Healthy water resources - balancing the needs of humans

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On Wednesday, 22 June 2011 Eawag will celebrate its 75th anniversary with an information day under the motto "Healthy water resources - balancing the needs of humans and the environment". A sustainable approach of society to surface water, drinking water and wastewater is needed to balance all needs in view of limited resources and climate change – and the longer the situation continues, the more it is needed.

What does society want to do or what must it do to ensure clean water and maintain sound bodies of water? Aquatic research at Eawag in the fields of drinking water, wastewater and water ecology have been providing an important contribution for 75 years in order to find answers to these questions, backed up by scientific evidence - both in the water-rich Switzerland and globally.

In the early days Eawag focussed on performing calculations for public utility plants, wastewater purification plants and sewerage systems. As early as the 1940s exploration for groundwater resources for drinking water was added and the purifying effect of the subsoil on the water seeping through was investigated in field studies. Eawag also tested disinfection processes in parallel - apart from chorine, also processes using ozone, UV, active carbon and membranes in the 1980s. Always at the leading edge of events, Eawag then began research in the field of the analysis of the smallest trace elements. As early as the 1970s it played a significant role in the development of high-resolution gas chromatography. Eco-toxicological assessment of substances and chemical processes in water was then added to chemical analysis. Today, the focus is increasingly on conversion products which are created, for example, under the influence of UV rays and are not necessarily less harmful than the original substance. For example, derivatives of the widely used pain-killer Diclofenac are known which are 10 times more dangerous in the environment than Diclofenac itself. Environmental toxicologists and chemists at Eawag have therefore developed tests that determine when the test for the original substances is insufficient.

There is more life in drinking water than was thought previously

Flow cytometry is now becoming the norm for microbiological analysis of drinking water. This process was used previously in medicine and was developed further by Eawag in collaboration with equipment manufacturers and water suppliers. It can now gradually replace the complicated method of plating bacteria, used for over 100 years. Results show that more life is in even the purest drinking water than previous growing techniques were able to detect: instead of 100, there are 100,000 viable germs per millilitre. However, there is no need to panic. On the contrary, this much more accurate analysis not only enables the function of water treatment to be assessed, but also on the biological stability of drinking water: in biologically stable drinking water harmless bacteria prevent pathogens from developing which means that chlorination can be dispensed with.

Wastewater infrastructure: bigger is not always cheaper

87,000 kilometres of sewers, 759 large-scale and 3,500 small scale sewage plants – around 220 thousand million Swiss francs have been invested in the Swiss wastewater infrastructure. Many of these plants were built in the 1970s and now need modernising. The question now arises whether they should be modernised or whether other systems would be more suitable. Large sewage plants are

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efficient but they require large sewer networks to be built. This is why Eawag is investigating smaller, distributed systems. These would allow a more flexible response to changes (demographic trends, climate change) and they can be designed not only to remove nutrients, but also to allow for low-energy, resource-friendly nutrient recycling. If various systems are available, this would also enable specific local needs to be addressed.

Linking habitats for stable populations

Clean water alone does not fully satisfy the aim of integrated water conservation. Studies by Eawag showed as early as the end of the 1970s that river training and artificial barriers had debased flowing waters as habitats. Today research and practical implementation acknowledge ever more clearly that not only were rare species exterminated, but that the water bodies can no longer provide other "eco-system services". Therefore the cantons have been commissioned by the Federal Government to determine which rivers and streams should be revitalised as a priority between the competing interests of utilisation and conservation. Eco-system research at Eawag is able to provide pointers to set priorities, thanks to its leading-edge molecular genetics techniques. For example, studies have shown that fish or ephemerids have developed very different local breeds depending on the water body. Only a network of independent habitats which are nevertheless connected to each other can ensure varied populations that can exchange genes to remain stable. Because only in this way can they adapt dynamically to new conditions such as increased temperatures, instead of being supplanted by a few non-specialised nondescript species.

Community hygiene saves lives

Diarrhoeal diseases transmitted by water remain responsible for many more deaths worldwide than aids, malaria or tuberculosis - especially in children. In 1968, at the request of the WHO a centre for waste and wastewater disposal in southern countries was created at Eawag - today it has become the Department for Water and Community Hygiene in Developing Countries with 40 employees. Eawag develops methods for the safe disposal of faeces and modified processes for the purification of drinking water. However, it is rarely possible to decree improved community hygiene. Water and sanitation infrastructure are only of real use when users are involved in its planning. Mostly these are distributed systems. They also make more sense economically than large, centralised plants. A study in Dakar (Senegal) compared the costs of a conventional sewer network and sewerage plant with distributed faecal sludge collection (with central processing). The investment costs for the first system are 11 times higher and the operating costs are double the costs for the second system.

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https://www.eawag.ch/en/info/portal/news/news-archive/archive-detail/healthy-water-resources-balancing-the-needs-of-humans