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# Hydrological study of the Mura river

# Annex I

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Ljubljana, February 2012

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## Hydrological stations history

## **AUSTRIA**

<u>Station Code</u> : 2055	Station name: GESTÜTHOF
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : Laβnitz bei Murau	Location: on right river bank
<i>Distance to state border</i> : 270.81 km	<u>Area</u> : 1700 km²
<u>GKX</u> : 588928.312	<u>GKY</u> : 221254.531
<i>LON:</i> 14.210278	<u>LAT</u> : 47.111111
<u>Ground <i>"zero"</i></u> : 776.3 m	<i>Purpose:</i> monitoring + prognosis
<u>Set</u> : 1959	<u>Alarm</u> : red – 347 cm (19.10.2009)
<u>Start</u> : 1959	<u>End:</u>
<u>Station type</u> :	
- hydrometrical wing	

- from year 2005 ADCP

## Active instruments:

- Seba Omega with pressure probe
- Solitax TS100
- data transmission: phone

## Measurements:

Data from year 1959 Daily minimum, maximum and average from year 1962 Continious measurements of water stage and discharge since 1976 Water temperature since 2001 Suspended material since 2008.

## Digitalised Data:

## Data Archive:

Amt der Steiermärkischen Landesregierung

FA19A - Hydrographischer Dienst Steiermark

## Description:

High water stage – 430 cm, 5.11.1966 High water – discharge – 490 m<sup>3</sup>/s, 5.11.1966 Low water – stage – 96 cm, 15.3.1984 Low water – discharge – 2.6 m<sup>3</sup>/s, 9.1.1963 Mean discharge – 35.25 m<sup>3</sup>/s Mean water stage – 164 cm Missing data for time period 1984-1987.

## Figures:









<u>Station Code</u> : 2170	Station name: ST. GEORGEN
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : St. Georgen ob Judenburg	Location: on left river bank
<i>Distance to state border:</i> 235.72 km	<u>Area</u> : 2368 km²
<u>GKX</u> : 614282	<u>GKY</u> : 231665
<i>LON:</i> 14.539167	<i>LAT:</i> 47.21
<u>Ground <i>"zero":</i></u> 700.15 m	Purpose: monitoring + prognosis
<u>Set</u> : 1889	<u><i>Alarm</i></u> : red – 481 (19.10.2009)
<u>Start</u> : 1951	<u>End:</u>
<b>.</b>	

## <u>Station type</u>:

- hydrometrical wing
- from year 2005 ADCP

#### Active instruments:

- Seba PS Light
- Sommer MRS4 with pressure probe
- Data transmission: Sommer

#### Measurements:

Data from year 1951 Daily minimum, maximum and average from year 1951 Continious measurements of water stage and discharge since 1976 Water temperature since 2001.

## Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

## Description:

High water – stage – 541 cm, 6.10.2005 High water – discharge – 550 m<sup>3</sup>/s, 19.8.1966 Low water – stage – 152 cm, 16.4.1997 Low water – discharge – 5.2 m<sup>3</sup>/s, 27.2.1986 Mean discharge – 45.67 m<sup>3</sup>/s Mean water stage – 232 cm Missing data for time period 1984-1987.





<u>Station Code</u> : 2400	Station name: ZELTWEG
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : Zeltweg	Location: on right river bank
<i>Distance to state border:</i> 210.14 km	<u>Area</u> : 2958 km²
<u>GKX</u> : 630294.5	<u><b>GKY</b></u> : 228547.234
<i>LON:</i> 14.753611	<u>LAT</u> : 47.185556
<u>Ground <i>"zero ":</i></u> 646.34 m	<i>Purpose:</i> monitoring + prognosis
<u>Set</u> : 1919	<u>Alarm</u> : red – 372 (19.10.2009)
<u>Start</u> : 1966	<u>End:</u>
Station type:	

- hydrometrical wing

- from year 2005 ADCP

#### Active instruments:

- Ott Nimbus
- Ott pressure probe with Duosens
- Data transmission: Funk

#### Measurements:

Data from year 1966 Daily minimum, maximum and average from year 1966. Continious measurements of water stage and discharge since 1976 Water temperature since 2009.

## Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

## Description:

High water – stage – 409 cm, 6.10.2005High water – discharge – 610 m<sup>3</sup>/s, 6.11.1966Low water – stage – 136 cm, 2.3.2005Low water – discharge – 8.16 m<sup>3</sup>/s, 8.1.1979 Mean discharge – 57.3 m<sup>3</sup>/s Mean water stage – 208 cm







<u>Station Code</u> : 2700	Station name: LEOBEN
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : Leoben	Location: on left river bank
<i>Distance to state border:</i> 161.37 km	<u>Area</u> : 4392 km²
<u>GKX</u> : 656460.625	<u>GKY</u> : 249453.297
<i>LON:</i> 15.094444	<u>LAT</u> : 47.377778
<u>Ground "zero"</u> : 531.24 m	<i>Purpose:</i> monitoring + prognosis
<u>Set</u> : 1854	<u><i>Alarm</i></u> : red – 495 (1.1.1983)
<u>Start</u> : 1951	<u>End:</u>
Station type:	

- hydrometrical wing
- from year 2005 ADCP

## Active instruments:

- Orpheus mini
- Ott pressure probe with Logosens
- Ultrasonic Wave
- Data transmission: GSM for US

#### Measurements:

Data from year 1951 Daily minimum, maximum and average from year 1951 Continious measurements of water stage and discharge since 1976 Water temperature since 2001.

#### Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

## Description:

High water – stage – 677 cm, 22.5.1938 High water – discharge – 840  $m^3/s$ , 19.8.1966 Low water - stage - 168 cm, 1.3.2005 Low water - discharge - 11.1 m<sup>3</sup>/s, 1.3.2005 Mean discharge - 77.36 m<sup>3</sup>/s Mean water stage - 262 cm





Station name: BRUCK
<u><i>River</i></u> : Mur
Location: on right river bank
<u>Area</u> : 6214 km <sup>2</sup>
<u><i>GKY</i></u> : 252874.719
<u>LAT</u> : 47.410556
<i>Purpose:</i> monitoring + prognosis
<u>Alarm</u> : red – 585 (19.10.2009)
<u>End:</u>

- hydrometrical wing

- from year 2005 ADCP

## Active instruments:

- Seba PS Light
- Seba Dipper
- Data transmission: Funk

#### Measurements:

Data from year 1967 Daily minimum, maximum and average from year 1967 Continious measurements of water stage and discharge since 1976.

#### Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

#### Description:

High water – stage – 601 cm, 22.5.1938 High water – discharge – 800 m<sup>3</sup>/s, 13.8.2002 Low water – stage – 162 cm, 25.1.1909 Low water – discharge – 18.7 m<sup>3</sup>/s, 4.1.2002 Mean discharge – 108.05 m<sup>3</sup>/s Mean water stage – 280 cm





<u>Station Code</u> : 3397	<u>Station name</u> : GRAZ
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : Graz	Location: on left river bank
<i>Distance to state border</i> : 79.85 km	<u>Area</u> : 7043 km²
<u>GKX</u> : 683001.9	<u>GKY</u> : 210730.1
<i>LON:</i> 15.451667	<i>LAT</i> : 47.032778
<u>Ground <i>"zero":</i></u> 328.67 m	<i>Purpose:</i> monitoring + prognosis
<u>Set</u> : 1850	<u><i>Alarm</i></u> : red – 532 (19.10.2009)
<u>Start</u> : 1966	<u>End:</u>

## <u>Station type</u>:

- hydrometrical wing
- from year 2005 ADCP

## Active instruments:

- Sommer MRS4 with pressure probe
- Seba PS Light
- Data transmission: Funk

#### Measurements:

Data from year 1966 Daily minimum, maximum and average from year 1966 Continious measurements of water stage and discharge since 1976 Water temperature since 1991.

## Digitalised Data:

## Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

## Description:

High water – stage – 812 cm, 22.5.1938 High water – discharge – 1170 m<sup>3</sup>/s, 20.8.1966 Low water – stage – 181 cm, 5.1.2002 Low water – discharge – 14 m<sup>3</sup>/s Mean discharge – 105.95 m<sup>3</sup>/s Mean water stage – 281 cm From 1.10.2003 water stage located at Graz – Puntigam – new alarm marks.





<u>Station Code</u> : 3870	<b>Station name</b> : SPIELFELD
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : Straß in Steiermark	<u>Location</u> : on left river bank
<i>Distance to state border</i> : 34.88 km	<u>Area</u> : 9480 km²
<u>GKX</u> : 696659.5	<u>GKY</u> : 174777.078
<i>LON:</i> 15.635556	<i>LAT</i> : 46.710556
<u>Ground "zero"</u> : 244.22 m	<u>Purpose</u> : monitoring
<u>Set</u> :1851	<u>Alarm</u> :
<u>Start</u> : 1968	<u>End:</u>
<u>Station type</u> :	

- hydrometrical wing
- from year 2005 ADCP

## Active instruments:

- Sommer DRS4 with pressure probe
- Ott Pneumatik pressure probe

#### Measurements:

Data from year 1968 Daily minimum, maximum and average from year 1968 Continious measurements of water stage and discharge since 1976 Water temperature since 2000.

#### Digitalised Data:

## Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

#### Description:

High water – stage – 635 cm, 19.8.1925 High water – discharge – 1268 m<sup>3</sup>/s, 5.7.1989 Low water - stage – 96 cm, 25.1.2000 Low water – discharge – 5.7 m<sup>3</sup>/s, 14.1.1985 Mean discharge – 148.37 m<sup>3</sup>/s Mean water stage – 207 cm





<u>Station Code</u> : 3902	Station name: MURECK
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : Gosdorf	Location: on left river bank
<i>Distance to state border:</i> 45.58 km	<u>Area</u> : 9770 km²
<u>GKX</u> : 708703.688	<u>GKY</u> : 174822.688
<i>LON:</i> 15.793333	<i>LAT:</i> 46.711667
<u>Ground "zero"</u> : 224.23 m	Purpose: monitoring + prognosis
<u>Set</u> : 1972	<u><i>Alarm</i></u> : red – 582 (19.10.2009)
<u>Start</u> : 1974	<u>End:</u>
<u>Station type</u> :	

- hydrometrical wing
- from year 2005 ADCP

## Active instruments:

- Ott Nimbus with Logosens
- Seba PS Light
- Seba Omega with pressure probe
- Solitax TS100
- Data transmission: Funk

#### Measurements:

Data from year 1974 Daily minimum, maximum and average from year 1974 Continious measurements of water stage and discharge since 1976 Water temperature since 1976 Suspended material since 2005.

## Digitalised Data:

## Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

## Description:

High water - stage - 680 cm, 24.6.1973 High water - discharge - 1190 m<sup>3</sup>/s, 1.7.1975 Low water - stage - 171 cm, 27.1.2006 Low water - discharge - 28.3 m<sup>3</sup>/s, 16.1.2002 Mean discharge - 147.0 m<sup>3</sup>/s Mean water stage - 275 cm







<u>Station Code</u> : 2940	Station name: NEUBERG
<u>Status</u> : Normal	<u><i>River</i></u> : MÜRZ
<u>Municipality</u> : Neuberg	Location: on left river bank
Distance to confluence: 60.81 km	<u>Area</u> : 232 km <sup>2</sup>
<u>GKX</u> : 694454	<u>GKY</u> : 280046
<i>LON:</i> 15.593889	<i>LAT</i> : 47.657222
<u>Ground "zero"</u> : 715.301 m	Purpose: monitoring + prognosis
<u>Set</u> : 1960	<u><i>Alarm</i></u> : red – 295 (19.10.2009)
<u>Start</u> : 1961	<u>End:</u>

## <u>Station type</u>:

- hydrometrical wing

#### Active instruments:

- Seba PS Light
- Sommer Radar RQ-24 with Logosens
- Data transmission: phone, Funk

#### <u>Measurements</u>:

Data from year 1961 Daily minimum, maximum and average from year 1961 Continious measurements of water stage and discharge since 1976 Water temperature since 1991.

#### Digitalised Data:

#### <u>Data Archive</u>:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

#### Description:

High water – stage – 415 cm, 28.7.1991 High water – discharge – 203 m<sup>3</sup>/s, 28.7.1991 Low water – stage – 111 cm, 23.1.2006 Low water – discharge – 0.37 m<sup>3</sup>/s, 29.09.1991 Mean discharge – 7.12 m<sup>3</sup>/s Mean water stage – 158 cm







<u>Station Code</u> : 3001	Station name: KINDTHAL
<u>Status</u> : Automatic	<u><b>River</b></u> : MÜRZ
<u>Municipality</u> : Wartberg im Mürztal	Location: on right river bank
<i>Distance to confluence</i> : 27.54 km	<u>Area</u> : 728 km²
<u>GKX</u> : 685198	<u>GKY</u> : 265533
<i>LON:</i> 15.473056	<u>LAT</u> : 47.526111
<u>Ground <i>"zero ":</i></u> 569.64 m	<i>Purpose:</i> monitoring + prognosis
<u>Set</u> : 1966	<u>Alarm</u> : red – 350 (19.10.2009)
<u>Start</u> : 1966	<u>End:</u>
Station type:	

- hydrometrical wing
- from year 2005 ADCP

## Active instruments:

- Seba PS Light
- Ott Pneumatik pressure probe
- Data transmission: Funk

#### Measurements:

Data from year 1966 Daily minimum, maximum and average from year 1966 Continious measurements of water stage and discharge since 1976 Water temperature since 2001.

## Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

## Description:

High water – stage – 400 cm, 29.7.1991 High water – discharge – 207 m<sup>3</sup>/s, 29.7.1991 Low water – stage – 74 cm, 24.1.1995 Low water – discharge – 0.88 m<sup>3</sup>/s, 9.10.1985 Mean discharge – 13.86 m<sup>3</sup>/s Mean water stage – 132 cm





<u>Station Code</u> : 3082	<u>Station name</u> : KAPFENBERG
<u>Status</u> : Automatic	<u><b>River</b></u> : MÜRZ
<u>Municipality</u> : Kapfenberg	Location: on left river bank
<i>Distance to confluence:</i> 2.8 km	<u>Area</u> : 1365 km²
<u>GKX</u> : 669954.375	<u><i>GKY</i></u> : 255232.516
<i>LON:</i> 15.272222	<u>LAT</u> : 47.431389
<u>Ground <i>"zero "</i></u> : 485.94 m	<u><i>Purpose</i></u> : prognosis
<u>Set</u> : 1971	<u>Alarm</u> : red – 340 (1.1.1986)
<u>Start</u> : 1971	<u>End:</u>

## <u>Station type</u>:

- hydrometrical wing
- from year 2005 ADCP

## Active instruments:

- SebaPS light
- Orpheus mini
- Rittmeyer Pneumatik pressure probe
- Solitax TS100
- Data transmission: phone, Funk

#### Measurements:

Data from year 1971 Daily minimum, maximum and average from year 1971 Continious measurements of water stage and discharge since 1976 Water temperature since 1991 Suspended material since 2008.

## Digitalised Data:

## Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

## Description:

High water – stage – 377 cm, 22.8.2005 High water – discharge – 235 m<sup>3</sup>/s, 22.8.2005 Low water - stage – 36 cm, 24.12.2001 Low water – discharge – 1.78 m<sup>3</sup>/s, 24.12.2001 Mean discharge – 22.35 m<sup>3</sup>/s Mean water stage – 101 cm







<u>Station Code</u> : 3670	Station name: VOITSBERG
<u>Status</u> : Normal	<u><i>River</i></u> : KAINACH
<u>Municipality</u> : Voitsberg	Location: on right river bank
<i>Distance to confluence:</i> 48.61 km	<u>Area</u> : 210 km <sup>2</sup>
<u>GKX</u> : 660005.062	<u>GKY</u> : 212804.312
<u>LON:</u> 15.148889	<i>LAT</i> : 47.048611
<u>Ground <i>"zero"</i></u> : 391.19 m	<i>Purpose:</i> monitoring + prognosis
<u>Set</u> : 1908	<u>Alarm</u> : red – 208 (19.10.2009)
<u>Start</u> : 1966	End:

## Station type:

- hydrometrical wing

#### Active instruments:

- Ott Thalimedes with Seba Schwimmer
- Seba PS Light
- Data transmission: phone, Funk

#### <u>Measurements</u>:

Data from year 1966 Daily minimum, maximum and average from year 1966 Continious measurements of water stage and discharge since 1976.

#### Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung

FA19A - Hydrographischer Dienst Steiermark

#### Description:

High water – stage – 243 cm, 6.10.1982 High water – discharge – 138 m<sup>3</sup>/s, 6.10.1982 Low water – stage – 44 cm, 2.1.1979 Low water – discharge – 0.21 m<sup>3</sup>/s, 23.2.1993 Mean discharge – 2.61 m<sup>3</sup>/s Mean water stage – 73 cm Missing data for time period 1973 - 1975.





<u>Station Code</u> : 3701	<b>Station name:</b> LIEBOCH
<u>Status</u> : Automatic	<u>River</u> : KAINACH
<u>Municipality</u> : Lieboch	Location: on left river bank
<i>Distance to confluence</i> : 23.54 km	<u>Area</u> : 756 km²
<u>GKX</u> : 674916.812	<u>GKY</u> : 202282.922
<i>LON:</i> 15.346667	<i>LAT</i> : 46.955833
<u>Ground "zero"</u> : 319.46 m	Purpose: monitoring + prognosis
<u>Set</u> : 1908	<u>Alarm</u> : red – 558 (19.10.2009)
<u>Start</u> : 1951	<u>End:</u>
<u>Station type</u> :	

- hydrometrical wing

#### Active instruments:

- Ott Nimbus
- Seba PS Light
- Rittmeyer Pneumatik pressure probe
- Data transmission: Funk

#### Measurements:

Data from year 1951 Daily minimum, maximum and average from year 1951 Continious measurements of water stage and discharge since 1976.

#### Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

#### Description:

High water - stage - 633 cm, 24.10.1993 High water - discharge - 320 m<sup>3</sup>/s, 24.10.1993 Low water - stage - 158 cm, 31.8.1950 Low water - discharge - 0.35 m<sup>3</sup>/s, 11.8.2003 Mean discharge - 9.2 m<sup>3</sup>/s Mean water stage - 219 cm





<u>Station Code</u> : 3791	<b>Station name:</b> GLEINSTÄTTEN
<u>Status</u> : Normal	<u>River</u> : SULM
Municipality: Gleinstätten	<i>Location</i> : on left river bank
<i>Distance to confluence</i> : 25.3 km	<u>Area</u> : 265 km²
<u>GKX</u> : 676593.75	<u>GKY</u> : 179754.172
<i>LON:</i> 15.3725	<i>LAT:</i> 46.753333
<u>Ground "zero"</u> : 292.81 m	<i>Purpose:</i> monitoring + prognosis
<u>Set</u> : 1993	<u><i>Alarm</i></u> : red – 388 (19.10.2009)
<u>Start</u> : 1993	End:
<u>Station type</u> :	

- hydrometrical wing

#### Active instruments:

- Seba PS Light
- Seba Omega with pressure probe
- Data transmission: phone, Funk

#### <u>Measurements</u>:

Data from year 1993 Daily minimum, maximum and average from year 1993 Continious measurements of water stage and discharge since 1993.

#### Digitalised Data:

#### Data Archive:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

#### Description:

High water – stage – 446 cm, 21.8.2005 High water – discharge – 146 m<sup>3</sup>/s, 21.8.2005 Low water – stage – 77 cm, 31.1.1999 Low water – discharge – 0.13 m<sup>3</sup>/s, 8.1.2004 Mean discharge – 4.24 m<sup>3</sup>/s Mean water stage – 110 cm





<u>Station Code</u> : 3856	Station name: LEIBNITZ
<u>Status</u> : Automatic	<u>River</u> : SULM
<u>Municipality</u> : Seggauberg	Location: on right river bank
<i>Distance to confluence</i> : 5.65 km	<u>Area</u> : 1103 km <sup>2</sup>
<u>GKX</u> : 688529	<u>GKY</u> : 182580
<u>LON:</u> 15.535556	<u>LAT</u> : 46.771389
<i>Ground ″zero ″</i> : 262.98 m	Purpose: monitoring + prognosis
<u>Set</u> : 1895	<u>Alarm</u> : red – 426 (19.10.2009)
<u>Start</u> : 1951	<u>End:</u>
Station type:	

- hydrometrical wing
- from year 2005 ADCP

## Active instruments:

- Ott Nimbus
- Seba PS Light
- Ott Pneumatik pressure probe
- Solitax TS100
- Data transmission: Funk

#### Measurements:

Data from year 1951 Daily minimum, maximum and average from year 1951 Continious measurements of water stage and discharge since 1976 Water temperature since 2006.

#### Digitalised Data:

## <u>Data Archive</u>:

Amt der Steiermärkischen Landesregierung FA19A - Hydrographischer Dienst Steiermark

#### Description:

High water - stage - 427 cm, 13.5.1996

High water – discharge – 400 m<sup>3</sup>/s, 5.6.1954 Low water - stage – 138 cm, 14.8.2003 Low water – discharge – 0.97 m<sup>3</sup>/s, 5.6.1973 Mean discharge – 14.96 m<sup>3</sup>/s Mean water stage – 170 cm







## **SLOVENIA**

<u>Station Code</u> : 1060	Station name: GORNJA RADGONA I
<u>Status</u> : Automatic	<u><i>River:</i></u> MURA
<u>Municipality</u> : Radgona	<u>Location</u> : on right bank
<i>Distance to confluence</i> : 106.64 km	<u>Area</u> : 10197.20 km <sup>2</sup>
<u>GKX</u> : 576530	<u><i>GKY</i></u> : 171280
<u>LON:</u> 15.99559	<u>LAT</u> : 46.68114
<u>Ground <i>"zero"</i></u> : 202.338 m	<i>Purpose:</i> Important for prognosis
<u>Set</u> : 1850	<u>Alarm</u> : 310 cm
<u>Start</u> : 1893	<u>End:</u>

#### Station type:

- In 1850 woody stage 5 m high was set by Austrian authority;

- In May 1973 - SEBA - OMEGA, first lymnigraph Hagenuk – start of automatic recording (build wired bridge);

- In April 1986 automatic station by Inštitut Jožef Štefan was set;

- In Oct. 1986 new stage was set on railway bridge;

- In Nov. 2004 were set more instruments: stage, water stage sensor, lymnigraph

## Active instruments:

OTT HYDROMETRIE KALESTO - stage

OTT HYDROMETRIE PS1 - water, air temperature

VAISALA DTS 12 G3 – air temperature

VAISALA HMP 45 DX – air temperature, humidity

FORMA M – stage

TERMO SCHNEIDER – water temperature

TLOS – water temperature

AMES GM probe A, B – suspended solids

VAISALA DTS 12 G3 – water temperature

MPS System TRWS 500 - precipitation

#### Measurements:

- stage from year1893;
- discharge from year 1906;
- temperature from year 1906;
- suspended material from year 1978;
- quality from year 1971

#### Digitalised Data:

- stage observation for time period 1952-1974,
- water stage sensor from year 1974,
- pressure probe from year 2004;
- temperature observation from year 1980,
- temperature sensor from year 2005;
- discharge observation for time period 1946-1972,
- discharge automatic from year 1973, 1991 correlation;
- suspended solids transport from year 1977,
- suspended solids concentration from year 1977,
- turbidity for time period 1998-2000

Data Archive: ARSO - Environmental Agency of RS

#### Description:

From 1893-1919 observations on stage on bridge in Radgona on Austrian station (ground "zero" was 205.17; station was set in 1850, but data from 1850-1893 are lost). Regulation works in channel between 1906 - 1908.

First observed flood in written data in 1916 had similar heights as in 1938 (330 m).

No data during 1919-1930 and II. World War.

In 1930 was set stage at administrative building of Mura River Regulation Section for need of regulation works in channel. In year 1945 station was moved 75 m downstream on new ground "zero" 1 m lower; from 1946 current ground "zero" 202.338.

The channel is deepening - from 1923 to 1963 cca. 1m.

Observation was first made by Mura River Regulation Section until 1946, when HMZ (Hydro meteorological Agency) took over the station and included it in state monitoring.

Station is on right bank, 730 m downstream of the bridge at administrative building of Section.

Channel profile has Holocene gravel bed - possible greater changes.

In 12.2.1954 stage was lost due to ice and high water level; in 26.2.1954 stage was reset. In Jan. 1959 and May 1962 are notes on bigger changes in river profile.

Profile is over-flooded at high water levels. For flooding an inundation channel upstream on left bank was built.

In July 1972 were catastrophically floods - mark on measured stage - 480 m.

On 22.Aug. 2005 highest measured stage ever – 482 cm.





#### Situation:



## Cross section



<u>Station Co</u>	<u>ode</u> : 1070	<b>Station name:</b> PETANJCI
<u>Status</u> :	Automatic	<u><i>River</i></u> : MURA
<u>Municipal</u>	<u>ity</u> : Petanjci	<u>Location</u> : on left bank
<u>Distance i</u>	t <u>o confluence</u> : 100.47 km	<i>Area:</i> 10391.44 km <sup>2</sup>
<u>GKX</u> : 5810	70	<u>GKY</u> : 167710
<i>LON:</i> 16.0	)54299	<i>LAT:</i> 46.648494
<u>Ground "</u> 2	zero <u>"</u> : 193.763 m	Purpose: State monitoring
<u>Set</u> : 1956		<u>Alarm</u> :
<b>Start:</b> 195	6	End:

#### Station type:

- In November 1961 – lymnigraph Hidrometeor;

- In 1970 new lymnigraph SEBA - OMEGA- start of automatic recording;

- In March 1985 stage for low water was set

#### Active instruments:

OTT HYDROMETRIE PS1 - water temperature (pressure probe)

OTT HYDROMETRIE PS1 - stage

THIES CLIMA - air temperature

VEGA VEGAPULS 62Hart - stage

FORMA M – stage

FORMA M – stage

KOGAST – stage

#### Measurements:

- stage from year1955;
- discharge from year 1957;
- suspended material for period 1956-1978

#### Digitalised Data:

- stage observation for time period 1956-1961,

- stage sensor from year 1962,

- discharge observation for time period 1956-1961,
- discharge automatic from year 1961;
- suspended material transport from year 1956-73,75-76,
- suspended solids concentration for years 1956-73,75-76

Data Archive: ARSO - Environmental Agency of RS

#### Description:

Hydro-station operates from December 1955. Stage is located 500 m downstream the bridge in Petanjci on left bank. In August 1959 stage was lost in high water and in September 1959 set again – new, two partly.

In November 1971 a lymnigraph was set.

In February 2001 stage was renovated.

In October 2003 new woody operating house was build (2x2m); montage of new equipment on solar energy.

High water floods over the river bank. For this reason 4 stages are set in bridge profile to observe high waters. Ground zero is 194,103.

River bad is quite stable and is not being much modified through years.

Station has a boat and a wired bridge.

Mark of highest water level H=538 cm on 22.8.2005.

#### Figures:





<u>Situation:</u>



#### Cross section



<u>Station Code</u> : 1140	<b>Station name:</b> PRISTAVA I
<u>Status</u> : Automatic	<u><i>River</i></u> : ŠČAVNICA
<u>Municipality</u> : Ljutomer	Location: on left bank
<i>Distance to confluence:</i> 5.78 km	<u>Area</u> : 272.54 km <sup>2</sup>
<u>GKX</u> : 594880	<u>GKY</u> : 153470
<i>LON:</i> 16.231768	<i>LAT</i> : 46.518601
<i>Ground ″zero ″</i> : 169.768 m	<i>Purpose</i> : Important for prognosis
<u>Set</u> : 1939	<u>Alarm</u> :
<u>Start</u> : 1973	<u>End:</u>

#### Station type:

- In 1939 woody stage was set in first profile
- In September 1973 lymnigraph SEBA DELTA was set;
- From May 2004 automatic data logger Thalimedes
- In 2006 new lymnigraph

#### Active instruments:

OTT HYDROMETRIE PS1 – water temperature (pressure probe)

OTT HYDROMETRIE PS1 - stage

THIES CLIMA Pt100 TPC 5/4-TH - air temperature

VEGA VEGAPULS 62Hart – stage

FORMA M – stage

FORMA M – stage

FORMA M – stage

#### Measurements:

- stage from year1939;
- discharge from year 1939;
- water temperature from year 1980;
- suspended material from year 1961
- water quality from 1976

## Digitalised Data:

- stage sensor from year 1973,
- stage sensor with automatic recorder from year 2004-2005,
- discharge automatic from year 1975;
- water temperature observation from year 1980-1987, 1989

Data Archive: ARSO - Environmental Agency of RS

### Description:

Hydro-station was set in 1939. Between years 1940 - 1945 station did not operate.

In November 1945 was the station renovated.

In June 1962 started regulation works in the river channel.

21.11.1962 bridge and stage was lost in flood.

In December 1962 new stage was set in regulated channel 30m upstream the old one.

New station was set in 1973 – moved 100m downstream to today ground zero.

In July 2006 a woody house was built and new stages; lymnigraph was replaced.

River profile is stabile – regulated and the river does not flood over banks.

River bed is composed of gravel, clay and sandstone.

Maximum water stage measured on 5.11. 1998 - 325 cm.

## Figures:





## <u>Situation:</u>



## Cross section:



ANNEX I

Station Code: 1220	Station name: POLANA
<u>Status</u> : Automatic	<u>River</u> : Ledava
<u>Municipality</u> : Polana	Location: on left bank
<i>Distance to confluence:</i> 44.72 / 44.33 km	<u>Area</u> : 208.20 / 208.21 km <sup>2</sup>
<u>GKX</u> : 587370 / 587405	<u>GKY</u> : 171060 / 171050
<u>LON:</u> 16.13722 / 16.13767	<u>LAT</u> : 46.67784 / 46.67774
<i>Ground ″zero″</i> : 192.122 / 191.399 m	<i>Purpose:</i> removed / important for prognosis
<u>Set</u> : 1956 / 1962	<u>Alarm</u> :
<u>Start</u> : 1956 / 1962	<u>End:</u> 1966 /
<u>Station type</u> :	

- In December 1955 station with woody stage (0-400 cm) (in bridge profile)
- In November 1961 new stage and lymnigraph Waldai
- In September 1970 lymnigraph SEBA DELTA in new profile
- In April 1992 reconstruction of a woody hydro-station house
- In June 1999 lymnigraph replaced with pressure probe AOTT R.20 P
- In June 2000 built new hydro-station house
- In October 2001 reconstruction of stage

#### Active instruments:

OTT HYDROMETRIE R20 P – stage, lymnigraph

- FORMA M stage
- FORMA M stage
- FORMA M stage
- FORMA M stage
- TERMO SCHNEIDER water temperature

#### <u>Measurements</u>:

- stage from year1956;
- discharge from year 1956;
- water temperature from year 1967
- suspended material from year 1961-1978

### Digitalised Data:

- stage sensor from year 1966-,
- discharge automatic from year 1966-,
- water temperature observation, year 1969, from year 1971-
- suspended material transport from year 1963-73,75, 78,
- suspended solids concentration from year 1963-73,75, 78

Data Archive: ARSO - Environmental Agency of RS

#### Description:

Hydro-station operates from December 1955. In year 1960 the river channel was regulated.

Due to regulation and improper location was station in year 1961 moved 36 m downstream on new ground zero. New station was set in regulated channel.

In 1961 limnigraph started to work and old profile was abandoned in December 1966.

River profile is regulated and river does not flood over the banks.

On 5.Nov. 1998 is marked highest water level mark on concrete steps to the station house H=350 m.







## Situation:



#### Cross section



## HUNGARY

<u>Station Code</u> : 360	<b>Station name:</b> LETENYE
<u>Status</u> : Automatic	<u><i>River</i></u> : Mur
<u>Municipality</u> : Letenye	Location: on left river bank
<i>Distance to confluence</i> : 35.6 kn	1 <u>Area</u> : 13022.3 km <sup>2</sup>
<u>GKX</u> : 469132	<u>GKY</u> : 122254
<i>LON:</i> 16° 41′ 40″	<u>LAT</u> : 46° 25′ 13″
<i>Ground ″zero ″:</i> 137.86 m	<u>Purpose</u> :
<u>Set</u> : 1961	<u>Alarm</u> : 330-380-430
<u>Start</u> : 1961	<u>End:</u>
<u>Station type</u> :	
- water stage (from May 1963)	
Measurements range:	
Water stage for low flows from 0 - Bank slope: water stage water stage water stage (water stage (water stage) (water stage) (water stage) (water stage)	350  cm, water stage for high flows $300-550  cme no. 1 0-350 \text{ cm} 1:1,5e no. 2 300-400 \text{ cm} verticale no. 3 400-550 \text{ cm} verticalje no. 4 300-450 \text{ cm} vertical, on the bridge)altic meas.$
<u>Active instruments:</u>	
- digital data recorder since 1993	
- water stage – between 1963 – 1	993 - METRA 501
between 1993 – 1 from year 1998 digital recording	998 - METRA 501 with rotation recorder with OTT OWK-16
- Data recorders and transmission	:
from 1993 recorder Gealog, transr	nission RKOG, modem
from 2010 recorder Gealog, transr	nission gprs modem I. P. GSMwGPRS with antenna.
- HTI-135 – water temperature	
<u>Measurements</u> :	
Data from year 1961. - water stage measurements 2/da - water temperature - daily	y, registration every 15 min

- discharge – monthly measurements harmonization with Croatia

- monthly measurements of suspended solids
- ice observation
- monthly verification of discharge and stage measurements
- verification of instruments every 3 months
- yearly verification of water stage discharge relation

#### Digitalised Data:

- daily data on web of ZPDVOVG

#### <u>Data Archive</u>:

Magyar Hidrológiai Adatbázis (MAHAB)

#### Description:

High water stage 514 cm Low water stage 47 cm

Observation start in 1891 on bridge over river Mur.

Distance from confluence: 1891: (27,3 km) , from 1905: 24,4km

Ground "zero":

From 1891 (138.33 m) (army), from 1905 138,61 m (army)

7. 2. 1909 water stage was lost with ice cover – temporary water stage was set.

Between 1933 -1934 observations were on temporary water stages.

25. 8. 1935 was set new water stage on left bank at bridge in Letenye.

Hydrological station was built on left bank by the bridge at the bank slope 1:1,5 od 0-250 cm.

Upstream the bridge was water stage for 250 - 500 cm

Ground "0" was 138,61 m. Distance from confluence: 24,4 km

From 12. 1. 1961 observations were on temporary water stage due to construction of new bridge.

11. 9. 1963 water stage was set 10 m downstream of the bridge. Longitudinal water stage was for 50 to 300 cm, slope 1 : 1,5, verticaly 300 to 400 cm and from 400 – 550 cm.

In 1976 new station was built.

From 1993 – automatic registration and transmission.

Distance from confluence:

1901-04	24,2 KIII
1964-65	24,4 km
1965-	35,4 km

Ground "0":

11.01.1961 - 138,564 m acc. to Adriatic meas. system

- 31.05.1963 138,558 m acc. to Adriatic meas. system
- 01.10.1971 138,570 m acc. to Adriatic meas. system
- 01.01.1982 138,540 m acc. to Adriatic meas. system

## <u>Figures:</u>









## Situation:



<u>Station Code</u> : 364	Station name: TORMAFÖLDE
<u>Status</u> : Automatic	<u><i>River</i></u> : KERKA
<u>Municipality</u> : Tormafölde	Location:
<i>Distance to confluence</i> : 15.2 km	<i>Area:</i> 968.9 km²
<u>GKX</u> : 137 306	<u>GKY</u> : 461 654
<i>LON:</i> 16° 35′ 28″	<i>LAT</i> : 46° 33′ 13″
<i>Ground "zero"</i> : 153.350 m	<u>Purpose</u> :
<u>Set</u> : 1963	<u>Alarm</u> :
<u>Start</u> : 1963	<u>End:</u>

## Station type:

water stage (from May 1963)
 Measurements range: from - 100 to 400 cm
 Bank slope: 1:2
 "0" ground: 153,35 m acc. to Baltic meas. system

## Active instruments:

water stage recorder:
between 1963-1998 METRA 501
from 1998 digital recorder RVM-3 – continuously recording
precipitation (connected to station Hm, 166056, Tormafölde)
from 1998 automatic recorder BOREAS (BES-01)
distance data transmission
between 1998-2010 recorder RKAG, connected to modem
from 2010 RKAG, GPRS modem I. P. GSMwGPRS and antena

## Measurements:

Data from year 1963.

- water stage measurements 2/day (1963-2009), registration every 15 min
- water temperature daily
- discharge monthly
- monthly verification of discharge and stage measurements every two months
- verification of instruments every 3 months

## Digitalised Data:

- daily data on web of ZPDVOVG

## Data Archive:

Magyar Hidrológiai Adatbázis (MAHAB)

## Description:

High water stage 282 cm (03.08.1965) Low water stage -63 cm (05. 12. 1973)

Station was set in 1961 by the VITUKI (Research institute). Location data are available from 1963 (water stage for -100 to 300 cm was set on left bank 30 m downstream of the bridge).

Regulation works on channel between 17.7.1966 – 15.3.1975.

In 1976 station took over ZPDVOVG.

Continuously data since 1961.

Distance from confluence: 1961- 15,2 km

Ground "zero": 17. 08. 1961 - 153,525 26. 09. 1963 - 153,485 14. 03. 1968 - 153,485 13. 05. 1971 - 153,437 16. 06. 1972 - 153,437 18. 07. 1973 - 153,437 18. 09. 1974 - 153,435 10. 09. 1975 - 153,437 26. 05. 1978 - 153,405 02. 10. 1980 - 153,350 31. 08. 2002 - 153,350

Situation:



## Figures:



## Cross section



## ANNEX I



## CROATIA

<u>Station Code</u> : 5044	Station name: MURSKO SREDIŠĆE
<u>Status</u> : Automatic	<u><i>River</i></u> : MURA
<u>Municipality</u> : Mursko Središće	Location: on right bank
<i>Distance to confluence</i> : 62.5 km	<u>Area</u> : 10942.8 km <sup>2</sup>
<u>GKX</u> : 5611135 m	<u><i>GKY</i></u> : 5153320 m
<i>LON:</i> 16.44379	<u>LAT</u> : 46.51466
<u>Ground <i>"zero":</i></u> 156.29 m	Purpose: Important for prognosis
<u>Set</u> : 1888	<u>Alarm</u> : 300 cm
<u>Start</u> :	<u>End:</u>

<u>Station type</u>: automatic lymnigraph with data teletransmission

## Active instruments:

- ADCP since 2004

- SEBA-Hagenuk lymnigraph

#### Measurements:

- water level from year 1926-1939; 1946-today

- discharge from year 1926-1939; 1941; 1946-today

- temperature from year 1969-1984; 1989; 1991-1992; 1995; 2003-2006.

## Digitalised Data:

Data Archive: DHMZ - Croatian meteorological and hydrological service

## Description:

Station was established in 1888, destroyed during 2.world war.

1945. station was re-established on the bridge, with ground "zero"156,55m.

1960. station was moved 200m downstream, on the right bank with new lymnigraph and 3-piece water level indicator.

1965. - ground "zero"is set to 156,289 m

1972. - water level indicator is reconstructed in 5-pieces

Dezember 1976 – SEBA-Hagenuk lymnigraph with teletransmission is installed

2006 – right bank was reconstructed, temporary water level indicator are set

2008- new waterstation was build with new 4 piece water level indicator

New station is on right bank, 230 m downstream of the road bridge and 60 m upstream of the railway bridge.

Channel profile has Holocene gravel bed - possible greater changes.

In August 2005. maximal water level was recorded +511 cm.



old station

New station-builded 2008.







#### Cross section



<u>Station Code</u> : 5035	<u>Station name</u> : GORIČAN
<u>Status</u> : Automatic	<u><i>River:</i></u> MURA
<u>Municipality</u> : Goričan	Location: on the bridge
<i>Distance to confluence</i> : 33.5 km	<u>Area</u> : 13022.3 km²
<u>GKX</u> : 5603510	<u><b>GKY</b></u> : 5143135
<i>LON:</i> 16.34218	<u>LAT</u> : 46.42425
<u>Ground <i>"zero "</i></u> : 138.59 m	Purpose: water level registration
<u>Set</u> : 1890	<u>Alarm</u> :
<u>Start</u> : 1926	<u>End:</u>
Station type:	

- ADCP since 2004
- automatic lymnigraph with data teletransmission

## Active instruments:

Radar sensor OTT Kalesto – water level

#### Measurements:

- water level from year 1926-1955; 1957-today
- discharge from year 1926-1955; 1957-today
- temperature from year 1981-1998; 2001-today
- suspended material concentration from 1990-today
- suspended material transportation from 1990-today

## Digitalised Data:

Data Archive: DHMZ - Croatian meteorological and hydrological service

## Description:

Water station was on the pier of destroyed bridge with ground "zero" 138,59m (data from 1948.).

1957. water level indicator was repaired, set 20m upstream of destroyed bridge with the same

ground "zero"

1965. water level indicator was repaired with the same ground "zero"

1978. lymnigraph was set on the middle pier of the bridge on the downstream side 2003. water level indicator was repaired

2007. radar sensor lymnigraph was set for continuos water level monitoring







## **Crosssection**



Station Code: 5026	Station name: JENDRAŠIČEK
<u>Status</u> :	<u><i>River</i></u> : Trnava Murska
<u>Municipality</u> : Mala Subotica	<i>Location:</i> on right bank
<u>Distance to confluence</u> : 18.75 km	<u>Area</u> : 154.8 km <sup>2</sup>
<u>GKX</u> : 5617420	<u>GKY</u> : 5138490
<i>LON:</i> 16.52196	<i>LAT</i> : 46.3802
<i>Ground "zero"</i> : 150.91 m	<u>Purpose</u> :
<u>Set</u> : 1948	<u>Alarm</u> :
<u>Start</u> :	<u>End:</u>

## Station type:

- water level indicator

#### Active instruments:

#### Measurements:

- water level from year 1948-2009.
- discharge from year 1956-1959; 1961-2009.

#### Digitalised Data:

- water level observation for time period 1948-2008,
- discharge observation for time period 1956-1959, 1961-2009

Data Archive: DHMZ - Croatian meteorological and hydrological service

#### Description:

- station was established in 1948. with ground "zero" 150,36 m.
- 1954. Water level indicator is destroyed

- 1955. Water level indicator is rebuild on right bank, 40m upstream of the road bridge with ground zero 150,91m

## Figures:







## Situation:



#### Cross section

