



Sediment management in the context of the EU Water Framework Directive

from the point of view of water ways maintenance for shipping

Introduction

For shipping and the economic functioning of waterways and harbours, regular dredging is of crucial importance. Providing adequate water depths for shipping produces an annual quantity of around 45 million m³ of dredged material every year in Germany, of which the overwhelming proportion is on the North Sea coast. Most of this remains in the water and is relocated.

Where the sediment has a higher level of contamination at certain points, the dredged material has to be disposed of on land. This handling on land is extensively covered by European or German regulations, in particular the waste law. It must be said that the particular characteristics of dredged material are not given sufficient weight in these regulations. Disposal on land is very expensive. Even when the contaminants are widely spread over the river basin, the bodies responsible for maintaining the waterways have so far had to pay these costs themselves.

The EU Water Framework Directive (WFD)¹ could offer an opportunity to clarify matters. They require that the whole river basin is taken into account and therefore come some way towards a properly understood sediment management policy which because of the mobility of suspended matter cannot stop at either local authority boundaries or national borders. The problems which still exist with dredged material can only be solved by controlling the sources of the contamination. Policies for handling sediments and dredged material require boundary conditions (which must ultimately be European). The following remarks will assist in defining the requirements for such sediment management.

¹ Directive establishing a framework for Community action in the field of water policy (2000/60/EC)

Suspended Matter, Sediments and Dredged Material

Suspended matter and sediments are original, essential and dynamic components of aquatic systems which occur naturally and are transported in watercourses by the current. Suspended matter consists of organic and inorganic solids. Sediments are the solid material found on the water bed. Suspended matter is deposited and becomes sediment which can be whirled up and become suspended matter again.

Depending on the type of water body, the natural solid matter content is variable. Mountain streams are largely free from suspended matter whereas markedly turbid zones form in estuaries with very high solid content close to the saturation limit. Solids are an essential habitat, suspended matter for living plankton-type organisms and sediments for benthic organisms. The biota of a watercourse corresponds to local conditions and adapts to natural variations.

In the whole river basin, from the source down to the sea, erosion, transportation and sedimentation of solid substances take place and these are distributed and mixed as part of the process. Sedimentation takes place in areas of a river with little current such as branches, behind dam walls, in harbour basins, on floodplains and marshlands during flooding. Floods can lead to the clearing out of such sediment deposits.

In estuaries and coastal areas large quantities of mainly mineral materials are moved, leading to constant morphological changes. In tidal parts of the river the transportation of solid matter can take place in both directions and marine substances can even be carried upstream as a result of tidal pumping. Often the natural sedimentation areas are severely restricted eg because of embankments and the loss of flooding areas as a result of these. Consequently questions about the solid matter budget in estuaries are substantially more important and should be regarded differently from upstream sections.

The processes of erosion or the discharge from land surfaces can be controlled to a certain extent eg by constructing water edge strips. The transportation of suspended matter cannot be influenced in practical terms. Sedimentation rates in harbours and water courses are only predictable to a limited extent and can be influenced by hydraulic engineering measures, but not avoided.

Contaminants discharged into the waterway are accumulated and bound to solid matter to a varying degree. Transportation, dilution and therefore distribution of the contaminants takes place with these along the course of the river to the sea. Many "small inputs" which possibly all correspond to emission regulations in themselves can in this way accumulate and reach a level which actually exceeds relevant target levels.

Dredged material

Dredged material is, to put it simply, dredged sediment.

Dredging becomes necessary in ports and waterways when reduced depths as a result of sedimentation endanger shipping. In the most common method used worldwide, dredged sediments are relocated to

another site in the watercourse. In this way the balance of solids in the habitat is disturbed as little as possible.

These measures have effects on the flora and fauna of the water, and the morphology is altered too. Shipping itself can have similar effects on the water bed and water column, if the turn of the propeller causes sediment to be whirled up. Comparable processes, such as increased turbidity, also occur naturally in water bodies, to a substantially greater extent during storms and floods.

Numerous investigations show that the effects of dredging and relocation are as a rule very small. For mitigation various options are available whose use should be investigated on a case-by-case basis.

At some places dredged material cannot be relocated freely because of its contamination. Experience shows, however, that for the large quantities produced during maintenance of waterways neither disposal nor treatment capacities are available and often there are also legal restrictions to beneficial use, not to mention the immense cost.

In the estuary area of rivers the upstream transportation of uncontaminated marine sediments can cause these to mix with contaminated upstream sediments. The consequence of this natural "dilution" is sometimes a decreasing contamination gradient towards the sea over short distances although quantities of contaminants transported remain unaltered. In these areas particularly large quantities of dredged material are produced. This can cause major problems for the operators of ports and waterways, who are usually not "responsible" for existing contamination originating in the whole river basin, in disposing of the dredged material.

Sediment, Dredged Material and the Water Framework Directive

The main objective of the Water Framework Directive (WFD) is a good status or potential of water bodies within 15 years. The details above make it clear that to achieve the goals of the WFD it is necessary to look at sediments. However, an assessment of the Directive and the (German) LAWA² Guidance on these shows that the question of sediments is practically not mentioned. Only Article 2 states that "Environmental quality standards" i.e. concentrations of contaminants in *sediments* amongst other things must not be exceeded and in Annex VIII "Indicative list of the main pollutants", *Materials in Suspension* is listed under no. 10.

In the LAWA Guidance "*Maintenance of waterways/ dredging/ removal of solids* with effects on the hydromorphology and biology by interruption of the *sediment transported* and direct mechanical damage to flora and fauna" are mentioned but no further details are given. It is also noted that in transitional and coastal waters "... the *management of dredged material* (is) to be taken into consideration as particular pressure resulting from the use of the sea."

² LAWA: Länderarbeitsgemeinschaft Wasser,

The WFD could assist in solving existing sediment problems, as it contains comprehensive approaches to analysis of waterways from the source to the mouth. River Basin Management Plans and Programmes of Measures should contribute to cleaning up sources which cause contamination of the dredged material. Such approaches have not, however, been discernable so far.

Other existing EC Guidelines also fail to take dredged material into account adequately. In addition to the WFD and the Waste Policy Guidelines, the handling of dredged material is touched on as part of EU environmental policy through the Soil and the Marine Protection Communication. The latter has links, so to speak, with the WFD area and overlaps with existing dredged material regulations issued by OSPAR, HELCOM etc.

To ensure that future plans make it possible to act in an environmentally friendly way, the handling of sediment should be regulated as part of water policy. As the term "dredged material" only refers to the material which is actually moved, although its significance and effects on other systems are much greater, a better concept for discussion is the term sediment management.

Sediment Management

Sediment management is necessary to ensure that the requirements governing utilisation or protection of water courses are met, and also to protect sediments as natural elements of water courses. Completely natural water courses which are not subject to human influence or requirements do not need sediment management.

The Water Framework Directive promotes management of river basins according to uniform criteria. Where necessary the River Basin Management Plan should be supplemented by a Sediment Management Plan which takes into account the underlying needs and represents part of an agreed maintenance plan linked to the measures necessary to achieve the sediment quality targets. In doing so, the various conditions of the catchment area must be taken into account. In general it will be necessary to differentiate between inland watercourses and tidal/coastal areas.

The components of a sediment management plan for a particular river basin should include the following:

- Basic objectives and requirements within the context of the River Basin Management Plan
 - Evaluation and/or monitoring of sediment quality
 - Action to reduce input of contaminants
 - Action to reduce erosion and control the sedimentation processes
 - Action to provide and maintain water depths, discharge conditions, the maintenance of wetland areas, shallow water areas and retention spaces, and clean up measures
 - Framework for the disposal of sediments in the water, ie relocation, or possibly sub-aquatic confined disposal
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- Options for beneficial use of removed sediment, including on land

Within the context of characterisation of the river basin and monitoring there should be an analysis of which input sources have what proportion of increased sediment contamination so that future action can be targeted to this.

Implementing the programme of measures should reduce the input of contaminants to such an extent that the quality targets for sediments and dredged material are achieved.

The existing contamination of suspended matter or sediment may exceed the relevant quality targets. If there is a widespread distribution of contaminants in rivers with a correspondingly widely increased sediment contamination level, the question arises as to whether it is reasonable to provide (expensive) special treatment for the sediment for reasons of maintenance removed far from discharges into the river. In this case, transitional schemes should be developed to close the source of the contamination and make it possible for the sediment to remain in the waterway.

For sediment with a higher contamination level, confined disposal in the water (like capping or subaquatic disposal as used in the Netherlands) and also possibly beneficial use in the direct neighbourhood of the waterway from which it was taken (eg as earth construction material) are sensible options for which there are currently, however, no satisfactory legal boundary conditions. The basic principles for these options should be developed.

If sediments have to be removed from the waterway because of their contamination, very costly disposal on land is normally necessary. Thought should be given to charging the resulting costs to the cause of the contamination in the river basin.

Outlook

For solutions to be found, it is necessary for sediment handling to be included in implementation of the WFD both for the purpose of achieving the objectives of the Directive and also to secure the future functioning of ports and waterways. This paper should be used as an approach in setting up such discussions.

Sources

In the Thematic Network SedNet promoted by the EU, questions related to handling contaminated sediments are being discussed over a period of 3 years. By the end of 2004 a guidance document and comprehensive status reports shall be in place (www.SedNet.org).

Many documents can be downloaded from the Homepage of the Technical Committee on Dredged Material of the Hafenbautechnische Gesellschaft eg on diverse areas ranging from the Dutch-German exchange of dredged material to legal questions on handling dredged material (partly in English, www.htg-baggergut.de).
