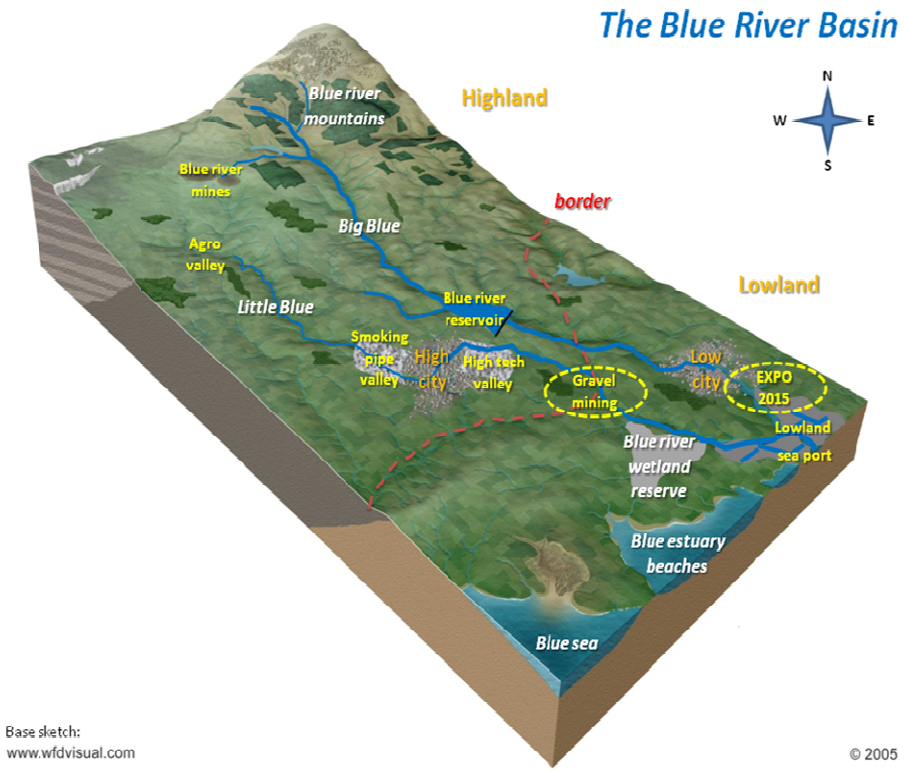
Advice on Blue River Sediment Management at Basin Scale

Background

This year (2009) the WFD river basin management plan (RBMP) was finalized for the Blue River basin – a basin shared by the two countries Highland and Lowland – and sent to Brussels. The plan reveals a rather low level of ambition. It includes only measures of which the river basin mangers are absolutely sure will be effective or which they would have implemented anyhow (without WFD as driving force). Furthermore, the plan lacks integration on the basin and thus trans-boundary scale. In fact one should rather speak of two individual country plans that are stapled together. The RBMP for the Highland part of the Blue River (see map) differs considerably and reveals even a lower level of ambition then the RBMP for the Lowland part. A sediment management plan is absent from both plans. However, recent advancements in river systems science as well as increasing policy and management attention on sediment issues both stress the need to better address sediment. In fact in a joined communication of the Blue River ministers last year it was stated that "the remobilisation of historic contamination of the Blue and its tributaries due to floods and/or due to excavation may be problematic. Hence we should address this issue".



The Blue River Basin

The Blue River drains the two European member states Highland and Lowland. The main flow direction of the river and ground water is oriented from north-west to south-east. There are two main branches of the Blue River: the Big Blue and the Little Blue. The Big Blue has its source in the Blue River mountains and is predominantly snow melt fed. The Little Blue begins in the Agro valley and is rain/ground water fed. The confluence of both branches is at the Lowland Sea Port. Tidal movements from the Blue Sea are noticeable all the way up till High City (Little Blue River) and the Big Blue River reservoir hydropower dam.

The Blue River reservoir plays an important role in flood retention and as a potable water resource. Its hydropower facility is the main source of electricity production for High City, the capital of Highland. It also is a significant source of energy for Low City, the capital of Lowland.

For more than a century the Agro valley in Highland has been the main source of food supply (vegetables and meat) for both countries. In the lower parts of the Blue River mountains are situated the former Blue River mines, which produced a range of metal ores. Their peak of operation was around 1900. These mines were closed down in the 1970's. The mines and their tailing ponds are abandoned now. A small river branch connects the site to the Big Blue River.

Also closed down and abandoned is the Smoking Pipe Valley Industrial Site, just upstream of the Little Blue in High City. This site contained a range of industries including several gas work plants. There are plans to redevelop the site but these have not gone forward because of a lack of funds as well as inadequate infrastructure (ND: the Little Blue upstream of High Valley is also too silted up for navigation). The High Tech Valley site is still going strong and – as the name suggests – predominantly contains high tech industries that fuel the Highland economy. Lowland's economy is mainly based on the Lowland Sea Port, one of Europe's leading container terminals. Most of the resources for High Tech Valley are transported by small container ships upstream along the Little Blue and its end-products go back by container to Lowland Sea Port, to be reloaded on bigger container ships that sail off to the global market.

Another site in the basin that will be redeveloped is the EXPO 2015 area. In May 2015 this EXPO will be opened and it is expected that it will attract visitors from all over the world. Its site is planned to be in the south-eastern out skirts of Low City and the north-western area of the Lowland Sea Port. This part of the port lost its economic viability for port activities some time ago and the south eastern outskirts have been identified for redevelopment for 20 years. A prestigious opera house ("better than in Sydney") is planned as new landmark for the city as well, as a magnet for the EXPO 2015. It is considered to be as essential part of the redevelopment of the whole area. The first digging and dredging activities to prepare the area for construction activities will start mid- next year. A park like landscape with small hills and water channels will be an important 'design element' in the EXPO 2015 construction.

Sites with exceptional natural and recreational value in the basin are: (1) the Big Blue Up- and downstream the Blue River Reservoir (Natura 2000 area), (2) the (Little) Blue River Wetland Reserve

(Ramsar site) in Lowland just upstream the Lowland Sea Port and (3) the Blue estuary beaches along the Blue Sea coast.

Sediment status

Big Blue

The main sources of sediment supply for the Big Blue up to the Blue River reservoir are from the weathering and erosion of rocks and minerals as well as organic material and soils from the Blue River Mountains, and from the erosion of river banks and other in-stream sources in headwater area. Natural river hydrodynamics maintain this stretch at a dynamic equilibrium, regulating small variations in water flow and sedimentation by re-entrainment and resettlement.

The last extreme flood event in 1975 broke some of the dams of the old mine tailing ponds in the Blue River Mines area. As a result enormous amounts of highly contaminated old mine sludge were transported downstream and deposited on the banks and floodplains of the Big Blue. The vast majority of the contaminated mass was deposited in the Blue River Reservoir, just behind the dam. Directly after this flooding event a range of clear toxicological impacts on river and floodplain ecology were observed. However, since then the impacts have lessened as contamination has been slowly covered by new and clean sediment to a depth of more than 30 cm. This 'natural capping' made a natural, ecological recovery possible. Nowadays it is hard to find any traces of the impacts from this 1975 disaster.

The Blue River Reservoir is severely silted up, which limits its flood retention capacity (and hence increases the risk of flooding for Low City) and hampers the Dam's operation (reducing power supply). Plans are in place to dredge the top-layer of sediment in the reservoir and deposit it just downstream of the dam from which point the sediment can continue its course towards the Blue Sea. As the top-layer of sediment in the reservoir is not as highly polluted as the 1975 layer, contaminant concentrations in this dredged material would just pass the Highland quality criteria for open water disposal. The redeposited material would then be mixed and diluted on its way towards the Blue Sea. However, on reaching the Lowland Sea Port its impact might be to increase sediment contaminant concentrations above the quality criteria that allow open sea relocation of dredged material from the port (which is the most cost effective option). This will significantly increase the dredged material handling costs for the Lowland Sea Port as handling of contaminated material is at least three times more expensive then handling of clean material. This is not acceptable for Lowland.

An additional sediment management problem is the fate of sediments that will be removed as part of the EXPO 2015 redevelopment. This is estimated to have a likely volume of at least 500,000 m^3 and will likely be severely contaminated sediment (and so fail open sea relocation criteria).

The 'sediment trapping capacity' of the Blue River reservoir is that large that it is thought to have caused a severe disruption of the Blue River sediment balance, resulting in a lack of sediment

downstream. The impact of this is thought to the noticeably retreating coast line (e.g. erosion of the Blue estuary beaches). However, it must be stated that this finding is still contested.

Little Blue

The main source of sediment supply for the Little Blue is soil erosion mainly due to bad land management in the Agro valley area. The resulting sediment is slightly contaminated with pesticides and nutrients. Its nutrient load contributes to the fact that WFD water quality criteria are not met in the river. Increased soil erosion from agriculture has also disrupted the natural/dynamic sediment balance in the Little Blue and has caused silting up of the waterway, which used to be navigable up to Smoking Pipe Valley. Furthermore, this siltation increases the flood risk for High City.

The waterway all the way up to High Tech Valley is kept navigable by continuous dredging. Until now the dredged material resulting from the Highland stretch of the Little Blue has been disposed of to land (river banks and flood plains) without restrictions. In the Lowland stretch of the river, the dredged material that passes the Lowland quality criteria is transported by barges to the sea where it is relocated in open water. Contaminated material failing these criteria – as a result of the Lowland stretch of the Little Blue – is deposited in deep pits from gravel extraction (see map). Public opposition in Lowland to this 'pit disposal' is growing and has even stopped disposal at some sites.

Furthermore, the gravel extraction itself is meeting increasing public opposition in Lowland (although not in Highland). This opposition is fuelled by local NGO's who argue that gravel mining has a negative impact on the downstream Blue River Wetland Reserve. The technical basis for the NGOs' view is contested. Uncontested is the fact that the as yet unrestricted gravel mining leads to river bed incision and undermining of the pillars of some of the bridges that span the Little River (downstream as well as upstream of the mining area).

Climate change impacts on sediment status

EU policy on climate change adaptation stresses that preventive action should be taken by anticipating potential impacts and minimising threats of climate change on ecosystems (EU White Paper on Climate change). Global climate projections currently available anticipate crucial changes regarding extreme weather conditions, oceanographic conditions and in the water regime of rivers. This applies also to the Blue River. These changes will, in turn, severely modify basic river Blue processes like currents and erosion, thus inducing important physical, geochemical and biological reactions.

Several recent research activities have been undertaken in the Blue River Basin. These have concluded that floods and storm flows will likely lead to a remobilisation of sediment and soil associated with historic contamination in Smoking Pipe Valley, Blue River Mines and Big Blue flood plains downstream of the mines as far as the Blue River Reservoir. These events will also lead to high-energy mass flows, thus increasing erosion of soil and remobilisation of sediment. All of these effects are likely to impact the Blue River ecosystems.

Your task today

You, as stakeholders, sediment experts and managers, are now gathered in this meeting today to jointly discuss this case and to **draw up and advice on how to manage sediment in the Blue River at the basin and thus trans-boundary scale.** This advice will be given to the responsible authorities in both countries.

You have full 'carte blanche' from these authorities as it is just an informal, 'out-off-the-box' exercise aimed to inspire the official negotiations that will start at ministerial level next year.

In your advice you have to address the following questions:

- To what extend are sediment issues obstructing the goals of the WFD and other important management goals?
- What type of sediment management measures are needed to manage these problems?
- Which of them would you give the highest priority?
- What should be dealt with within/outside the WFD (current and next planning cycle)?
- What opportunities can be identified for the whole river basin community and for individual users/interest groups? How will they profit from an improved sediment situation and who will, from your opinion, profit most?
- What does all this mean for the process (actors, roles)?