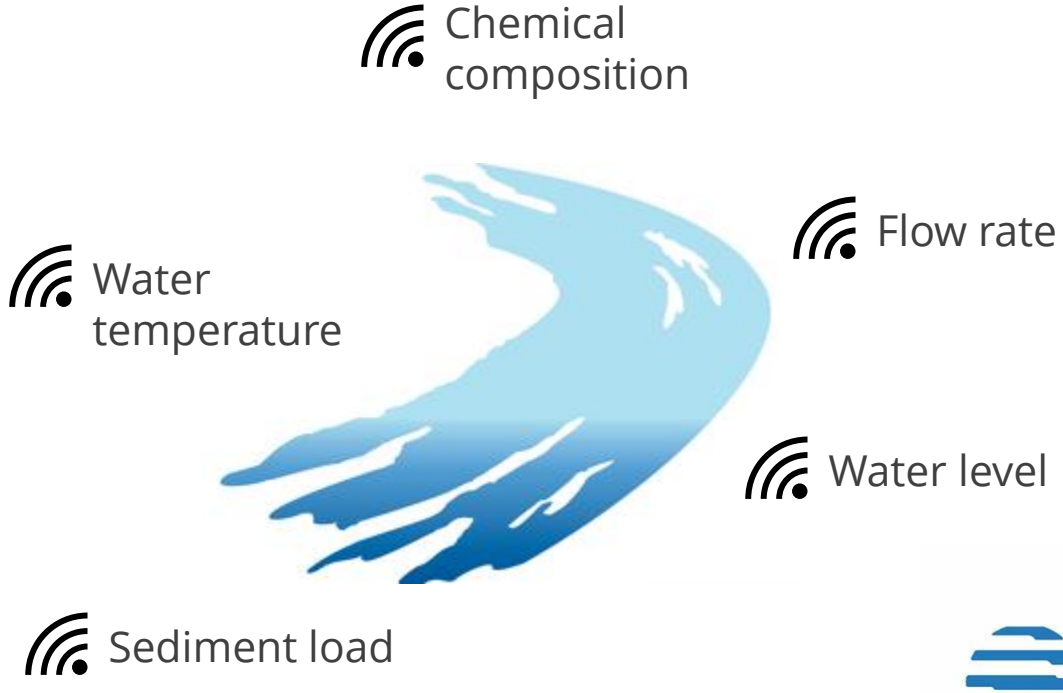
Reconnecting Rivers and Cities

We have divorced the built environment of a city from water management but too much or too little water is where most of us will come face to face with climate change

- Environmental awareness is rising
- Heavy industry has or is moving out of cities
- As cities become more congested, alternative means of transport are being sought
- We now have technology to better understand, monitor and improve our rivers

Instrumenting the river

Sensors will be the primary way we will instrument rivers. They can be used to gather a variety of data on a river's physical characteristics to better understand its behavior.



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Threatened by water scarcity and extreme weather, by **2027**, **40%** of large cities will have **digital twins of their water resources** to manage water supply, quality, resilience, and behavioral change.
IDC Futurescape 2023

Making data accessible and useful

Digital twin

We can simulate various scenarios such as changes in water levels, temperature, and flow rate. This can help us understand how the river behaves under different conditions and make prediction about its future behavior.

Implement Controls

Based on the simulations, we can implement controls to manage the river's behavior. For example, if the simulations show that the river is at risk of flooding, we can release floodgates to prevent damage.

Monitor & Optimize

Finally, the digital twin can be used to continuously monitor the river's behavior and optimize its performance. This can help detect any issues early on and take corrective action before they become major problems

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Namami Gange project is a major $9Billion initiative undertaken by the Indian government to rejuvenate and clean the Ganga River

Pollution Control: reducing and eventually eliminating the discharge of untreated sewage, industrial effluents, and other pollutants into the river. It includes the construction and upgradation of sewage treatment plants, effluent treatment plants, and solid waste management infrastructure along the river and its tributaries.

Riverfront Development: develop and beautify the riverfront areas, including ghats (steps leading to the river), by improving their cleanliness, accessibility, and amenities. It involves the construction of bathing ghats, crematoriums, public amenities, and riverfront walkways.

Biodiversity Conservation: tackling the conservation and rejuvenation of the river's biodiversity. It includes the implementation of measures to enhance the aquatic and terrestrial ecosystem, such as the conservation of wetlands, afforestation along the riverbanks, and the promotion of organic farming practices.

Community Participation: raise public awareness about the importance of the Ganga River and promote community participation in its conservation. It involves educational campaigns, public outreach programs, and the involvement of various stakeholders, including local communities, NGOs, and religious institutions.

Technological Interventions: the adoption of innovative technologies for monitoring and managing the river's health. It involves the use of real-time monitoring systems, data analysis, and remote sensing techniques to assess water quality, flow, and pollution sources.

Cheonggyecheon River; an urban renewal and restoration project of a historic waterway that had been covered by a highway

Environmental Restoration: The project successfully restored the river as a natural waterway, removing the elevated highway that had covered it for several decades.

Improved Water Management: The restoration of the river also helped improve water management in the area. The river now serves as a natural drainage system, helping to mitigate flooding during heavy rainfalls. The project included the installation of flood control infrastructure and the implementation of sustainable water management practices.

Enhanced Urban Aesthetics: The removal of the highway and the freeing of the stream allowed for the development of pedestrian walkways, green spaces, and public parks along the riverbanks. The project integrated cultural elements, such as artwork, sculptures, and historical monuments, enhancing the visual appeal of the area.

Increased Connectivity: the project improved connectivity and accessibility in the city through the construction of numerous pedestrian bridges and the integration of public transportation facilities. This enhanced the overall connectivity of the city and encouraged people to use sustainable modes of transportation, such as walking and cycling.

Economic Benefits: The restoration attracted investment and stimulated economic development, with the revitalized riverfront becoming a popular destination for residents and tourists alike. The project contributed to increased property values, the growth of businesses, and the creation of employment opportunities.

Bordeaux Estuary Digital Twin, an EU Innovation Project with Scope to Scale

This digital twin was built to help project participants in both their day-day tactical decision-making process as well as addressing longer-term and strategic challenges. Data sources include IoT sensors as well as geospatial data such as satellite imagery from Copernicus.

- **Current characteristics** of the river (water level, water quality). Those can be displayed as past data and forecasted data.
- **Climate change impact**, through the Garonne 2050 visualization that shows the forecasted evolution of the river.
- **Dredging and navigation**, to provide decision-support tools for current operations and future planning.
- **Studies for decision makers**, including data analytics and visualizations to inform management policies and facilities management.