06

CLEAN WATER AND SANITATION

2020-2024 Publications	143
2020-2024 Percentage of all Taiwan Publications	4.0%
Course Units	36
Student Engagement with Units on SDG 6	380

Research

Green Innovations in Wastewater Treatment

NYCU's Environmental Technology and Smart System Research Center, Industrial Wastewater Group, focuses on the treatment and reuse of industrial effluents, pursuing both process optimization and next-generation technology R&D with pilot testing. The team has developed a circulable, low-carbon catalytic technology (COAC) that efficiently removes pollutants, particularly from high-strength industrial wastewater. The process features low carbon emissions, low sludge generation, and low energy consumption, reducing operating costs while improving treatment efficiency and stability, and enabling in-plant water recycling and reuse.

Renewable Solutions for Groundwater Purification

Addressing the detection of PFAS (perfluorinated/polyfluoroalkyl substances) in discharges and groundwater near semiconductor, dyeing/finishing, and electroplating industries, Deputy Director Shanshan Chou and colleagues at the Environmental Technology and Smart System Research Center have developed a treatment train centered on regenerative adsorption particles (RAP). By integrating adsorption, catalytic oxidation, and in situ regeneration, the optimized process was validated at potential contamination sites. The results show that RAP can be effectively regenerated after adsorption and catalytic oxidation, maintaining its activity for repeated use, making it a durable solution for PFAS groundwater remediation. This outcome offers a scalable technical pathway that balances performance, cost, and sustainability, thereby strengthening risk control and governance resilience in water environments surrounding industrial clusters.

06 CLEAN WATER AND SANITATION

Social Impact

Ocean & Everyday Life: Popular Science Outreach

NYCU's Disaster Prevention and Water Environment Research Center co-hosted the 2024 Ministry of the Interior Smart 3D Surveying Workshop — "Ocean and Life: Spatial Information" at the National Museum of Marine Science & Technology. Together with Professors Tian-Yuan Shih and Tee-Ann Teo from the Department of Civil Engineering, lecturers from the Central Weather Administration and the Museum led talks and guided tours for high school students. The program introduced core concepts such as vertical datum, geodesy, and tide-gauge observation, and showed their practical applications in sea-level change monitoring, coastal disaster prevention, port operations, and everyday life. Through scenario-based cases and on-site tours, participants strengthened their hydrological observation literacy and scientific reasoning, laying the groundwork for future engagement in community and public governance.

Taiwan–India Water Environment Partnership: Exporting Taiwan's Groundwater-Remediation Experience

In line with the New Southbound Policy, NYCU's Center for Environmental Technology and Smart Systems mobilized resources across industry, government, academia, and research to collaborate with India on groundwater pollution remediation and emerging wastewater treatment technologies. In 2024, the initiative completed three phases:

- Taiwan–India Bilateral Online Forum on a Sustainable Water Environment: Co-organized with the IIT Madras International Centre for Clean Water (ICCW), the forum focused on challenges and opportunities in industrial wastewater treatment and reuse, engaging approximately 70 participants.
- In-Depth Visit to India: The NYCU team met with government agencies, chambers of commerce, and research centers to map governance roles and water supply targets. The visit confirmed that Environmental Technology Verification (ETV) would facilitate the localization of Taiwan-developed technologies, and identified local needs such as desalination and salt recovery, inorganic/organic sludge treatment, biomass conversion, and zero liquid discharge.
- Taiwan-India Practical Water Environment Protection and Management Forum: Focusing on "India's water treatment needs," the forum invited two Indian experts to Taiwan, bringing together 50 representatives from industry, government, academia, and research. The following day, the forum included a visit to the Hsinchu Science Park wastewater treatment plant and a technical discussion. The forum also included in-depth discussions on key technologies with our university and the Industrial Technology Research Institute's Materials and Chemical Engineering Research Institute.

Education & Cultivation

Transnational Co-Creation in Water-Resource Design Practice

The Institute of Applied Arts at NYCU and the Design Academy Eindhoven (Social Design MA) co-ran the course “The Water Council of Relationality,” taking water as encountered in both Taiwan and the Netherlands as the central theme. A fictional institution served as the pedagogical framework, linking design, humanities, science, and local knowledge. Working in teams, the students conducted fieldwork and gathered data to understand the historical contexts and scientific foundations of water governance, marine ecology, climate change, and technology industries in both regions. Through information visualization, materials experimentation, and curatorial practice, they presented future-oriented and research-driven design proposals at the end of the semester. As a platform for cross-border, inter-university collaboration, the course moved water and sanitation topics from knowledge acquisition to design practice and public communication, deepening campus and public engagement with water issues in the process.

Watershed Restoration and Water Culture Forum

NYCU’s International Center for Cultural Studies hosted the forum “Watershed Re-Making on Taiwan’s West Coast,” foregrounding urban development and hydrological change. Drawing on walking field-study experiences in Taoyuan, Hsinchu, and Taipei’s Shezi Island, the program examined water history and culture, the postwar groundwater governance regime and its breakdown, and the blue–green infrastructure in urban planning. Through keynote talks and dialogues with local practitioners, the participants explored the governance challenges and restoration pathways for western Taiwan’s river basins under rapid urbanization. Scholars from Academia Sinica and National Taiwan University presented research, while community groups, including the Environmental Rights Protection Foundation, Taiwan Clean Water Action Alliance, and Shezi Island organizers, offered proposals for public participation and site-based water governance practices.

台島西部「流域改」讀書會/走讀

06 CLEAN WATER AND SANITATION

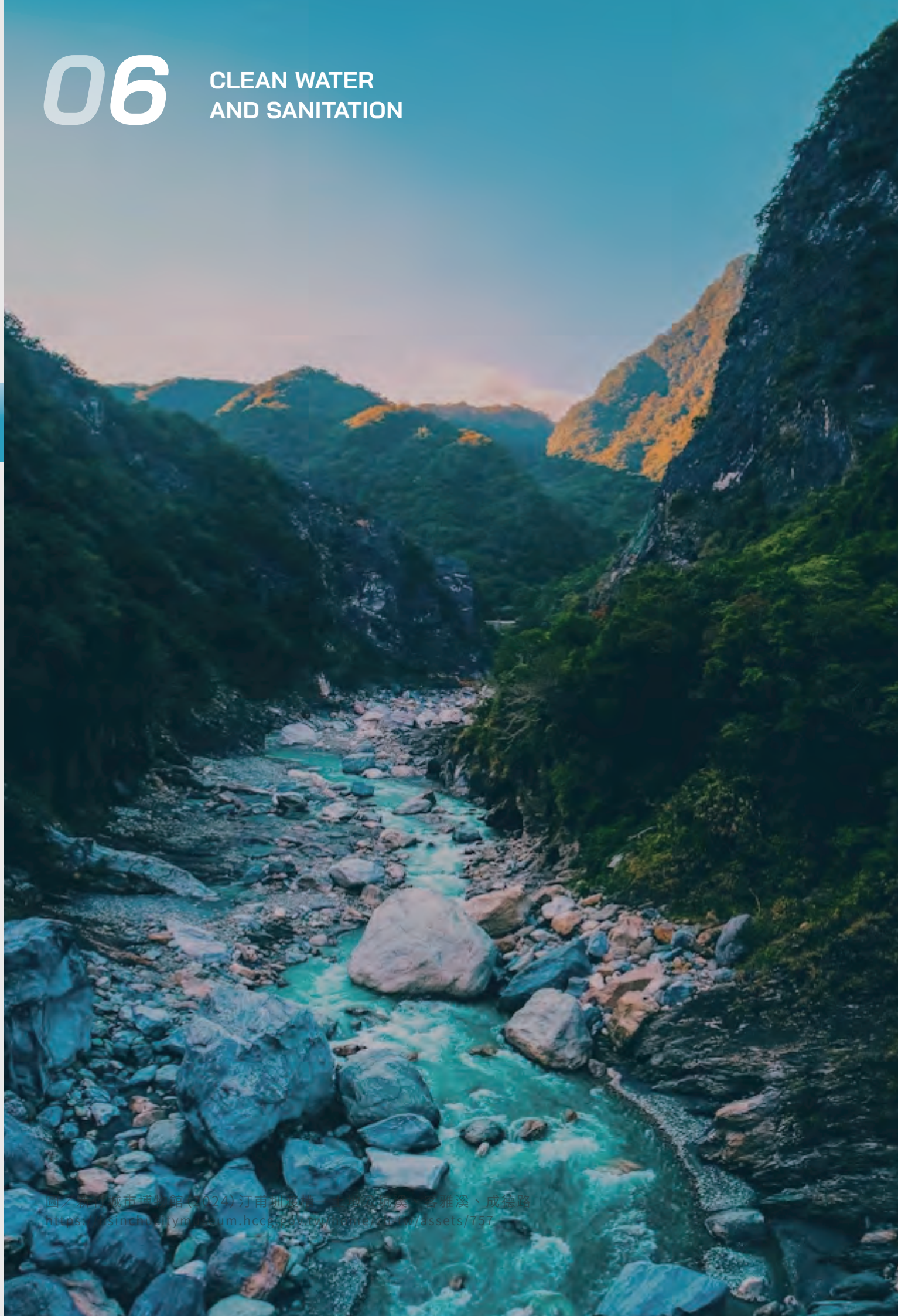

圖 2 新竹城市博物館（2024）汀甫北溪 [ ] 雅溪、成德路 | https://hsinchucitymuseum.hccg.gov.tw/home.jsp?id=1&act=/assets/757

Stewardship

Smart Water Services for a Sustainable, Clean-Water Campus

Since 2016, the University has phased in a Campus Energy and Water Resource Management System. By 2024, more than 100 smart water meters had been installed across campuses and integrated into a cloud-based Energy Management System (EMS) to display real-time consumption, nighttime base-flow, abnormal peaks, and district balancing. The system issues leak alerts, benchmarks usage against baseline targets, tracks water-saving performance, and generates audit reports, enabling building-level water management and pipeline leak control, and informing decisions on equipment replacement, repairs, and conservation investments.

To ensure clean, safe drinking water for the campus and surrounding community, we operate a routine water-quality maintenance program: monthly sampling of drinking fountains for physicochemical and microbial indicators with regular filter replacement; annual cleaning and disinfection of each building's water tanks, including checks of refill, overflow, and vent safety mechanisms; and scheduled maintenance of the on-campus wastewater treatment plant, including equipment servicing, chemical dosing calibration, and sludge removal to keep effluent stable and compliant.

Regarding resource recycling, a rainwater retention system was installed on campus for flushing toilets in buildings and irrigating campus plants, reducing tap water demand and improving resilience during dry seasons. Real-time data and maintenance records were integrated into the EMS to quantify water conservation efforts. Through data-driven governance and water recycling, the campus water resource system comprehensively improves water-use efficiency, drinking water hygiene, and water environment quality, while also balancing the health of faculty and students, community service, and sustainable development goals.