

Flood Prevention and Control in the Elbe Region

Czech Republic



Vaclav Jirasek - Elbe River Authority

Krakow, September 2004, EURO-INBO

Flood Risk Areas



- 1977 Upa, Labe; Q_{20} - Q_{100} ; 0,5 bill. CZK
- 1978 Jizera; Q_{50} - Q_{100} ; 2 bill. CZK
- 1979 Stenava; Q_{100} - Q_{500} ; 2,5 bill. CZK
- 1983 Labe; Q_{100} ; 0,7 bill. CZK
- 1997 Orlice, Labe, Stenava; Q_{50} - Q_{100} ;
3,3 bill. CZK (total 62,6 bill. CZK)
- 1998 Dedina, Orlice; Q_{50} - Q_{100} ;
1,8 bill. CZK
- 2000 Jizera, Labe, Orlice; Q_{20} - Q_{100} ;
3,8 bill. CZK
- 2001 Labe, Stenava, Doubrava; Q_{10} - Q_{50} ;
1,0 bill. CZK
- 2002 August => Vltava, Labe Q_{250} - Q_{500} ;
10,0 bill. CZK (total 75,1 bill. CZK)

Flooding in Litomerice Region



Roudnice n.L.

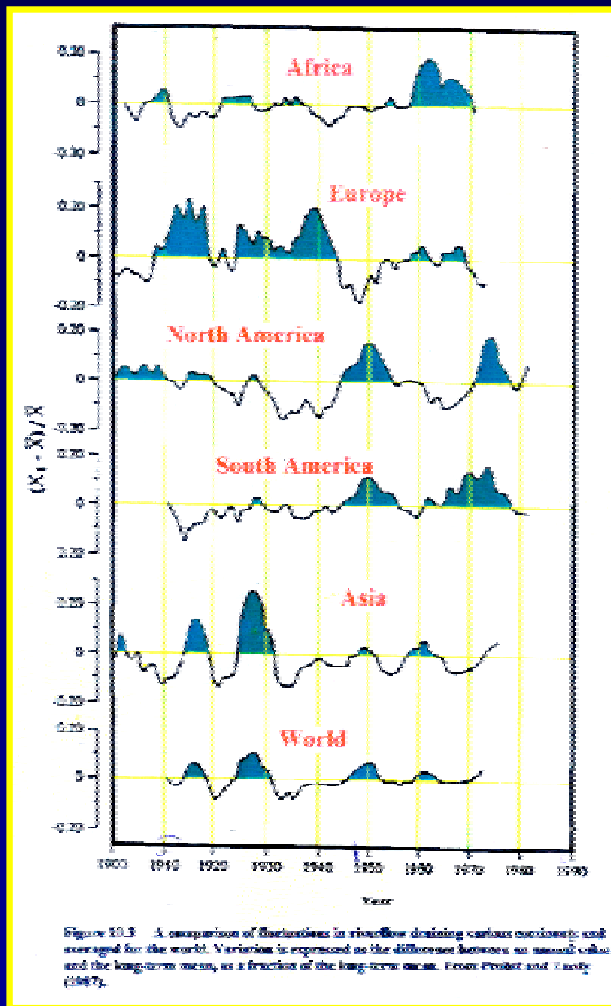


Lovosice

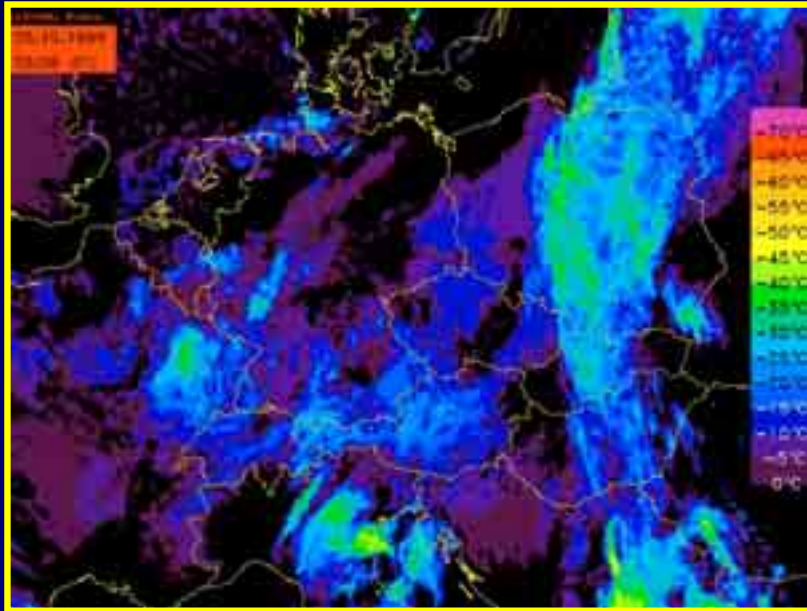
Prague



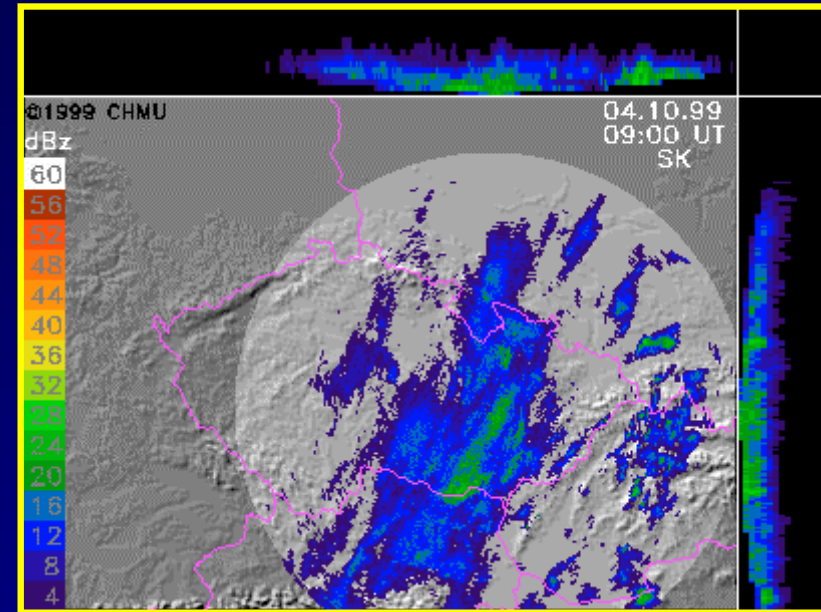
Outflow from continents



Flood Forecasting & Warning - CHMI



Picture from the NOAA polar satellite



Radar information

Input data

Flood Forecasting & Warning - CHMI + RA



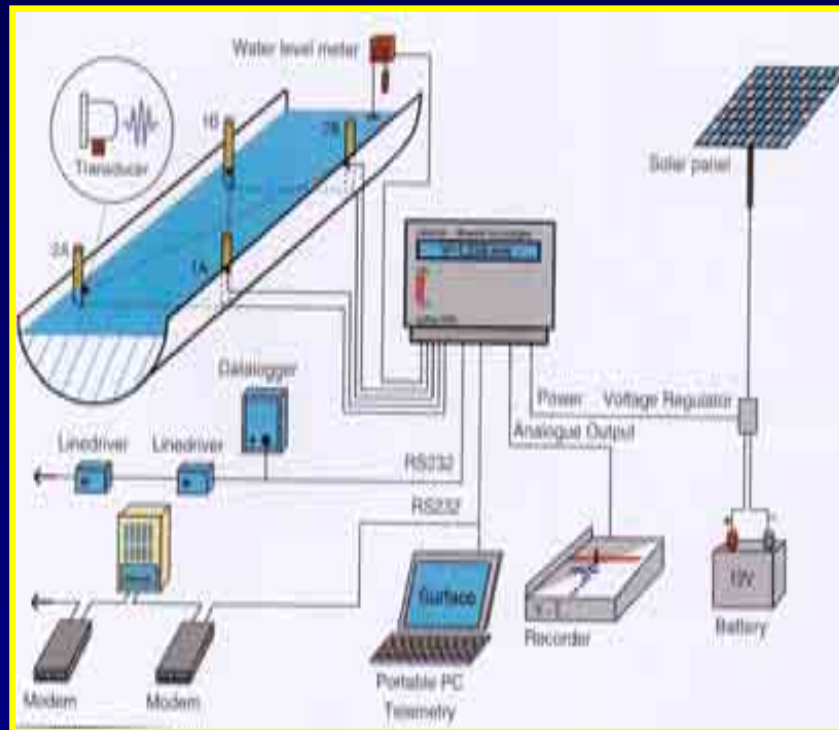
**Rain gauging station in
the Giant Mountains**



**Water level gauge on
the river Jizera**

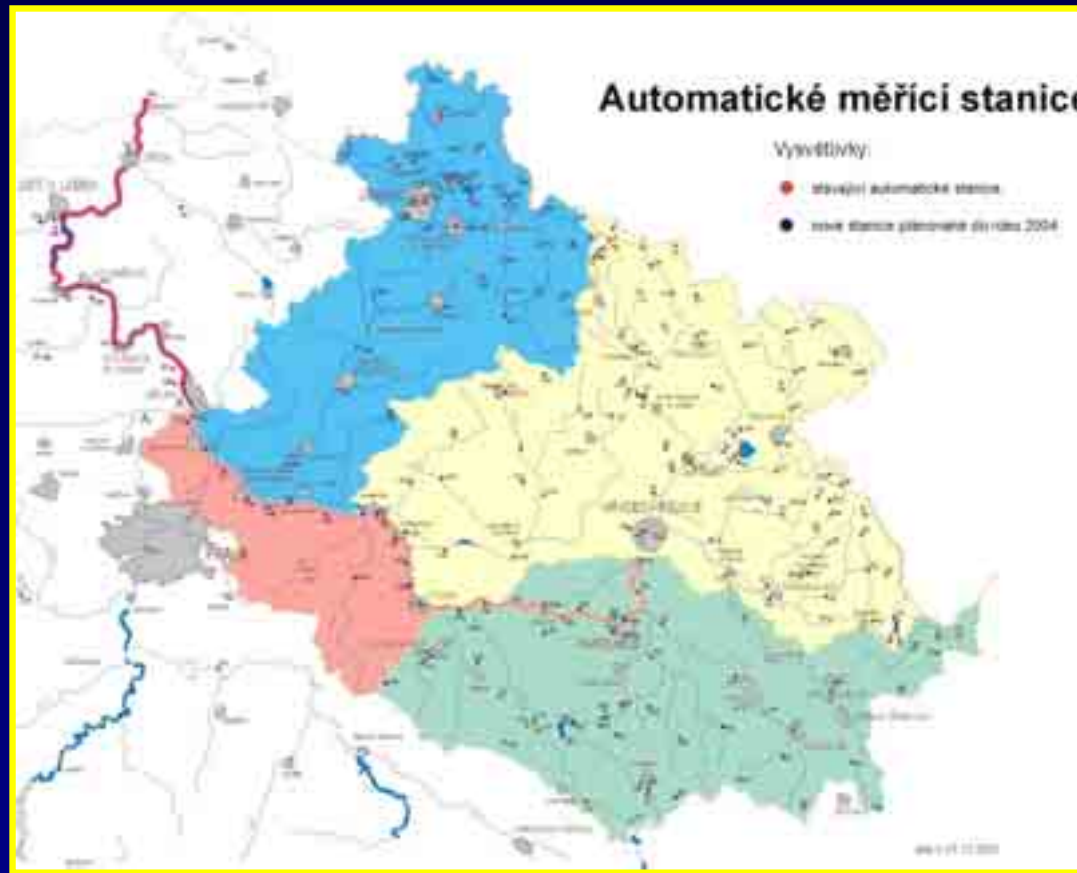
Directly measured data

Flood Forecasting & Warning - RA



SURFLOW 4000 - Instromet, Belgium
Discharge data

Automatical measurement stations



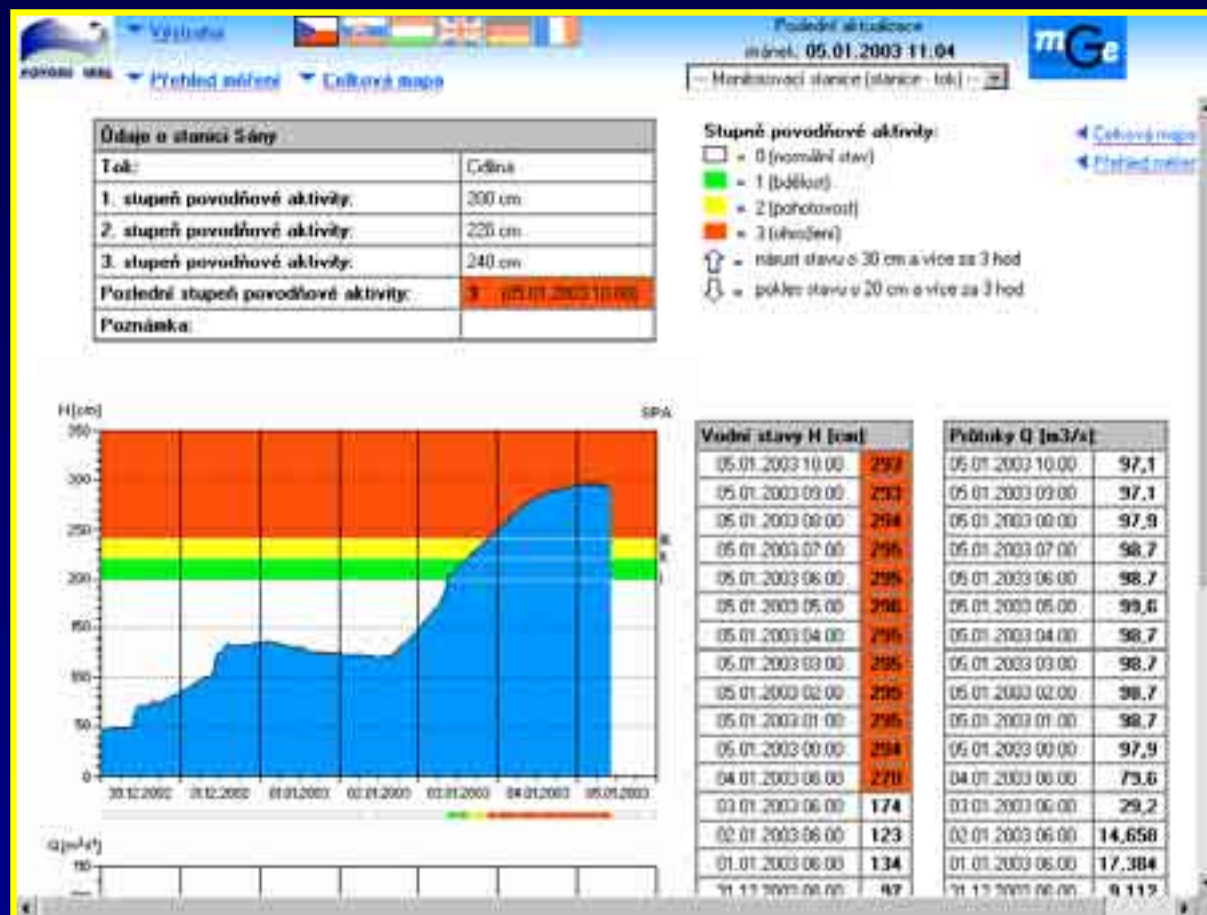
1997 - 15 pc. 2002 - 180 pc. 2004 - 230 pc.

Flood Forecasting & Warning - RA



Water system control - Operation Room

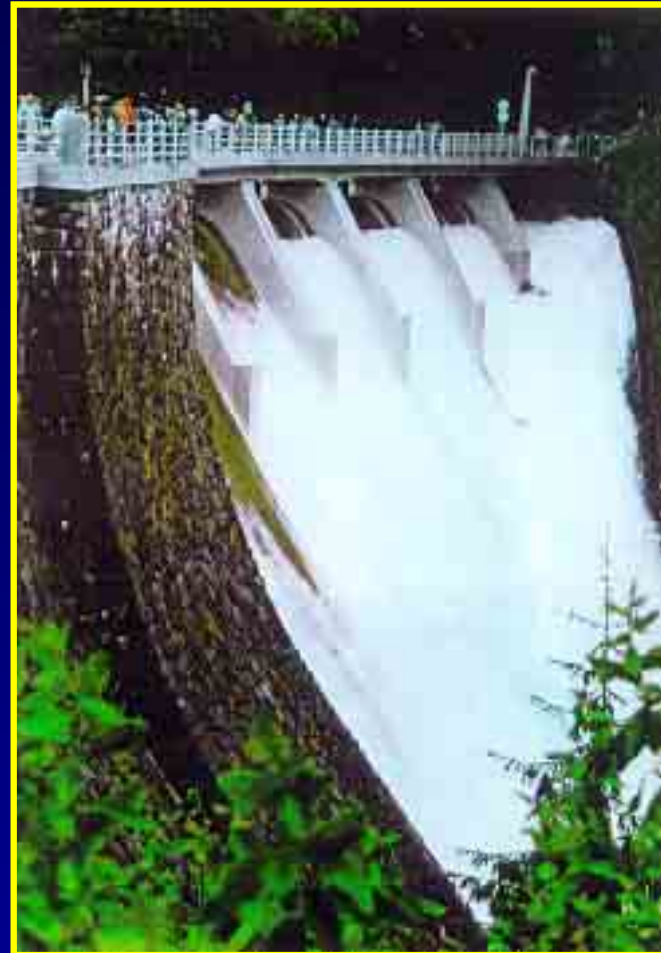
Data Available to Other Clients



www.pla.cz

Regulation of Flow Regime

- **Inflow**
- **Time**
- **Volume**
- **Discharge**

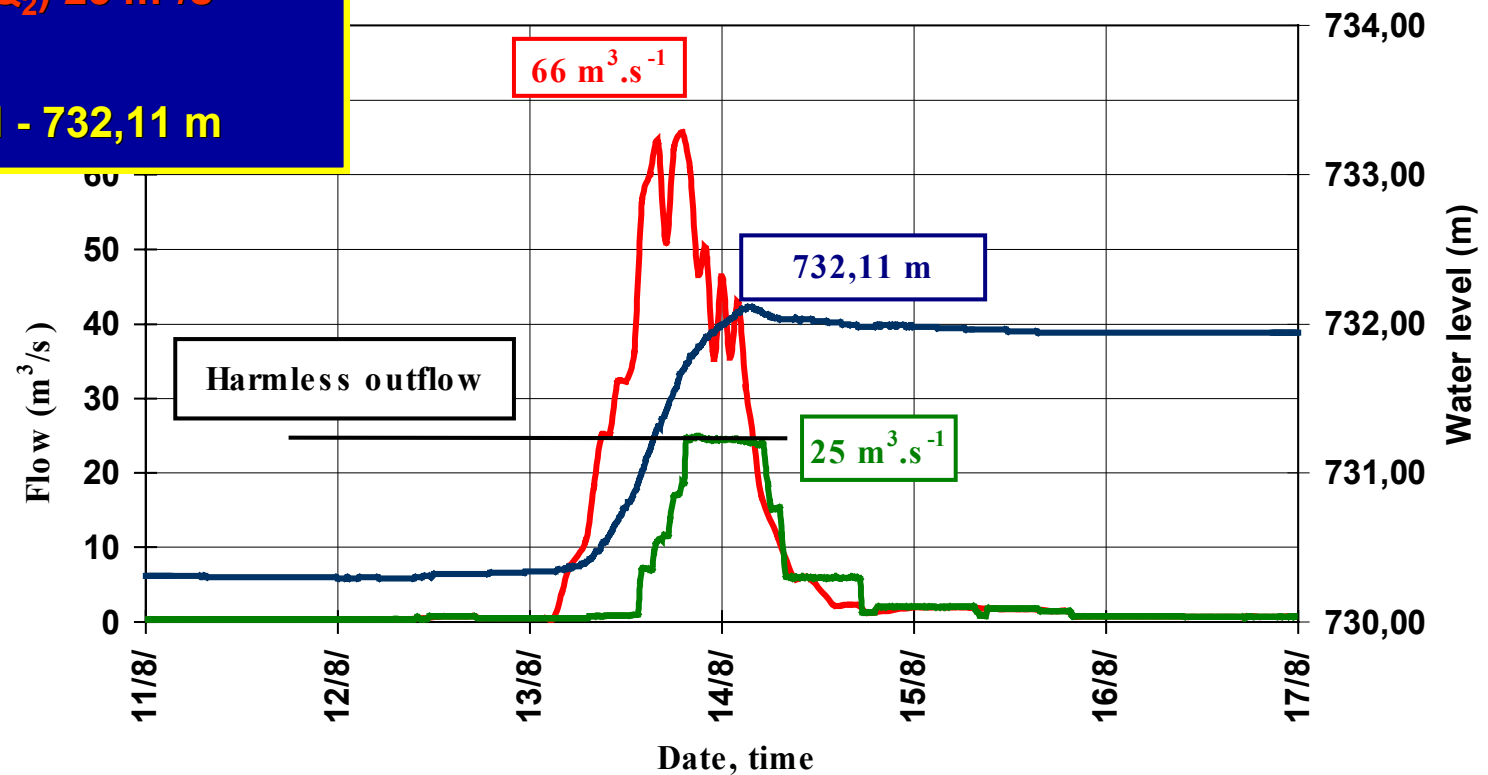


- ♦ 12.8. 2002
water level - 730,29 m
171 cm bellow the full
supply level
- ♦ total pre-prepared storage
2,5 mil.m³
- ♦ inflow ($>Q_{20}$) 66 m³/s
- ♦ outflow ($<Q_2$) 25 m³/s
- ♦ 14.8. 2002
water level - 732,11 m

Dam Josefuv Dul 11. - 17. 8. 2002



Dam Josefuv Dul

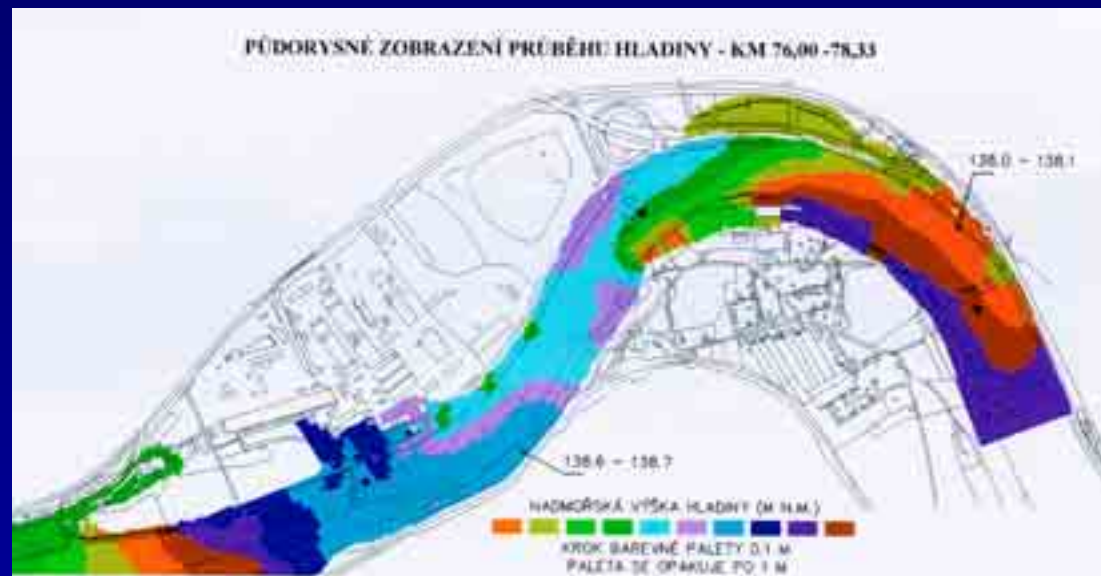


Delineation of Flood Prone Areas

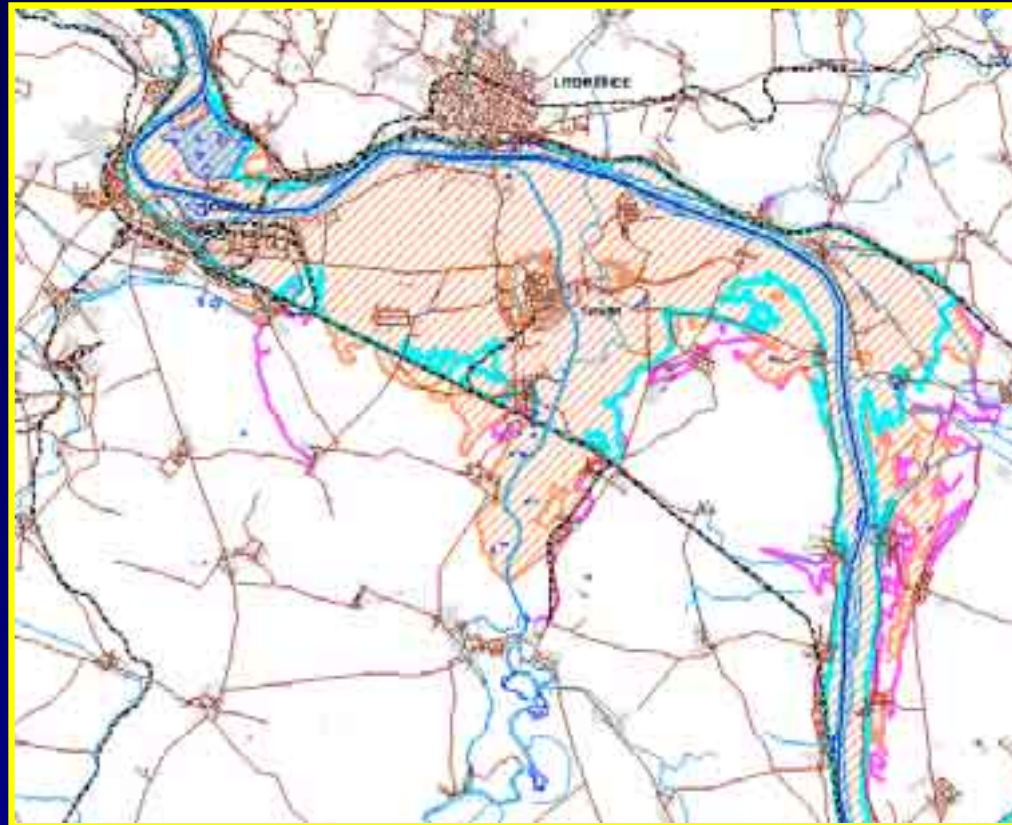


Delineation of Flood Prone Areas

- Basic data for site planning
- Active/passive zones
 - building restriction in flood prone areas
- Risk evaluation
 - velocity, depth, time
- Mathematical modelling
 - LaserScan, DMT, ortofoto, MIKE 11, MIKE 21C, HEC



Flooding in Litomerice Region



Flooded area

- Q 100 (theoretical flood 4400 m³/s) - blue
- Prognosis Q = 5500 m³/s - pink
- August 2002 reality - brown

Flood Risk Assessment

(Criteria x Weight Method)

Rank Criterium	1	2	3	4
I - Flooded Area W = 1	Downtown	Concentrated Development	Low Development	Scarse Development
II - River Bed Capacity W = 0,4	$< Q_1$	$Q_1 - Q_5$	$Q_5 - Q_{20}$	$Q_{20} - Q_{100}$
III - Erosion W = 0,3	Extreme	Very High	Strong	Medium
IV - Number of Flood Days in Area W = 0,2	> 20	11 - 20	5 - 10	0,4

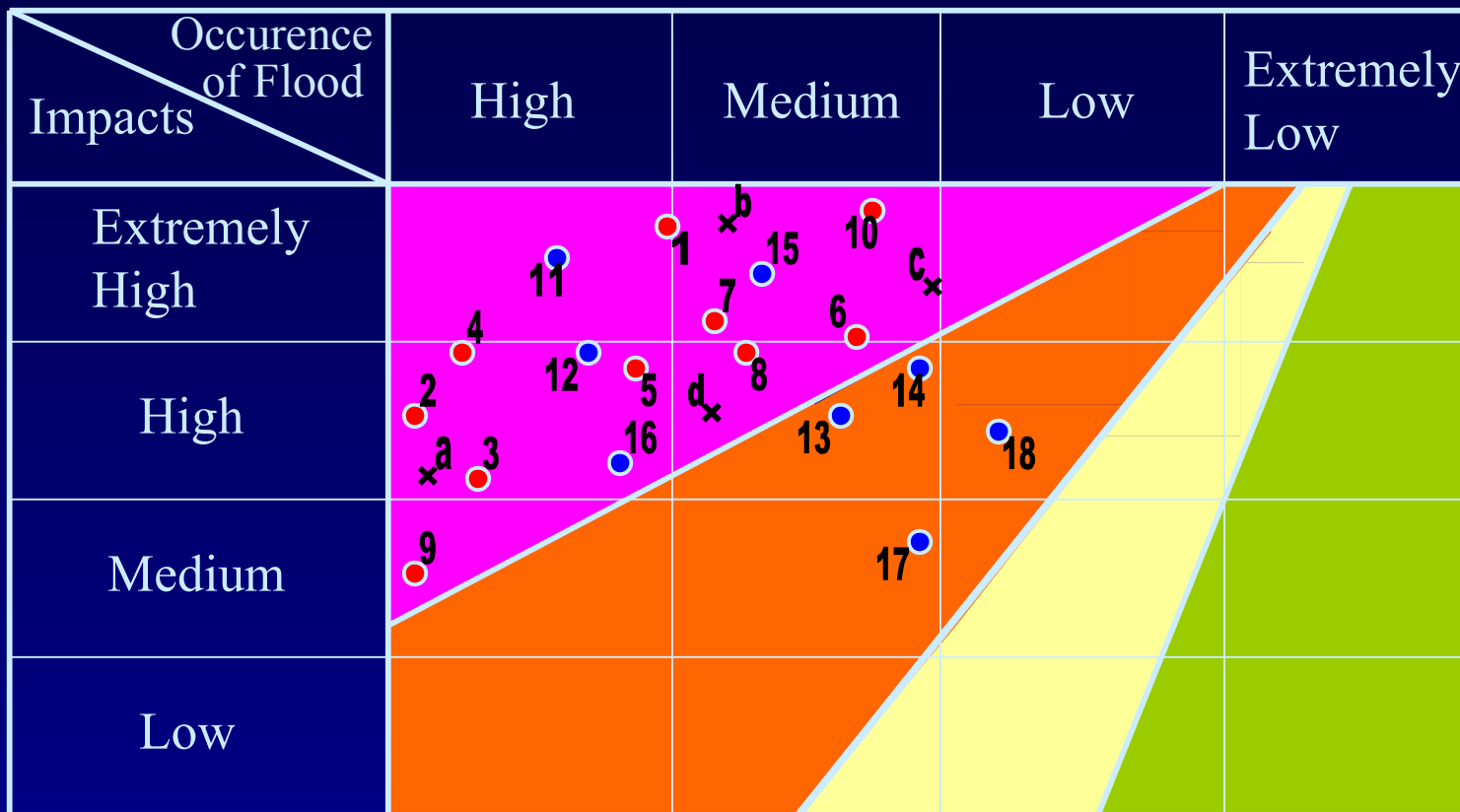
1st Cathegory - Till 4.5 Points

2nd Cathegory - 4.6 - 5 Points

Flood Risk Assessment of Communities

Place	River	District	Population	Bed Capacity	Flooded area specification	Risk Score	No. of measures
Liberec	Lužická Nisa	Liberec	101018	Q5 - Q20	concentrated development	4,3	15
Hradec Králové	Labe	Hradec Králové	100854	Q20 - Q100	concentrated development	4,9	6,13,17
Ústí n.L.	Labe	Ústí n.L.	97290	Q1	concentrated development	4,7	
Pardubice	Labe	Pardubice	94820	Q5 - Q20	historical downtown	3,7	1
Děčín	Labe	Děčín	54205	Q1 - Q5	concentrated development	5,1	
Jablonec n. N.	Lužická Nisa	Jablonec n.N.	46449	Q1 - Q5	concentrated development	4,7	
Mladá Boleslav	Jizera	Mladá Boleslav	45004	Q1 - Q5	concentrated development	4,9	7,16
Trutnov - Hor. St. Město	Úpa	Trutnov	32694	Q20 - Q100	concentrated development	4,7	10
Kolín	Labe	Kolín	31705	Q1 - Q5	low development	5,3	
Hronov -Náchod	Metuje	Náchod	30329	Q1 - Q5	concentrated development	4,5	
Litoměřice	Labe	Litoměřice	26065	Q1 - Q5	low development	5,3	
Chrudim - Štětín	Chrudimka	Chrudim	24397	Q5 - Q20	concentrated development	5	9
agglomeration Třebovka	Třebovka	Ústí n.O., Svitavy	22100	Q1 - Q5	concentrated development	4,1	3,4,5
Mělník	Labe	Mělník	19929	Q1 - Q5	low development	5,7	
Dvůr Králové n. L.	Labe	Trutnov	17098	Q1 - Q5	low development	5	18
Jičín	Cidlina	Jičín	16994	Q5 - Q20	low development	5,4	
Neratovice	Labe	Mělník	16071	Q1 - Q5	concentrated development	4,5	
Ústí n. Orlicí	Tichá Orlice	Ústí n.O.	15323	Q1 - Q5	concentrated development	4,6	2,3,4,5

Flood Risk Perception (Public & Council)



- Unacceptable Risk



- Percepted Risk



- Underestimated Risk



- Unpercepted Risk

Seminar WMA, Berlin 1999

- Maximum Protection Demands

- Economically Based Demands

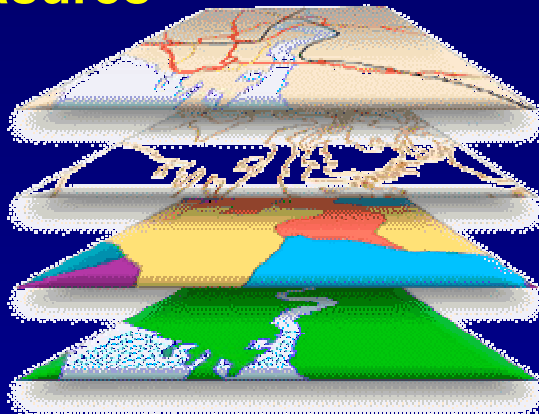
- Exceptional Demands

- No Protection Demands

Risk and Feasibility Assessment

GIS Layers:

- 0 - Basic map ZABAGED
- 1 - Flood prone areas
- 2 - Regional development plans
- 3 - NATURA 2000
- 4 - Flood protection measures
- 5 - Communities



Priorities -> 2008 (Program of Measures) -> 2015 (evaluation)

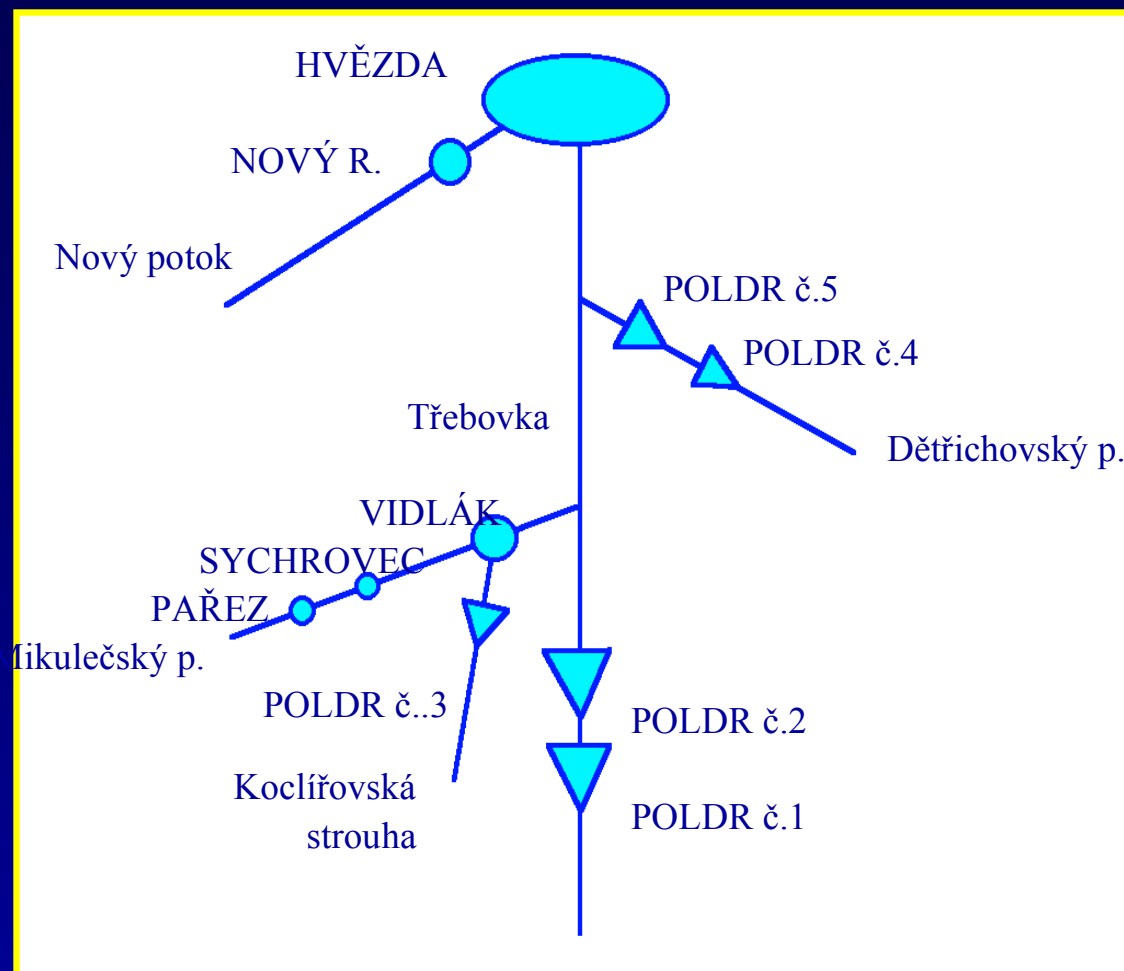
Complex Flood Measures in the Trebovka Rivier Catchment Area



Polder Nr. 2



Complex Flood Measures in the Trebovka Rivier Catchment Area





Flood barriers

Proposals

- **Improvement of early warning**
(European Weather Forecast centre, satellite and radar inputs => rain intensity)
- **In time run-off modelling**
(flood wave prediction models)
- **Specification of flood risk areas**
(area zoning => active flow zones)
- **Reasonable countryside management**
(water retention capacity; biological & technical provisions)
- **Flood Protection Measures**
(retention capacity; river improvement; biological & technical provisions)
- **WFD 2000/60/EC - Art. 4 -7.**
((deterioration only from High to Good Status of W.B.)