GRAVEL MINING

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River Engineering Measures

SCALE ORIENTED CLASSIFICATION

- Catchment based Measures
- Sectional Measures
- Local Measures
- Point Scale Measures

„POSITION ORIENTED“ CLASSIFICATION

- Plan form changes
- Changes of the longitudinal profile
- Changes of the cross section

Effects of gravel mining in rivers

- effects of gravel mining in streams including:
- 1.Extraction of bed material in excess of natural replenishment by upstream transport causes bed degradation.
- 2.Gravel extraction increases suspended sediment, sediment transport, water turbidity and gravel siltation.
- 3.Bed degradation changes the morphology of the channel.
- 4.Gravel bar skimming significantly impacts aquatic habitat.
- 5.Operation of heavy equipment in the channel bed can directly destroy spawning habitat and produce increased turbidity and suspended sediment downstream.
- 6.Stockpiles and overburden left in the floodplain can alter channel hydraulics during high flows.
- 7.Removal or disturbance of in-stream roughness elements during gravel extraction activities affects both the quality and quantity of anadromous fish habitat.
- 8.Destruction of the riparian zone during gravel extraction operations can have multiple deleterious effects on anadromous fish habitat.

http://www.fish.bc.ca/html/fish2E1B.htm

River Engineering Measures

PROCESS ORIENTED CLASSIFICATION

- Water Discharge
- Sediment regime and sediment transport
- River morphology
- Structural improvement

CLASSIFICATION ACCORDING TO BASIC CONCEPT

- Structural Alternatives
- Nonstructural Measures

CLASSIFICATION BASED ON ECOLOGICAL GOALS

- High ecological status is reached
- Good ecological status is reached
- Moderate ecological status is reached
- Low ecological status is reached

Structure of measure discussion

1. Goals of measure
2. Technical boundary conditions
3. Effects on water flow and sediment regime
4. Effects on Ecological Integrity
5. Examples

Goals of the lecture

		Impact of measure	
Measures	Modifies Discharge Frequency Function	Modifies Stage – Discharge Function	Modifies Stage-Damage Function
Reservoir	yes	Maybe if stream and downstream channel erosion and deposition due to change in discharge	Maybe, if increased development in floodplain
Diversion	yes	Maybe, if channel erosion and deposition due to change in discharge	Maybe, if increased development in floodplain
Channel improvement	Maybe, if channel affects timing and storage altered significantly	yes	Not likely
Levee or floodwall	Maybe, if floodplain storage no longer available for flood flow	yes	yes
Floodproofing	Not likely	Not likely	yes
Relocation	Not likely	Maybe, if flow obstructions removed	yes
Land use and construction regulation	Not likely	Maybe, if flow obstructions removed	yes
Acquisit[redacted]		Maybe, if flow obstructions	yes

Historical Development – Danube

- dddk

Non-structural measures

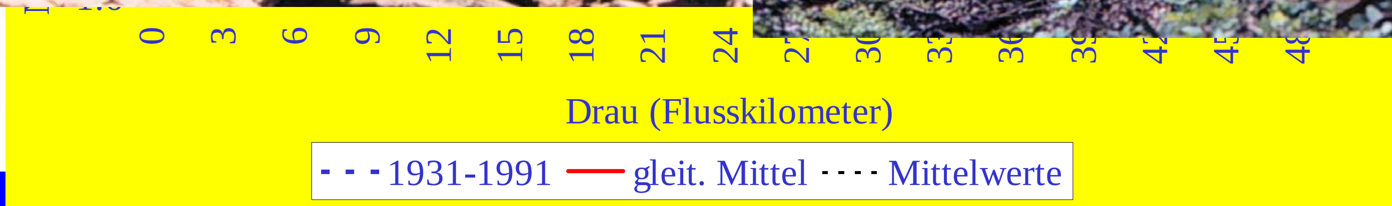
- forecasting and planning
- methods, risk analysis, water and flood management techniques, disaster preparedness, damage recovery and
- disaster relief. Forecasting used with historical information enabled much more effective management of water
- flows to anticipate the onset of weather patterns likely to result in floods.

Goals of the lecture

- dddk

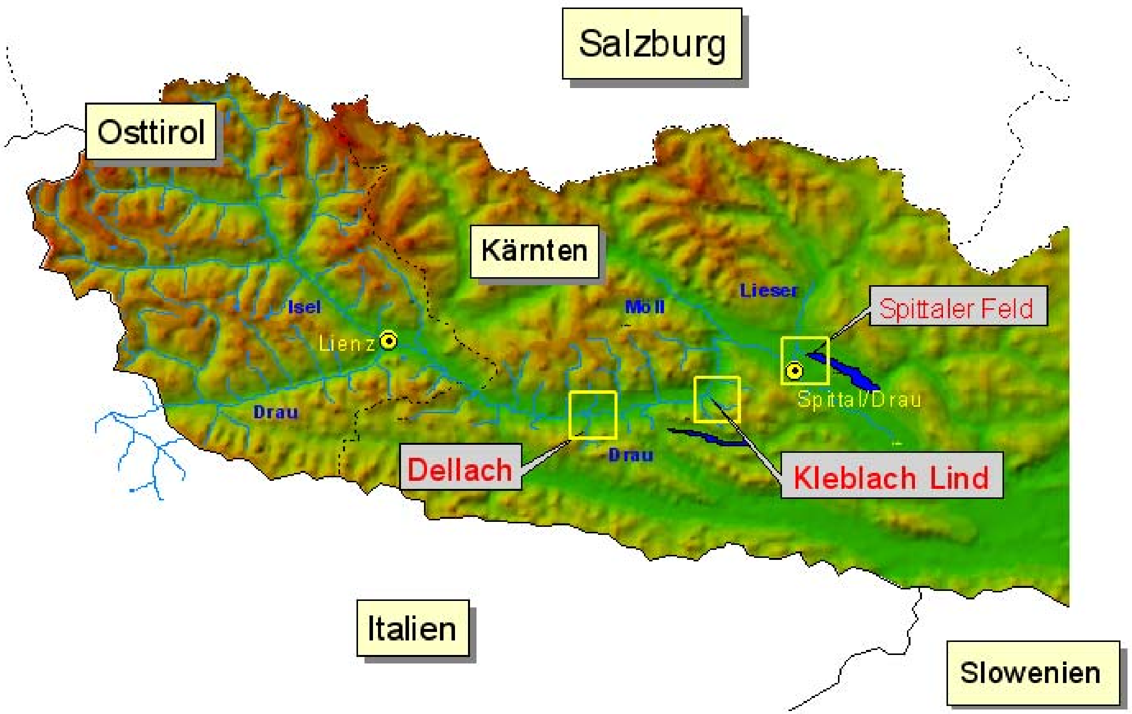
Landschaftswasserbau Bsp. Drau

- Hochwasserschutz
- Sohleintiefung
- Ökologische Funktionsfähigkeit



Auenverbund Obere Drau

Planungsraum



Pegel Drauhofen

- **EG: 3674,4 km²**
- **Flussgebiet 7. Ordnung**
- **mittleres Gefälle beträgt 1,5 ‰**
- **Mittelwasserabfluss 102,3 m³/s**
- **HQ_{100} ca. 1600 m³/s**
- **Flussbreite ca. 55-80 m**
- **Korngröße d_m ca. 36 mm**

Spittaler Feld

$$\frac{h}{h_m} = e^{\left[\frac{1}{2} A\left(\frac{r_{\max}^2}{r^2} - 1\right)\right] - 1} \qquad A = \frac{(1{,}629 v_m - 2{,}580 v^*)}{((s-1)gD)^{0{,}5}}$$