



Project: *Towards practical guidance for Sustainable Sediment Management (SSM) using the Sava river basin as a showcase*

Establishment of the Sediment Monitoring System for the Sava River

Zagreb, 3.9.'15.

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Establishment of strategic goals and specific objectives of the sediment monitoring and data exchange system

- *Aim:* to set the scene

- *Content:*
 - description of the purpose to establish effective monitoring system regarding needs of navigation, flood protection, energy production, agriculture, floodplain restoration, conservation of biodiversity and aquatic eco-system protection;
 - description of river channels and river beds changes and evolution;
 - use of sediment data for modeling.

Sediment management is integral part of river basin management

- ❑ Every single river contains sediment as an important natural part of its flow;
- ❑ Usually over the year, sedimentation and erosion level each other out. The river keeps its shape.
- ❑ Construction of any hydro installation on the river, for any purposes, faces sediment aspects. Many of them, sooner or later, suffer from severe sediment problems.
- ❑ Sedimentation or erosion is a sneaking problem. It is necessary to act before it is “suddenly” too late.
- ❑ Any dam on the river profoundly changes the sediment balance. The reservoir usually keeps most of the sediments. Only a part of the sediments is passed on. The downstream river is affected by erosion.
- ❑ There are no examples of the fully fledged integration of sediment mngmnt into river-basin management yet (Brils, 2012).



Sustainable sediment management

The key issues related to sustainable sediment management are:

- ❑ Global change involves much more than climate change;
- ❑ Important changes to the earth's surface occur as result of population growth, land clearance and land use change, infrastructure development and resource exploitation;
- ❑ Changing erosion and sediment dynamics have wide-ranging implications for water resource development, food production, food security, and terrestrial and aquatic ecosystems;
- ❑ Need for improved sediment management in river basins, and resulting need for capacity building and improved education in the sediment field has appeared;
- ❑ Sediment monitoring programs and predictive capabilities for erosion and sediment dynamics should be improved.

Strategic goals of sediment monitoring - Basic facts

- ❑ Sediment transport is the general term used for the transport of material (sand, gravel, and boulder) in rivers and streams;
- ❑ The bed load characterizes grains rolling along the bed while suspended load refers to grains maintained in suspension by turbulence;
- ❑ Professional engineers can apply the basic principles of hydraulics to the most man-made channels and to some extent to grassed waterways;
- ❑ Hydraulics cannot predict the morphology changes of natural streams, because of the numerous interactions with the catchment, its hydrology and the sediment transport processes; indeed, the stream boundaries are movable;
- ❑ Sediments in water, such as clay, silt, and algae, can have many negative effects on aquatic life.



Purpose to establish a monitoring system

- ❑ Thus, a sedimentation monitoring is needed. It will provide an indication of temporal changes over a prolonged period, such as increase or decrease in concentrations of contaminants over time, changes in river bed, and changes in the water capacity of the rivers, decrease of the water quality for agriculture or even for drinking water (Brils, 2008);
- ❑ Natural sedimentation areas are often severely restricted, because of embankments and the loss of flooding areas as a result of these embankments.
- ❑ Natural river hydrodynamics maintain a dynamic equilibrium, regulating (small) variations in water flow and sedimentation by suspension and resettlement. In estuaries, sediment transport occurs both downstream and upstream, mixing fluvial and marine sediment as a result of tidal currents.

Purpose to establish a monitoring system – cont.

- ❑ Sediment forms a variety of habitats. Many aquatic species live in these sediments. Microbial processes cause regeneration of nutrients and important functioning of nutrient cycles for the whole water body. Sediment dynamics and gradients (wet-dry and fresh-salt) form favorable conditions for a large biodiversity, from the origin of the river to the coastal zone (Brils, 2008);
- ❑ A healthy river needs sediment as a source of life.
- ❑ Sediment is also a resource for human needs. For millennia, mankind has utilized sediment in river systems as fertile farmland and as a source of construction material.
- ❑ Sediment acts as a potential sink for many hazardous chemicals. Since the industrial revolution, human-made chemicals have been emitted to surface waters. Due to their properties, many of these chemicals stick to sediment.

Purpose to establish a monitoring system – cont.

- ❑ In areas with a long record of sedimentation, sediment cores reflect the history of the pollution in a given river basin. Where water quality is improving, the legacy of the past may still be present in sediments hidden at the bottom of rivers, behind dams, in lakes, estuaries, seas and on the floodplains of many river basins. These sediments may become a secondary source of pollution when they are eroded due to flooding and channel bank erosion and transported further downstream (Reuther, 2009).
- ❑ In order to protect surface water resources and optimize their use, soil loss must be controlled and minimized. This requires changes in land use and land management, which may also have an impact on water quality;
- ❑ Control of the siltation rate in reservoirs and rivers requires that adequate data are available at the design stage.



Monitoring program

- An effective monitoring program consists of the following steps:
 - Choice of meaningful and attainable monitoring objectives,
 - The development of a monitoring plan, and
 - Design of a proper sampling strategy and method (Reuther, 2009).
- To better evaluate and manage surface waters, controlling authorities need data on the chemical and biological status of sediments (Selander, 2011).
- Major goal of every sediment monitoring program is to measure, map, and document the distribution of concentration, mobility, and toxicity of pollutants and of possible cause and effects in sediments, to identify spatial and temporal trends.
- Other objectives are to investigate and consider implications for lake and river restoration options, or, for geochemical exploration or prospecting of minerals (Reuther, 2009).



Influences of sedimentations on the environmental system

- ❑ Rivers play a major role in landscape evolution, transmitting signals of climactic or tectonic change across the landscape, controlling the timescale of response of the landscape to these changes (Selander, 2011);
- ❑ Changes in the climatic regime of a catchment have direct impacts on the amount and regime of water and sediment in the system;
- ❑ Sedimentation effects are usually local, but trans-boundary impacts may occur where major river systems are international;
- ❑ Increased sedimentations lead basically to:
 - fill watercourses, storm drains and reservoirs, leading to costly dredging and an increased risk for flooding;
 - a decrease the water capacity in the rivers which influence badly on the navigation process;



Influences of sedimentations on the environmental system – cont.

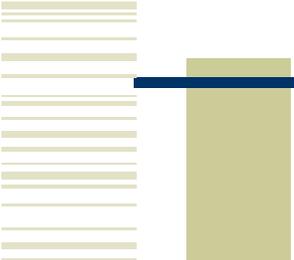
- Decreased sedimentation:
 - increased velocity of the water which may cause erosion downstream and cause damage to human settlements and ecosystems;
 - if a decrease of sediment occurs it can lead to degradation of an ecosystem by starving it of the elements needed to sustain production since sediments often carry a variety of minerals, nutrients, and organic matter.

Sediment monitoring system (SMS)

The AMPS subgroup on sediment monitoring, under the EU WFD, emphasized the following important issues in a plan for SMS:

- ❑ Monitoring the changes regarding the quantity of sediments which have an impact on existing or any new hydro technical works, including navigation and agriculture.
- ❑ Monitoring the progressive reduction or increase in the contamination of sediments;
- ❑ Demonstrate that there is no deterioration in sediment quality;
- ❑ Phasing out of the physicochemical properties of sediments, since it have an impact on the aquatic ecosystem;
- ❑ Controlling the geomorphological process within the river system including the operation in floodplains;

The AMPS revealed also that currently there is a wide range of approaches to sediment monitoring. Different authorities appear to organize their sediment monitoring in different ways, because of the different addressed objectives.



In the end of this item



Thanks for your attention!