

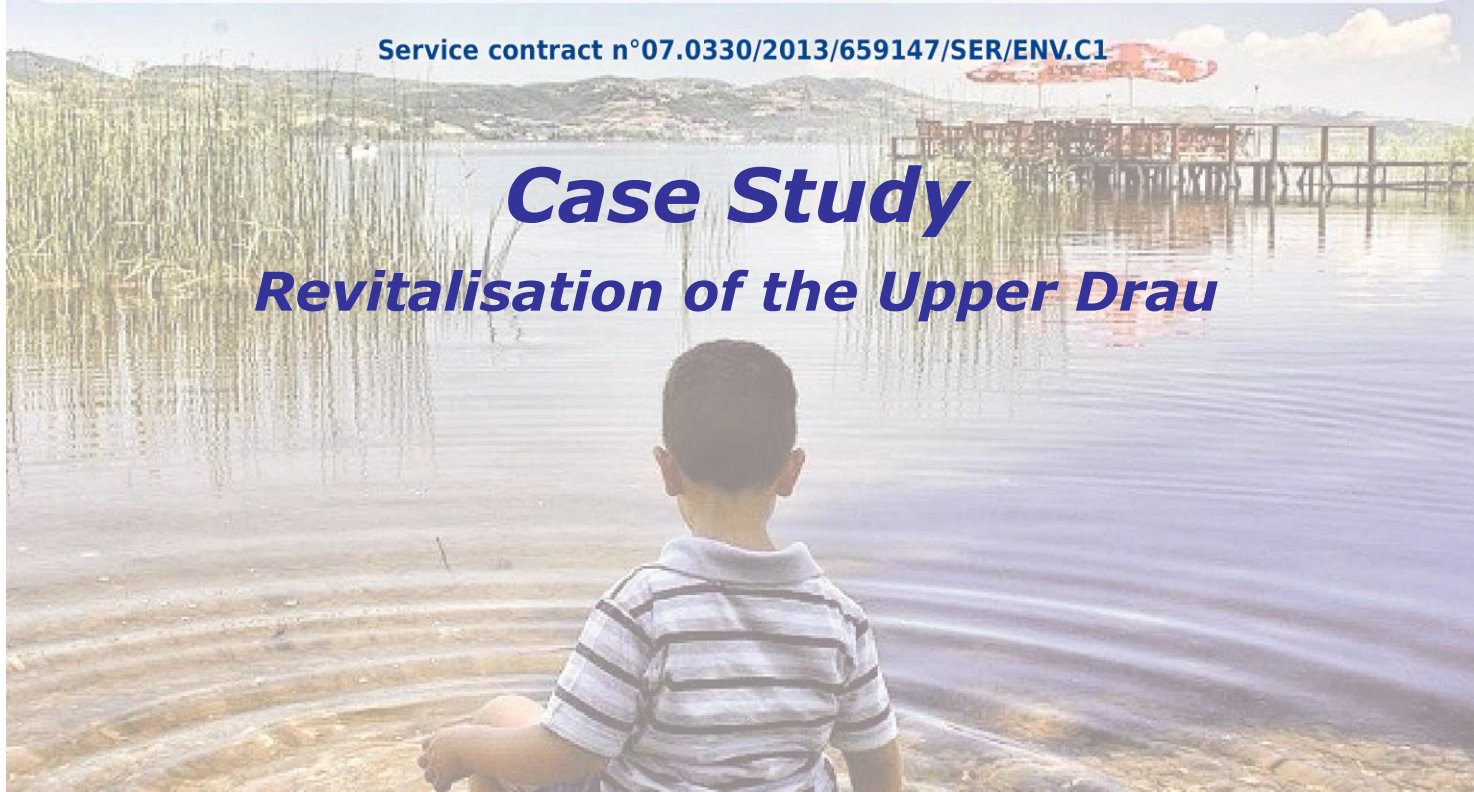


Natural Water Retention Measures

www.nwrp.eu

Service contract n°07.0330/2013/659147/SER/ENV.C1

Case Study *Revitalisation of the Upper Drau*



This report was prepared by the NWRM project, led by Office International de l'Eau (OIEau), in consortium with Actéon Environment (France), AMEC Foster Wheeler (United Kingdom), BEF (Baltic States), ENVECO (Sweden), IACO (Cyprus/Greece), IMDEA Water (Spain), REC (Hungary/Central & Eastern Europe), REKK inc. (Hungary), SLU (Sweden) and SRUC (UK) under contract 07.0330/2013/659147/SER/ENV.C1 for the Directorate-General for Environment of the European Commission. The information and views set out in this report represent NWRM project's views on the subject matter and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this report. Neither the Commission nor any person acting on the Commission's behalf may be held Key words: Biophysical impact, runoff, water retention, effectiveness - Please consult the NWRM glossary for more information.

*NWRM project publications are available at
<http://www.nwrn.eu>*

Table of content

I. Basic Information.....	1
II. Policy context and design targets	1
III. Site characteristics.....	3
IV. Design & implementation parameters.....	3
V. Biophysical impacts	6
VI. Socio-Economic Information.....	7
VII. Monitoring & maintenance requirements.....	7
VIII. Performance metrics and assessment criteria	8
IX. Main risks, implications, enabling factors and preconditions	8
X. Lessons learned.....	9
XI. References.....	9
XII. Photos Gallery	11

I. Basic Information

Application ID	<i>Austria_01</i>		
Application Name	Revitalisation Upper Drau		
Application Location	Country:	Austria	Country 2: <i>In case of transboundary applications</i>
	NUTS2 Code	<i>AT21 Kärnten</i>	
	River Basin District Code	<i>AT1000</i>	
	WFD Water Body Code		
	Description	<i>The project side lies close to the Italian border in the west of Klagenfurt. The revitalized parts of the Drau are between Spittal i.Dr. and Oberdrauburg</i>	
Application Site Coordinates <i>WGS84</i>	Latitude: - 46.748666°N	Longitude -12.96743°E	
Target Sector(s)	Primary:	Hydromorphology	
	Secondary:	Forest	
Implemented NWRM(s)	Measure #1:	<i>N3 Floodplains</i>	
	Measure #2:	<i>N4 Re-Meandering</i>	
	Measure #3:	<i>N5 revitalization of flowing waters</i>	
	Measure #4:	<i>N8 Riverbed</i>	
	Measure #5	<i>N10 natural bank stabilization</i>	
	Measure #6	<i>N12 lakes</i>	
	Measure #7	<i>F1 Riparian buffers</i>	
Application description short	At 3 different sections of the Drau the river bed was widened. Moreover 25 ha of riparian forest were created as well as meadows, lakes and several river branches		

II. Policy context and design targets

Brief description of the problem to be tackled	The river bed is too narrow and there is a lack of brush and pebbles. As consequence the river bed became deeper, bank stabilization got insecure and flood plains inoperable.		
What were the primary & secondary targets when designing this application?	Primary target #1:	Flood control and flood risk mitigation	
	Primary target #2:	Soil formation and maintenance	
	Secondary target #1:	Biodiversity and gene-pool conservation in riparia	
	Secondary target #2:	Select secondary target	
	Remarks	Flood control and flood risk mitigation	
Which specific types of pressures did you aim at mitigating?	Pressure #1:	WFD identified pressure	4.1.3 Physical alteration of channel/bed/riparian area/shore of water body for navigation

CS: Revitalisation Upper Drau, Austria

	Pressure #2:	WFD identified pressure	4.1.2 Physical alteration of channel/bed/riparian area/shore of water body for agriculture
	Pressure #3:	Select the relevant Directive	
	Pressure #4:	Select the relevant Directive	
	Remarks		
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	WFD identified impact	Altered habitats due to morphological changes
	Impact #2:	WFD identified impact	Damage to groundwater dependent terrestrial ecosystems for chemical / quantitative reasons
	Impact #3:	Floods Directive identified impact	<i>Property</i>
	Impact #4:	Floods Directive identified impact	<i>Infrastructure</i>
	Remarks		
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:	WFD-mitigation of significant pressure	<i>Flood control, less damage to infrastructure and property</i>
	Requirement #2:	WFD-achievement of good ecological status	<i>River Drau should be able again to form its own river bed by re-meandering and flooding riparian forests</i>
	Requirement #3:	Select the relevant Directive and Requirements	
	Requirement #4:	Select the relevant Directive and Requirements	
	Remarks		
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	A good ecological status of the Drau should be achieved in order to meet the demands of the WFD. Moreover the project follows a master plan for the development of the river. With RIWA-T technical guidelines are established that give priority to passive flood protection, NWRM and take into account the ecological functions of a water body		

III. Site characteristics

Dominant Land Use type(s)	Dominant land use	<i>242 complex cultivation patterns</i>	
	Secondary land use	<i>313 Mixed forests</i>	
	Other important land use	<i>Type in the relevant Code Level3</i>	
	Remarks		
Climate zone	cool temperate moist		
Soil type	<i>No information available</i>		
Average Slope	nearly level (0-1%)		
Mean Annual Rainfall	900 - 1200 mm		
Mean Annual Runoff	73,8 m3/s		
Average Runoff coefficient (or % imperviousness on site)	Select the Average Runoff Coefficient value	Select the % imperviousness on site	
	Remarks		
Characterization of water quality status (prior to the implementation of the NWRMs)	Given that water quality improvement was not an objective of the project, no information is available.		
Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	Text		
	<p><i>Positive way:</i></p> <p><i>Negative way:</i> The availability of plots determines which kinds of NWRMs can be done, and to which extent they can be implemented. In this project the measures had to be re-planned several times, due to farmers changing their opinion or claiming to high prices.</p>		

IV. Design & implementation parameters

Project scale	Medium (eg. public park, new development district)	<i>Although the enlargement of the river bed was done on a length of 5 km the affected length of the river/region around the river is 68 km. The surface of the project region (river and surroundings) are 976 ha</i>
Time frame	Date of installation/construction 2006-2011	<i>River enlargement Rosenheim Nov 06-Jun 07</i> <i>Reconstruction of open check dam at Feistritzbach Oct 08-May 09</i> <i>River enlargement Amlach St. Peter Apr 09 – Oct 09</i> <i>River enlargement Obergottesfeld Feb 10 – May 11</i>
	Expected average lifespan (life expectancy) of the application in years	<i>Eternity, exception: the river “decides” to search itself a completely new bed</i>

CS: Revitalisation Upper Drau, Austria

	<i>Name of responsible authority/ stakeholder</i>	<i>Role, responsibilities</i>
Responsible authority and other stakeholders involved	1. Federal Ministry for Agriculture, Forestry, Environment and Water Management, represented by the Carinthian State Government, department 8-Competence Centre environment, Nature and Water conservation, subdivision water management	Execution
	2. Federal Ministry for Agriculture, Forestry, Environment and Water Management (rural development section) department II/4	Financing
	3. Torrent and avalanche control, section Carinthia, regional management supervision 4 Upper Drau Valley and Möll Valley	Reconstruction of the open check dam
	4. Carinthian State Government, department 8, competence centre environment, water and nature protection, subdivision Nature Conservation and National Park Law	Supervision of nature conservation measures
	5. DI Klaus Michor of REVITAL Ziviltechniker GmbH	Project coordination
	6. DI Dr. Peter Mayr and his team	Planning of the revitalization measures Geodetic survey of the river (monitoring)
	7. University of Vienna	Monitoring: Analysis of the river bed before and after the LIFE Project, Study of the composition of the fish fauna, calculation of the transported bedload in the Feistritzbach
	8. Ökoteam	Monitoring: search for indicator species in order to document the improvement of the ecological state
	9. Agrarian Regional Office of Villach	Purchase of land
	10. LIFE Nature	Project controlling for the EU
The application was initiated and financed	<ul style="list-style-type: none"> Federal Ministry for Agriculture, Forestry, Environment and Water Management: 2.6 Mio € 	

by	<ul style="list-style-type: none"> • European Union: 1.5 Mio € • Carinthian State Government, department 8, competence centre environment, water and nature protection, subdivision Nature Conservation and National Park Law: 0.2 Mio € • Torrent and avalanche control: 0.2 Mio € • Federal Ministry for Agriculture, Forestry, Environment and Water Management (rural development section) department II/4 (nature and protection of species, national parks): 0.1 Mio € 	
What were specific principles that were followed in the design of this application?	<p>As already explained the erosion of the river bed (the Drau became deeper and deeper) determined the choice of measures. Another point to mention is the availability of land. Next to the negotiations with farmers a reallocation of land took place. Plots were exchanged between farmers and the project responsible. Depending on the size of riparian buffers available the measurements were adapted.</p> <p>A good ecological status should be achieved for the Drau river. The measurements combine habitat diversity with passive flood protection. Secondary the regional tourism department supported the project by designing picnic areas, positioning info points and marketing the project.</p>	
Area (ha)	Number of hectares treated by the NWRM(s). <i>e.g. It could be the upstream drainage area in case of retention ponds</i>	26
	Text to specify <i>(caution to differentiate between treated or target area vs. the application area occupied by the NWRM). In some cases treated area may not have a meaning (e.g. green walls). In other cases you may have a measure applied in an upstream forest but with the purpose of mitigate an impact in a downstream area</i>	1 ha meadow lakes, 25 ha riparian forests
Design capacity	Since flood protection wasn't the main target of the project quantitative data is missing on the success of the implemented NWRM. Monitoring may be done in future. After Norbert Sereinig it is moreover difficult to describe effects on water retention. The flood plains are designed in a way that already quinquennial and decennial floods enter the floodplains completely.	
Reference to existing engineering standards, guidelines and manuals that have been used during the design phase	<i>Reference</i>	
	1. RIWA-T	http://www.bmlfuw.gv.at/wasser/wasser-oesterreich/foerderungen/foerd_hochwasserschutz/trl.html
	2.	
	3.	
	4.	
5.		
Main factors and/or constraints that	1. Erosion of the river bed (becoming deeper and deeper)	

influenced the selection and design of the NWRM(s) in this application?	2. Availability of land (detailed description at questions on design principles and specific site characters)
-------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------

V. Biophysical impacts

Impact category	Impact description	Impact quantification (specifying units)
<ul style="list-style-type: none"> • Runoff Control • Peak Flow Rate reduction • Restoring hydraulic connection • Impact on soil storage capacity • WFD Ecological status • Reducing flood risks • biodiversity 	<p>Unfortunately no quantitative data is given for the success of the NWRMs. One can only qualitatively say that the reconnection of side arms, the widening of the river bed (5 km length) and the creation of riparian forests and buffer strips help to control floods, reduce flow rates and reduce risks.</p> <p>However a quantitative monitoring on biological impacts was done. The number of amphibian species multiplied by 6. The number of fish and insect species increased as well. With the reconnection of arms and a better bed load balance there is more habitat diversity for fish/insect/amphibian larva. Birds like the kingfisher came to the newly created steep bank. Fourteen fish species can be found in the enlarged river sections, especially small fish. But there are still barriers to fish migration outside the national park. A number of endangered species were also identified.</p>	<p><i>No quantitative data available</i></p> <p><i>X6 number of amphibian species</i></p> <p><i>14 fish species</i></p> <p><i>>100 spider and ground beetle species</i></p>
Runoff attenuation / control		
Peak flow rate reduction		
Impact on groundwater		
Impact on soil moisture and soil storage capacity		
Restoring hydraulic connection		
Water quality Improvements		
WFD Ecological Status and objectives		
Reducing flood risks (Floods Directive)		
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)		
Soil Quality Improvements		
Other		

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	The river bed was stabilized → the reconstructed dam mobilized until mid 2011 28000 m ³ bed load 16000 m ³ reached the Drau. Bed load balance is reached, as well as a stable ground water level Increase of biodiversity: Number of amphibian species was multiplied by six, new habitats and higher habitat quality for fish and their breeding, more than 100 spider and ground beetle species several of which are endangered or threatened by extinction		
Financial costs	Total:	4.6 Mio €	
	<i>Capital:</i>	3.93 Mio €	<i>Construction, staff, journeys, measuring instruments, gauges</i>
	<i>Land acquisition and value:</i>	670000 €	<i>Land and compensation</i>
	<i>Operational:</i>	10000 €/yr	<i>Monitoring of the river bed</i>
	<i>Maintenance:</i>	0 €	<i>No project-specific maintenance needed</i>
	<i>Other:</i>	<i>Value in €</i>	
Were financial compensations required? What amount?	<i>Was financial compensation required: Yes</i>		
	<i>Total amount of money paid (in €): sum is included in land acquisition</i>		
	<i>Compensation schema: farmers got financial compensation for land given up</i>		
	<i>Comments / Remarks:</i>		
Economic costs	<i>Actual income loss: no information</i>		
	<i>Additional costs:</i>		
	<i>Other opportunity costs:</i>		
	<i>Comments / Remarks:</i>		
Which link can be made to the ecosystem services approach?	Flood security and protection Amenities : higher habitat quality for fish, amphibians and insects New recreational areas for humans (Drau oasis), environmental education, tourism		

VII. Monitoring & maintenance requirements

Monitoring requirements	The river bed is steadily monitored as well as the amount and size of transported bed load. By geodetic engineers and research cooperation with the University of Vienna cross profiles are recorded by echo sounding. Terrain models are recorded by drones performing laser scans. Aerial photos are assessed in order to see changes in the river morphology. Steel boards are at the bottom of the river and monitor by ultrasound the transported sediments. Researchers are also interested in side-erosion effects since the Drau has now the possibility to form its bed. Already accomplished is the biological monitoring
Maintenance requirements	There are no project-specific maintenance requirements. As for every river every few years grass will be needed to cut as well as

	trees.
What are the administrative costs?	Monitoring: 10000 €/year

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	Biophysical impacts such as run-off or water storage capacity weren't assessed during this project. See the Monitoring part for the assessment of transported sediments and changed morphology
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	No assessment was done neither on the benefits nor the cost-effectiveness.
How cost-effective are NWRM's compared to "traditional / structural" measures?	No information available
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	It's difficult to give an answer here, since no quantitative data about the effectiveness is given. The success of a revitalization project depends on the available land on which measures can be implemented.
What is the standard time delay for measuring the effects of the measures?	<i>Regarding biodiversity the measurement can be done already several months after finishing the measure. The changing river morphology has to be recorded over years.</i>

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	The project had to be re-planned several times since farmers didn't want to sell ground or sell it for very high prices. Others changed their opinion suddenly and new possibilities opened up There is always tension between the disciplines agriculture, nature protection and hydraulic engineering having different aims
What were the main enabling and success factors?	Since the revitalization measures on the Drau were subsequent to former projects and measures much less publicity had to be done. Those responsible were able to allay the fears and worries of farmers and citizens. There is already 20 years of experience on restoring the river to a more natural state. Moreover there is good cooperation between the different participant of nature conservation and hydraulic engineering The regional tourist department supported the measure and furthermore helped to market the Drau project. How to design picnic areas? Where are the best places for information boards? How can we conduct tourists through the region? The purchase of land was combined with a reallocation of land process. Lots were exchanged between farmers. There were a lot of farmers willing to give land for the project and there was also

	political support of the action. A company constructing/operating hydropower plants had bought lots in the 90s. After their project of building 4 new power plants on the Drau was refused they were nevertheless ready to give their lots to the project partners for a fair price.
Financing	<ul style="list-style-type: none"> • Federal Ministry for Agriculture, Forestry, Environment and Water Management: 2.6 Mio € • European Union: 1.5 Mio € • Carinthian State Government, department 8, competence centre environment, water and nature protection, subdivision Nature Conservation and National Park Law: 0.2 Mio € • Torrent and avalanche control: 0.2 Mio € • Federal Ministry for Agriculture, Forestry, Environment and Water Management (rural development section) department II/4 (nature and protection of species, national parks): 0.1 Mio €
Flexibility & Adaptability	Since the river has freedom to form its bed, it will adapt the measures on its own. The adaptation of the measures by humans is linked with huge costs and difficult to execute.
Transferability	<i>There has to be knowledge about the original characteristics of the river. Was it a branched or meandering river?</i>

X. Lessons learned

Key lessons	The adaptation of open check dams to improve bed load balance is possible. The widening of the river bed and the reconnection of side arms create larger habitat diversity and as consequence the number of species in the area rises.
-------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

XI. References

Source Type <i>Select from the drop-down menu</i>	Project Report		
Source Author(s) <i>Provide the Name of the author(s)</i>	Carinthian state government (ed.)		
Source Title <i>Provide the Title of the reference</i>	<i>Life vein-Upper Drau River ; Carinthia's largest nature restoration campaign (2006-2011)</i>		
Year of publication <i>Provide the year in the format (YYYY)</i>	2011		
Editor/Publisher <i>e.g. Journal/ Volume/ Issue</i>	Carinthian state government		
Source Weblink <i>Direct weblink(s) of the reference</i>	http://www.life-drau.at/		
Key People <i>List names, affiliation and contact details of key people who have communicated important information presented in this factsheet</i>		<i>Name / affiliation</i>	<i>Contact details</i>
	1.	Norbert Sereinig	norbert.sereinig@ktn.gv.at

Source Type <i>Select from the drop-down menu</i>	Presentation		
Source Author(s) <i>Provide the Name of the author(s)</i>	Veronika Koller-Kreimel		
Source Title <i>Provide the Title of the reference</i>	NWRMs - experience from Austria		
Year of publication <i>Provide the year in the format (YYYY)</i>	2014		
Editor/Publisher <i>e.g. Journal/Volume/Issue</i>	Project data base		
Source Weblink <i>Direct weblink(s) of the reference</i>	http://nwrn.eu/sites/default/files/regional-workshops/Danube/sessionII/S-2-7.Experience from Austria VKoller.pdf		
Key People <i>List names, affiliation and contact details of key people who have communicated important information presented in this factsheet</i>		<i>Name / affiliation</i>	<i>Contact details</i>
	1.	Veronika Koller-Kreimel	Veronica.koller-kreimel@bmlfuw.gv.at

Source Type <i>Select from the drop-down menu</i>	Project Report		
Source Author(s) <i>Provide the Name of the author(s)</i>			
Source Title <i>Provide the Title of the reference</i>	Auenverbund Obere Drau (meadow connection upper Drau)		
Year of publication <i>Provide the year in the format (YYYY)</i>	2004		
Editor/Publisher <i>e.g. Journal/Volume/Issue</i>			
Source Weblink <i>Direct weblink(s) of the reference</i>	http://ec.europa.eu/environment/life/project/Projects/files/book/LIFE99_NAT_A_006055_Endbericht_Monitor.pdf#page=18&zoom=auto,0,819		
Key People <i>List names, affiliation and contact details of key people who have communicated important information presented in this factsheet</i>		<i>Name / affiliation</i>	<i>Contact details</i>
	1.	Norbert Sereinig	Norbert.sereinig@ktn.gv.at

XII. Photos Gallery



Figure 1 Before-After: The LIFE Project measure at Amlach/ St. Peter before construction in 2009 and after completion of the measure in 2011 (Carinthian state government (ed.) 2011)

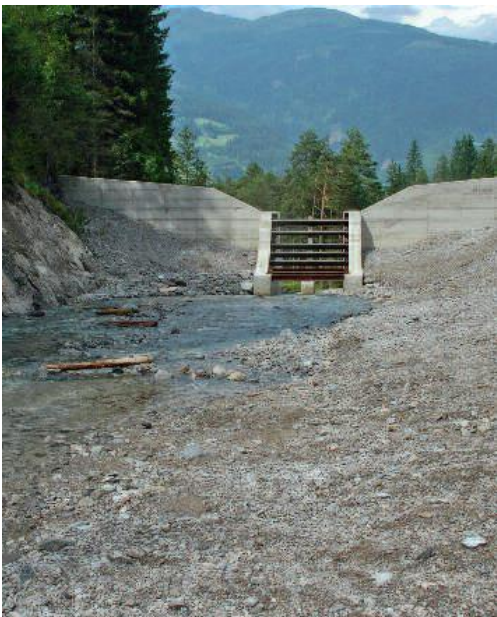


Figure 2 Open check dam at the creek Feistritzbach (Carinthian state government (ed.) 2011)

CS: Revitalisation Upper Drau, Austria



Figure 3 Project Overview: situation of the river Drau in Austria (Carinthian state government (ed.) 2011)