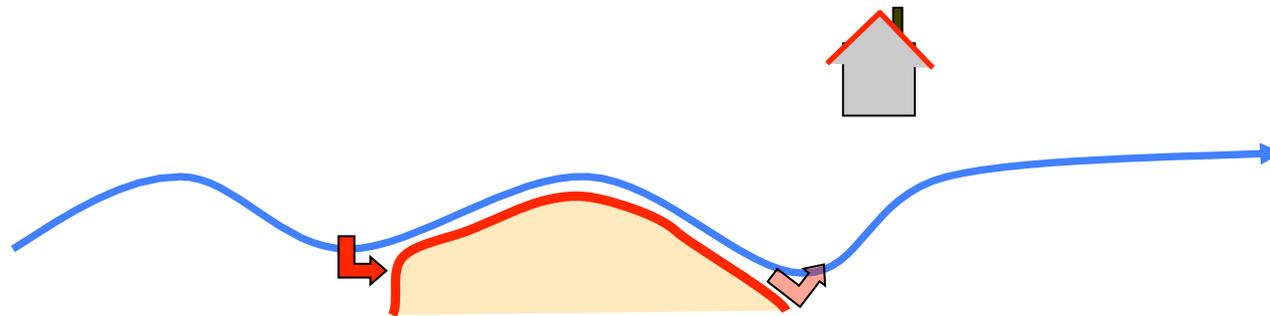
# Rückhalt im Nebenschluss

a) ungesteuert

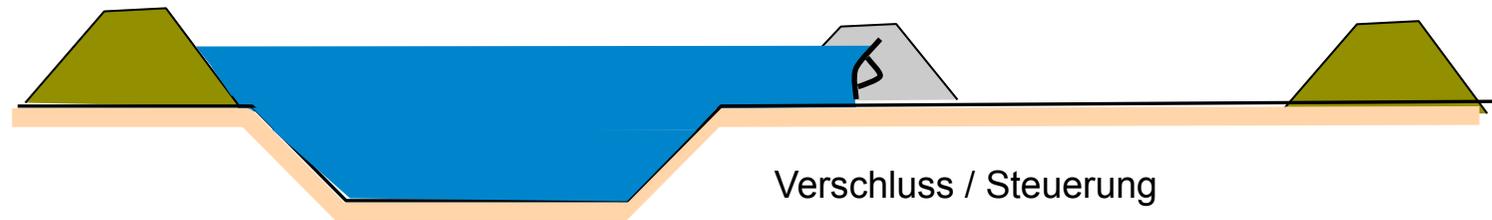
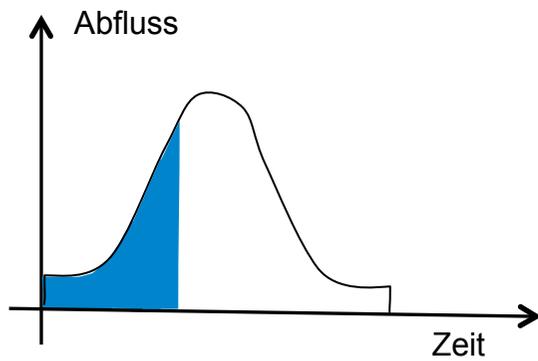


# Rückhalt im Nebenschluss

b) gesteuert

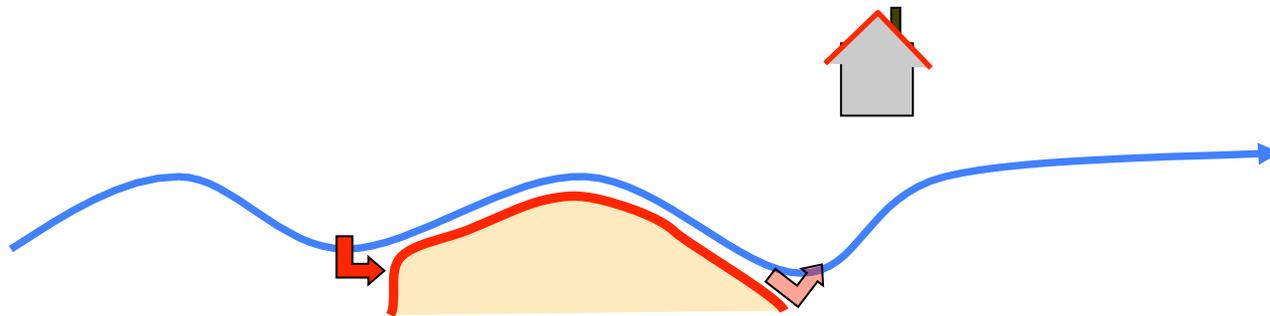


HWRHB im  
Nebenschluss  
(Flutpolder)

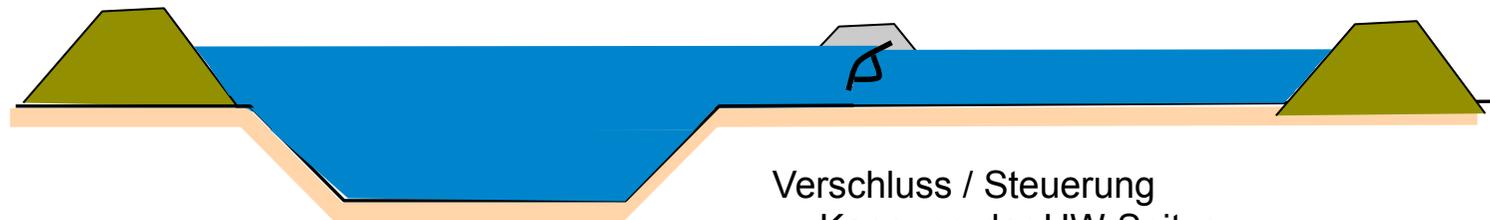
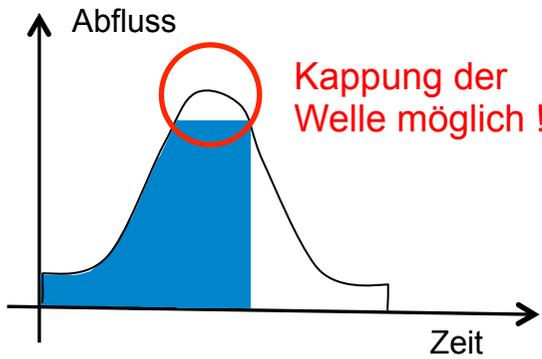


# Rückhalt im Nebenschluss

b) gesteuert

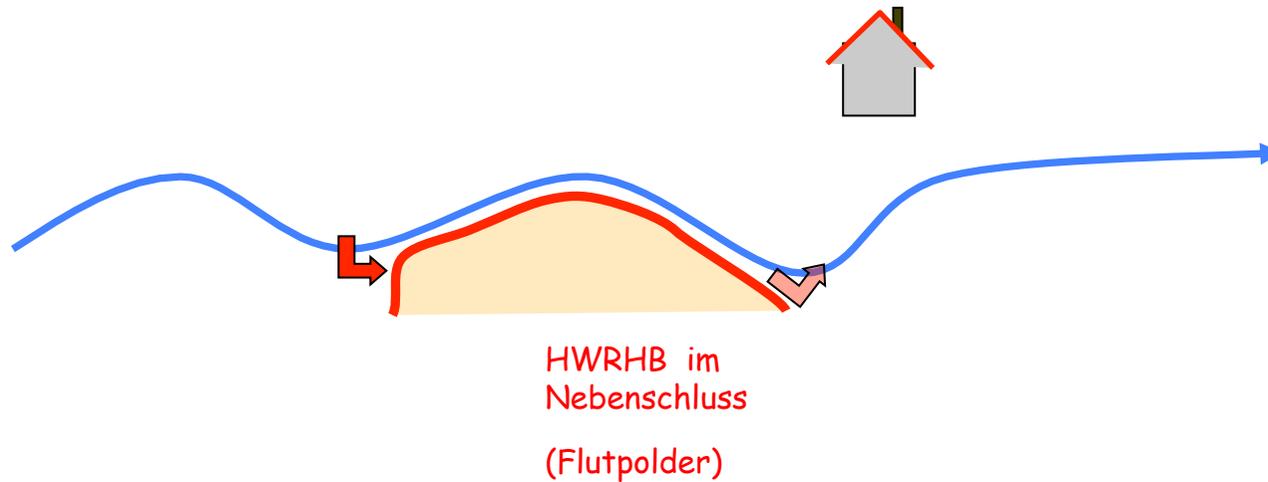


HWRHB im Nebenschluss  
(Flutpolder)



Verschluss / Steuerung  
→ Kappung der HW-Spitze

# Rückhalt im Nebenschluss



Volumen [Mio. m<sup>3</sup>] →  $\Delta Q$  [m<sup>3</sup>/s]

Hohe Rückhaltewirkung,  
abh. von

- Volumen [Mio. m<sup>3</sup>]
- Steuerung (inkl. Vorhersage)

# Gesteigerter Hochwasserrückhalt durch naturnahe Retentionsräume und technische Schutzmaßnahmen

Markus Aufleger  
Münchsmünster, 25.9.2015