



Implemented measures at the border stretch of River Mur since 2002

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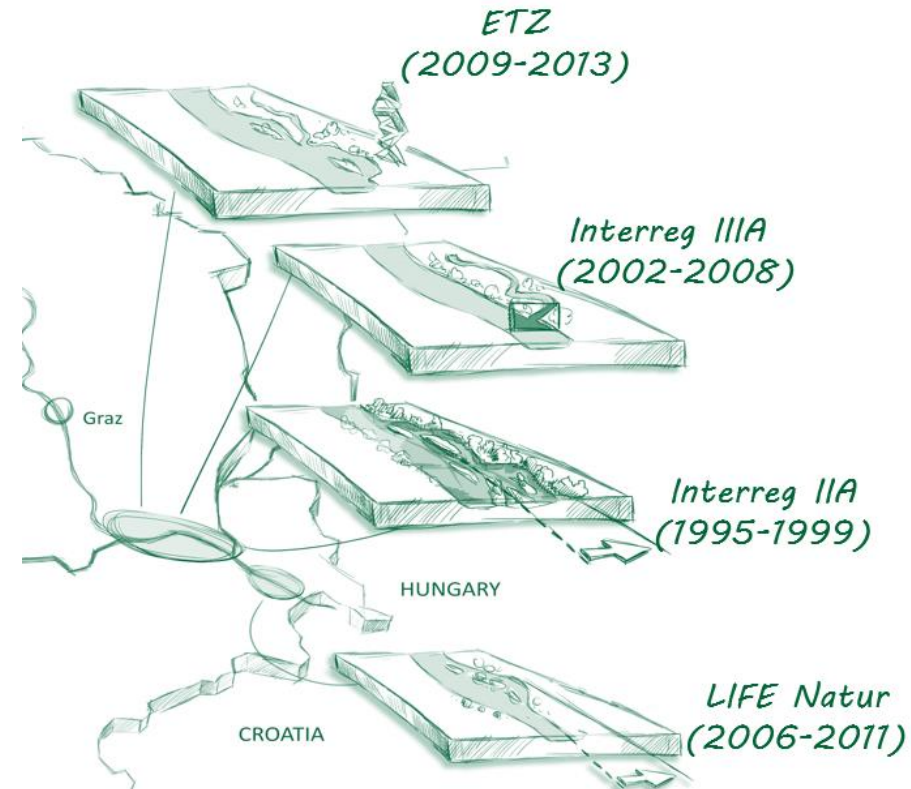
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Activities

- 1995: First baseline surveys
- 1998 – 2001
Principaled Water Management
Concept PWC 2001
- 2002 – 2013
Planning & Implementation of
measures



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Main objectives PVMC 2001 and others

- Prevention of further deepening by stabilisation of the riverbed and the groundwater balance
- Flood protection – non-technical water retention measures
- Restoration of natural river structures and habitats
- Re-activation and free migration of tributary streams
- Creation of dynamic river- and alluvial habitats
- Preservation and enhancement of the “NATURA 2000” EU-wide network
- Enhancement of accessibility and public awareness
- Bilateral cooperation and inclusion of all relevant stakeholders

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Implemented measures AT-SI

River MUR (14 measures)

- River widening Oberschwarza (2004)
- River widening Weitersfeld (2005)
- River widening Donnersdorf (2006-2007)
- River widening Gosdorf I (2006-2007), Widening Gosdorf II (2013)
- River widening Sieldorf (2012)
- River widening Estuary Breuss-Lahn (2012)
- Fish pass Spielfeld & Estuary Gamlitzbach (2006-2009)
- River restructuring Bad Radkersburg (2005-2007)
- Cross-border river attraction– Skupaj (2010-2014)
- Side arm connection Alter Graba (2012)*
- Widening Segovci*
- Flood wall construction,*
- Flood levee reconstruction Gornja Radgona (in preparation)*

Tributaries and back waters (13 measures)

- Flow donation mill-stream Mureck-Radkersburg (2000-2001)
- Flow donation mill-stream Straß-Lichendorf
- Flow donation Wäschbach (2002-2003)
- Flow donation Trummerbach-Lahn (2007)
- Flow donation Schwarzaubach (2008)
- Fish pass Gnasbach – Feilbach (2006)
- Fish pass & Flow diversion Ruppühle (2006-2007)
- Restoration Saßbach (2004)
- Restoration Tischler pond (2005)
- Restoration Glauningbach (2007)
- Restoration Kutschenitza
- Pond habitat Perbersdorf (2006)
- Enajstmlinski mill channel (2012)*

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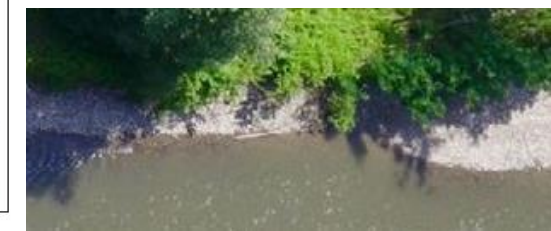
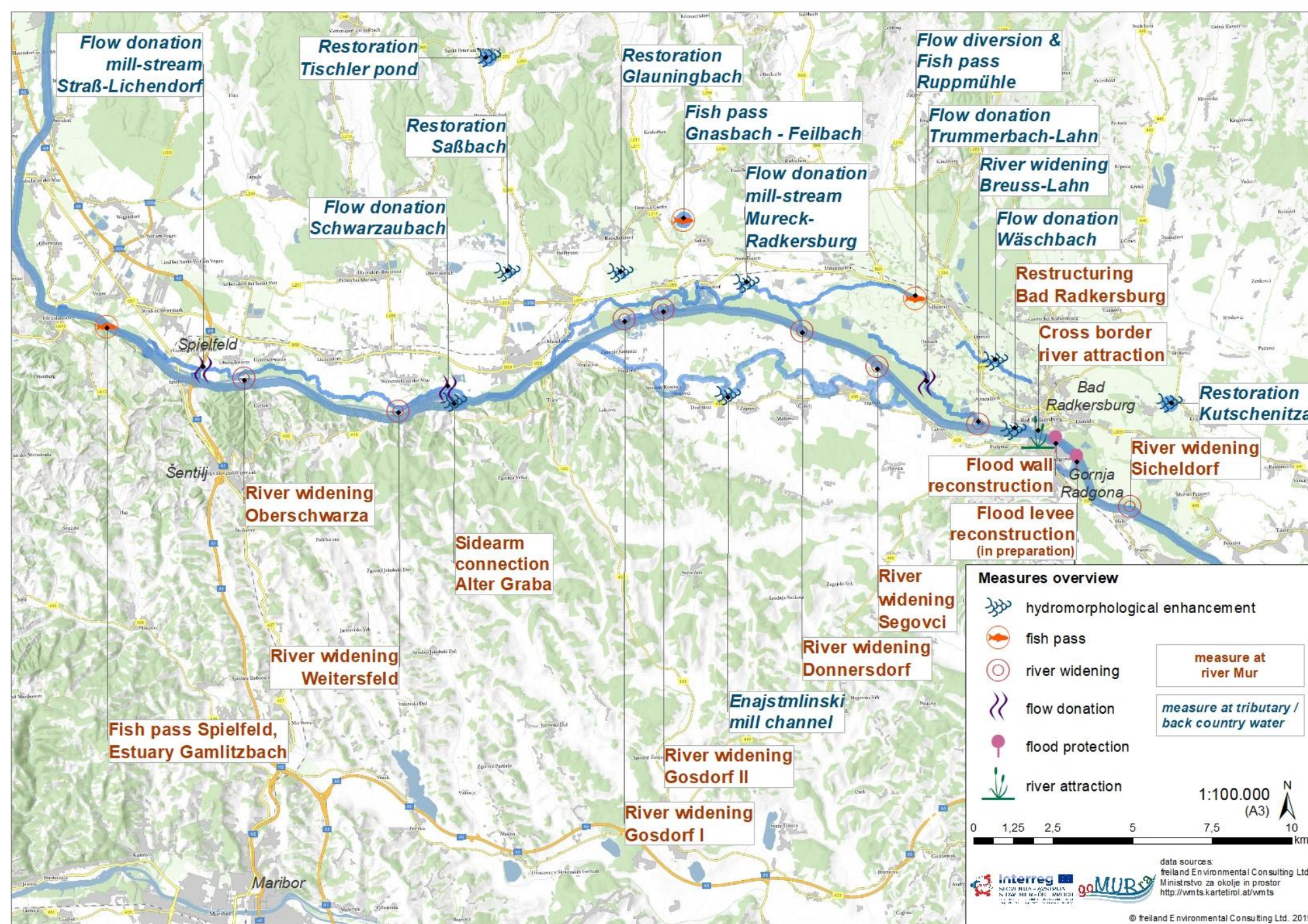
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Measures of PMWC 2001 monitoring & surveys 1

Riverbed monitoring

- Constant measurement of selected cross-sections between km 95,00 and approx. km 130,00
- 07/2009: Interim report “Morphodynamic analysis of river-widenings and lateral erosion at Border Mura” covering widening Gosdorf and Donnersdorf
- 06/2013: Report “Sediment and suspended sediment monitoring, sediment-transport and lateral erosion at Border Mur”
- 04/2016: Report “Significance of river-engineering measures for the groundwater at Border Mur”
“... it is proven, that the river-engineering measures between Spielfeld and Bad Radkersburg initiated the stabilization of the river-bed resp. initiated a raising of the river bed level . . .”

Groundwater

- 2005 and 2012: Studies on possible effects of river-widenings concerning the public wells near Gosdorf I (2005) and Gosdorf II (2012)

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Measures of PMWC 2001 monitoring & surveys 2

Habitats monitoring

- 05/2008: 1st monitoring of river-widening Gosdorf I
- Other habitat-monitorings are cited, have not yet been found (e.g. general forest survey)

Species monitoring

- 02/2013: Zoological monitoring in the river-widenings Gosdorf I and Donnersdorf (birds, ground beetles, dragonflies)
- Styrian Government: Fish monitoring “Motorway bridge Spielfeld”: 2007, 2010, 2013
- Styrian Government: Fish monitoring “Radkersburg”: 2007, 2010, 2016
- 10/2009: Spielfeld Power-station, survey on the fish pass and it’s functionality

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N2000 Baseline 2004 in the area

N2000 Management Plan „Measures“ of 2004

- Covers the “Border Mur” river stretch
- Comprises 5 chapters of measures:
 - Water: measures of PVMC and other measures (backwaters, ponds etc.)
 - Forestry
 - Agriculture
 - Protected species according to FFH-Directive
 - Visitors guidance

N2000 MMP “Measures” of 2004 bases on

- 2003/2004 Survey on Fish population in N2000 covering the area of Border Mura including Gamlitzbach and Gnasbach
- 2004 “MMP N2000 area Border Mura including Gamlitzbach and Gnasbach” - baseline surveys and proposed measures dealing with
 - Habitats according to appendix I FFH-Directive
 - Species according to appendix II FFH-Directive
 - Birds according to appendix I Birds-Directive

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Evaluation/Monitoring

Riverbed monitoring

- constant cross-section survey
- analysis of bed-load discharge
- maintenance work of widenings

Overall, it can be stated that the measures fulfil their functions - a dynamic course of the river and embankments is in process. Except measure Gosdorf I is limited in it's functionality.

- **Nature 2000 monitoring**

- fish- ecological assessment
- extensive monitoring combined with habitat modelling and an investigation of different types of biotopes and animal species, visitor pressure and invasive species

The monitoring results show a striking development of already existing and new habitats of the examined protective goods concerning the realization of measures.

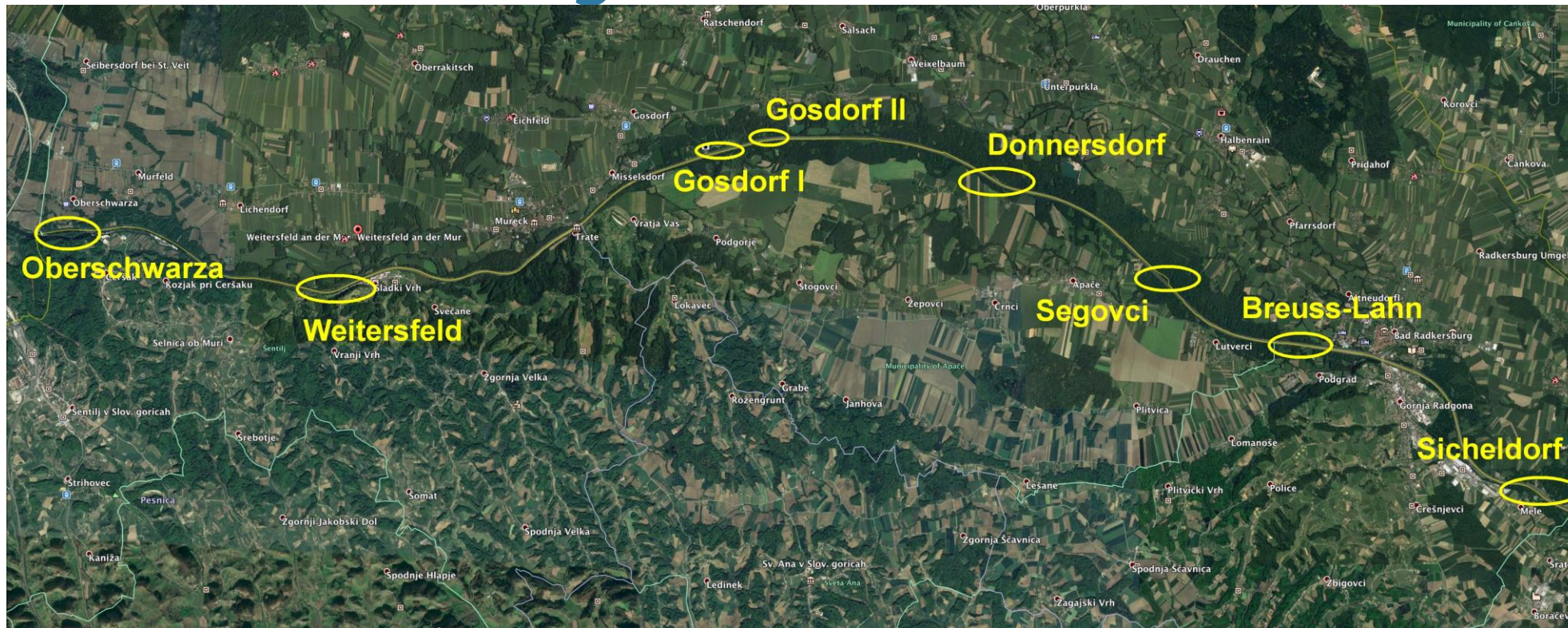
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River widenings



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River widening Oberschwarza



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River widening Oberschwarza

Objectives

- Counteracting river-bed erosion
- Promoting gravel mobilization
- Enhancement of (hydro-)morphology and fish ecology

Implemented measures

- River bank protection removal along 300 m
- Creation of a side branch of 400 m length – thereby establishing an island in the river

Recent development

- Good functionality: constant discharge in river side branch, no siltation tendency
- Strong dynamic around the river island - as this river section is not secured by bank protection measures

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River widening Weitersfeld



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River widening Weitersfeld

Objectives

- Counteracting river-bed erosion
- Promoting gravel mobilization
- Enhancement of (hydro-)morphology and fish ecology

Implemented measures

- River widening - river bank protection removal along 500 m
- Creation of a side branch of 600 m length

Recent development

- Good functionality: constant discharge in river side branch, no siltation tendency

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River widening Gosdorf I



- Mur-Tower
- Estuary Sassbach

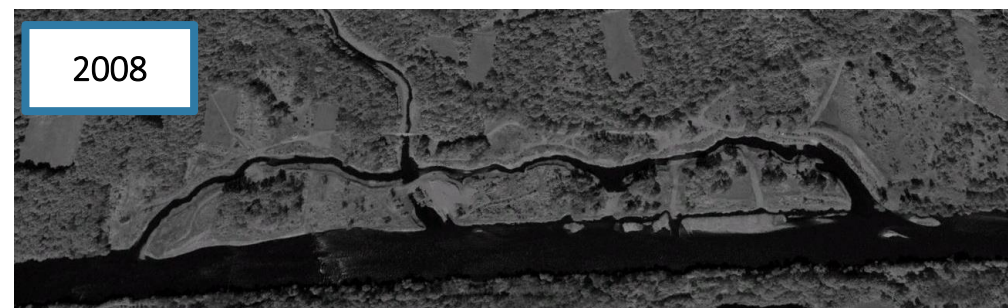
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River widening Gosdorf I



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Source: Google Earth Pro



River widening Gosdorf II



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River widening Gosdorf I & II

Objectives

- Counteracting river-bed erosion - Promoting river bank erosion / gravel mobilization
- Enhancement of (hydro-)morphology and fish ecology
- Attraction for recreational visitors

Implemented measures

- River widening - river bank protection removal along 1000 m (Gosdorf I)
- Creation of a side branch - establishing natural river banks (Gosdorf I)
- Initiation of a Bumblebee habitat (Gosdorf I)
- Construction of an observation tower (Gosdorf I)
- Creation of a 900 m length-side branch (tied to the main river downstream), additional discharge in the case of flood events (Gosdorf II)

Recent development

- Gosdorf I: Functionality not sufficiently established: strong siltation tendency as the side branch is connected to the main river right-angled (due to limited availability of land). Deposited gravel had to be dredged three times since implementation
- Gosdorf II: Good functionality, no siltation - constant discharge

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River widening Donnersdorf



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River widening Donnersdorf

Objectives

- Counteracting river-bed erosion
- Promoting gravel mobilization
- Development of a natural river-shore
- Re-connecting of a tributary (Feilbach)

Implemented measures

- River widening and river bank protection removal along 300 m
- Creation of a 400 m side branch
- Widening estuary Feilbach, establishing passable estuary
- Creation of a Jetty/ boat dock

Recent development

- Constant discharge in river side branch, no siltation tendency
- Subsequent modification of the jetty was necessary

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River widening Sicheldorf



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River widening Sichelendorf

Objectives

- Counteracting river-bed erosion
- Promoting gravel mobilization
- Creation of retention areas for floods

Implemented measures

- Widening on a length of about 1.400m by initial erosion scars for river widening (bays, excavation of 15,000 m³)
- Removal of bank protection

Recent development

- Very dynamic system, shift of the border (gravel bar in Slovenia, River bank dynamics on Austrian side)
- Protection of adjacent properties necessary due to high river dynamics
- Neophytes in high numbers

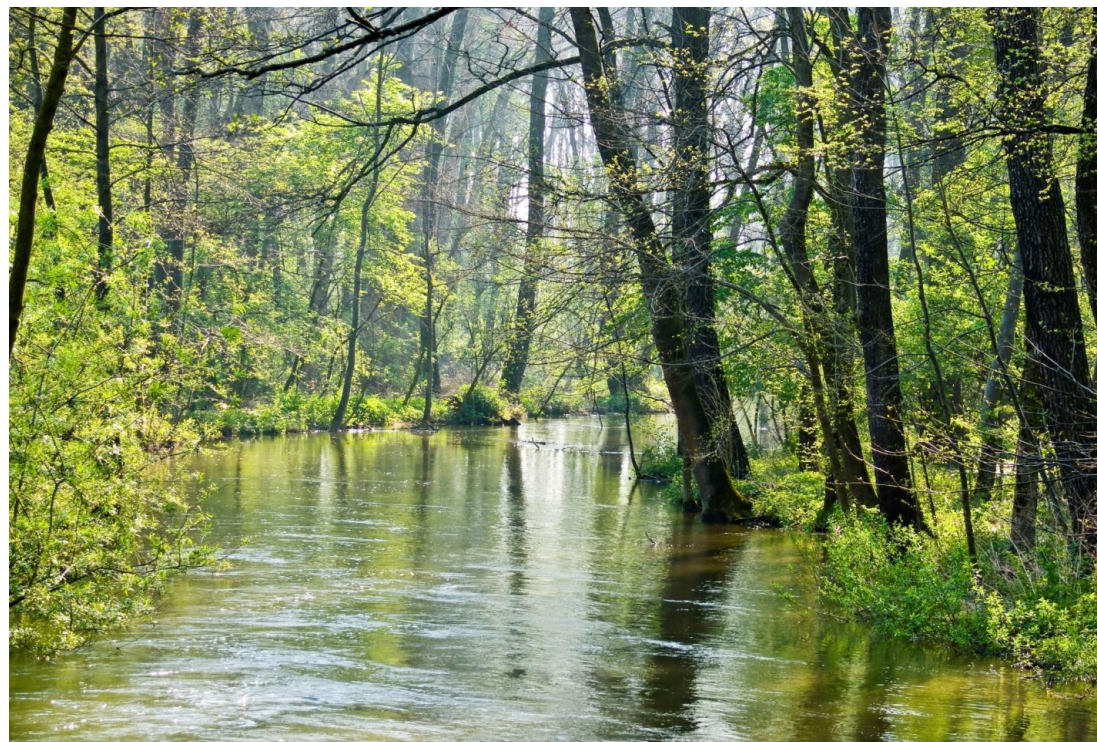
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Flow donation mill-stream Straß-Lichendorf



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Flow donation mill-stream Straß-Lichendorf

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Objectives

- Establishing connectivity and constant flow to a formerly dried-up side channel of the Mur
- Irrigation of agricultural areas
- Enhancement of groundwater situation

Implemented measures

- Constant discharge for the Mühlbach (800 l/s) from the HPP Spielfeld

Recent development

- Good functionality established



Fish pass HPP Spielfeld, Gamlitzbach



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Fish pass HPP Spielfeld, Gamlitzbach

Objectives

- Enabling upstream migration/longitudinal connectivity (Mur, Gamlitzbach)
- Establishing new valuable fish habitats

Implemented measures

- Construction of a 3 km long, nature-like bypass channel (which incorporates the tributary Gamlitzbach)
- Construction of a technical fish-pass (Vertical-Slot)
- Re-design of Gamlitzbach estuary

Recent development

- Fish pass functionality confirmed
- New habitats for fish established
- Increase in fish species shortly after implementation

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Enajstmlinski mill channel



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Enajstmlinski mill channel

- The longest (only) mill channel on Slovene side of the border Mura (cca 17 km)
- High local interest (Apače Municipality) and good cooperation of local and national authorities (municipality – DRSV)
- Executed measures:
 - Channel clearing of sediment and vegetation (DraMurCI and Apače municipality funds)
 - Discharge analysis (numerical hydraulic modeling) and
 - Groundwater analysis: levels (flooding of certain basements) and flow patterns (drinking water quality)
- Recent development:
 - Pilot activity of water inflow carried out in september 2018
 - Flow monitoring at 18 sections of the stream and groundwater level monitoring at all 20 endangered objects
 - Pilot activity stopped after few days
 - Results: need for reconstruction of channel at Žiberci
- Current development:
 - Channel reconstructed and awaiting continuation of the pilot
- Future development:
 - Pilot activities will give insight to possible negative impacts (endangered objects, groundwater flow pattern)
 - Planed activities: reconstruction of inflow and outflow objects, securing sufficient levels on Mura at inflow, measures to reduce possible negative impacts (if needed)

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Flow donation Trummerbach-Lahn



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Flow donation Trummerbach-Lahn

Objectives

- Establishing constant flow from Sulzbach
- River protection (crossings)
- Preservation of existing water-bound meadows

Implemented measures

- Flow donation through a intake structure at the Sulzbach (technical construction with slice gate)
- Securing of stagnant waters
- Construction of river-crossings instead of using riffles

Recent development

- Functionality not sufficiently established
- Strong siltation tendency - deposited gravel needs regular dredging.

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Widening Breuss-Lahn



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Widening Breuss-Lahn

Objectives

- Enhancement of (hydro-)morphology and fish ecology
- Counteracting river-bed erosion

Implemented measures

- River widening estuary Breuss-Lahn (size: 1 ha)
- Creation of a jetty
- River widening Mur (37 m width)

Recent development

- Near-natural development
- Siltation tendencies at the boat deck

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THANK YOU!

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