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Water Reuse in a Circular Economy Context

THEME II

River Basins as the Basis for Water Reuse Planning

KEY POLICY MESSAGES

- Basins with marginal water resources due to limited water quantity or poor water quality should consider including wastewater as a potential supply source.
- By showing the cumulative impact of water pollution, a river basin approach can help wastewater treatment planners develop more cost-effective solutions.
- Basin-scale water reuse planning requires the development of new technical expertise and capacity.

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Water reuse planners can develop more sustainable, integrated solutions, by taking a river basin approach that accounts for the cumulative impact of upstream pollution sources, in combination with the characteristics of downstream communities, the receiving water body, and consumers of reused water and bi-products.

The Iguazu falls, Brazil © CDC

DEVELOP COMPREHENSIVE WATER BUDGETS FOR BASINS

A river basin refers to the total area of land drained by a river and its tributaries. The river basin approach allows managers to develop water budgets to help plan for how to meet water demands, given the available water supply within a hydrologic unit.

The availability of water in a basin depends upon not only the *volume* of water available, but also the *quality* of the water. Yet despite the widespread use of river basins as the basis for water resources management, the basin is rarely used as the functional unit for decision-making on water reuse and wastewater treatment Compromised water quality can prevent its immediate use for some purposes, while it might still be viable for other uses. As such, it is also important to assess water demands in terms of quality requirements to evaluate water availability. Comprehensive basin water budgets should include the quality of water supplied and water demand, allowing for better accounting for the water reuse potential in basins.

TRANSFORM WASTEWATER INTO AN ASSET FOR RIVER BASINS

In regions with marginal water resources, water reuse can provide an essential source of supply at the local and basin scales. Consideration of water reuse in water budgeting transforms the water system from use-to-waste into a circular model. The circular model treats wastewater as a potential water source to help meet new and increasing demands, as shown in a case study in the Iguazu River (Box 1). Additionally, increasing water availability from reuse can allow more water to remain instream to meet environmental demands.

ADDRESS POLLUTION HOLISTICALLY AND STRATEGICALLY

Historically, with smaller populations, more abundant resources, and less understanding of the environmental and human health impacts of pollution, many water managers followed the mantra, "Dilution is the solution to pollution." However, increased

River basins are widely used as the basis for water resources management, but rarely used for water reuse and wastewater treatment.

WATER REUSE CASE STUDY IN THE IGUAZU RIVER BASIN

To demonstrate the possibility of developing a circular economy system for river basin management, a case study in Brazil undertook a comprehensive assessment of water availability in the Iguazu River basin that considered treated sewage and industrial effluents as potential sources for industrial water use. Under the maximum possible reuse scenario, water abstraction decreased from 6% to 1% of available river volume. This would result in a larger volume of higher quality water available to downstream users and for the ecosystem, as industries reuse their effluent rather than releasing it into the river. Further, if industries maintain current abstraction rates, while also introducing reuse into their practices, their water availability could double.

water demand, decreased surface water quality, and changing water supply under climate change require new, strategic, and resilient approaches to managing pollution and water treatment.

Scientists and policymakers now recognize the need to understand pollution sources throughout a basin to effectively develop solutions to treat, reduce, or eliminate the discharge of pollution into waterways. Analysis of water quality issues on a basin-scale should include all important sources of water quality impairment, including direct effluent discharges (e.g. from wastewater treatment plants, industrial facilities, stormwater outfalls, agricultural drains) and other diffuse pollution sources (e.g. illegal dumping and litter, excess use of fertilizers and pesticides, urban runoff, soil erosion).

Understanding the cumulative effects of different sources of water pollution and their interactions allows for the optimal deployment of water reuse and wastewater treatment investments throughout a basin. Ad hoc and isolated wastewater solutions, such as typically made by individual communities and industrial dischargers within a basin, provide limited, localized benefits. If planners make decisions based on individual end-of-pipe quality, the basin could lose opportunities for water reuse, downstream water use, investments in other regions of the basin, or ecosystem renewal and protection. Alternatively, consideration of characteristics of the upstream river basin, downstream users, and the receiving water body can yield more cost-effective and resilient water reuse solutions. The river basin approach can also improve and tailor effluent standards to the needs of a specific receiving water body, instead of using uniform or arbitrary water pollution control standards.

Reducing and managing key pollution sources within a river basin can more equitably allocate the cost of wastewater treatment and water purification, as well as reduce human health risks and increase environmental benefits. For example, the case study on the Iguazu River found that water extracted at the downstream water treatment plant contains organic material from effluent releases upstream. The authors suggest a strategy to require lower pollutant loads in upstream releases to provide the downstream users with better water availability, shifting the responsibility for pollution reduction to the polluter.

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River basin planning should also consider the downstream pollution reduction and environmental benefits of water reuse, whereby wastewater treatment plants and industries discharge less effluent into rivers.

APPLY INTEGRATED RIVER BASIN PLANNING TO OVERCOME BOUNDARY MISMATCHES

The hydrological boundaries of basins do not correspond to the administrative boundaries of cities, states/ provinces, or countries; these mismatches complicate managing water resources. Integrated river basin planning offers a coordinating framework to identify the needs of users within basins to collaboratively establish basin goals, and work to achieve water quality effluent standards consistent with those goals. It is an iterative process that allows decision-makers to move from the traditional reactive approach to a proactive approach of managing available resources in any given basin through a structured, adaptive process.

Place-based solutions can overcome territorial mismatches, help gain buy-in from stakeholders, and encourage cooperation among communities and their surroundings. A participatory approach can foster the identification of synergies across sectors and promote the development of projects that bring in key partners, such as industries with water needs consistent

The circular model views wastewater as a potential water source to help meet new and increasing demands.

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Integrated river basin planning can help identify the needs of basins, collaboratively establish basin goals, and achieve water quality consistent with those goals.

with treated wastewater quality, or that can use treatment by-products, such as biogas and biosolids. For example, the use of wastewater sludge generated in cities could provide compost and organic fertiliser to peri-urban farms and contribute to closing basin nutrient cycles. Identifying linkages across urban and rural areas within a basin is key to using residual products in proximity of where they are produced to avoid the transport of negative externalities. Including industrial partners in river basin planning can yield more streamlined and resilient wastewater solutions.

STRENGTHEN BASIN PLANNING EFFORTS AND TECHNICAL CAPACITY FOR WATER REUSE PLANNING

The wastewater sector—as one of the key beneficiaries of river basin planning—needs to be present and active in basin organizations and planning. However, the wastewater and sanitation sectors are often absent in river basin planning efforts due to a lack of coordination between water resource management institutions and those responsible for sanitation service delivery. This leads to inefficient infrastructure and water use.

Achieving the full potential of using river basins as the basis for wastewater treatment and reuse planning requires supportive economic and governance conditions. Governments need to support basin organizations so they can improve their technical expertise and exert oversight powers to enforce the implementation of basin plans. For example, water reuse is prominently featured in Spain's strategy for a circular economy, which includes an action item to include water reuse actions in River Basin Management Plans; Morocco's river basin agencies are responsible for developing new techniques and technologies to improve the quality of wastewater.

Water reuse plans often require expensive infrastructure. Without robust water utilities to perform operations and maintenance, the benefits of the basin planning approach to sanitation and wastewater treatment will be severely compromised.

Incorporating water reuse initiatives into a basin planning framework can maximize benefits, improve resource allocation, and better address stakeholder needs. Yet this requires governmental support to strengthen basin organizations and to improve technical expertise in the wastewater sector.

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