University : National Chin-Yi University of Technology
Country : Taiwan
Web Address : www.ncut.edu.tw

[SDG6] Clean Water and Sanitation

[SDG64.2] Does your university as a body measure the reuse of water across the university?

NCUT's Water Reuse Measurement and Sustainable Water Management System

NCUT, Taiwan, has established a robust water reuse monitoring and management framework as part of its long-term sustainability strategy under SDG 6 (Clean Water and Sanitation). The system ensures that all wastewater is properly treated, measured, and reused efficiently to minimize water waste and promote resource circularity.

1. Sewage Collection and Treatment

All domestic sewage generated by faculty, staff, and students is centrally collected across the campus. The university's sewage treatment plant operates continuously under professional supervision, with equipment inspections carried out twice monthly. Comprehensive water quality testing ensures compliance with national discharge standards.

- **Qualified Water:** When tests meet reuse standards, treated water is directly reused.
- **Unqualified Water:** If quality fails to meet standards due to weather variations, reduced inflow during vacations, or equipment issues, corrective measures are implemented immediately

2. Reuse and Recycling of Treated Water

After tertiary treatment, qualified water is reused for:

- Landscape irrigation and garden maintenance
- Toilet and building sanitation
- Supplementing Mingxiu Lake**,** the campus's main ecological reservoir

These reuse systems significantly reduce fresh-water consumption while maintaining campus aesthetics and ecological stability.

3. Water-Saving Management and Performance Tracking

NCUT employs a comprehensive water conservation management plan that includes:

- Appointment of water-saving management officers
- Smart metering and leak detection

- Laboratory, dormitory, and air-conditioning water-use optimization
- Rainwater harvesting and reuse from cooling systems

Performance indicators include total annual savings, average per-capita water use, cost-benefit evaluation, and goal attainment analysis.

4. Government Recognition and Innovation

The university's achievements have been recognized by Taiwan's Water Resources Department, which awarded NCUT the Outstanding Water Conservation Unit honor. Continuous improvement projects focus on smart irrigation, condensate recovery, dual-flush toilets, and integration of IoT-based monitoring for precision control

5. Off-Campus and Research Contributions

Beyond campus boundaries, NCUT promotes sustainable water-energy management through:

- Community water-conservation education in local colleges
- Industrial collaboration introducing water-saving technologies to high-tech manufacturing sectors
- Research on the Water Resources Energy Conversion System, an NCUT innovation using water as a medium for renewable energy storage and conversion

6. Alignment with the Sustainable Development Goals

NCUT's integrated water-reuse and conservation framework supports:

- **SDG 6 (Clean Water and Sanitation)** – efficient water treatment and reuse
- **SDG 7 (Affordable and Clean Energy)** – water-energy nexus innovation
- **SDG 9 (Industry, Innovation and Infrastructure)** – sustainable resource technology
- **SDG 13 (Climate Action)** – adaptive response to water scarcity and climate impacts

In summary, NCUT has established a measurable, smart, and sustainable water reuse system that optimizes resource use, ensures regulatory compliance, and demonstrates leadership in sustainable campus and industrial water management.

NCUT Sewage Treatment Operation Process

5-1: Sewage Collection

Domestic sewage from faculty, staff, and students is collected from across the campus.

5-2: Treatment Operations Begin

The sewage treatment plant begins its operation. The manufacturer visits the school twice a month to assist with equipment inspections.

5-3: Water Quality Testing

Water quality tests are conducted to ensure the treated sewage meets discharge standards.

- **5-3-1: Qualified Discharge**
- If the water meets the standards, the treatment process is complete, and the water is reused.
- **5-3-2: Unqualified Discharge**
- If the water does not meet the standards, corrective actions are taken. Possible reasons for failure include:
    1. **Weather Conditions:** Significant temperature changes can affect oxygen levels in the water, impacting treatment results.
    2. **Vacations:** During winter and summer breaks, a reduction in student numbers leads to a decrease in sewage inflow, requiring adjustments in the treatment process.
    3. **Mechanical Failures:** Ongoing regular maintenance is necessary to prevent equipment malfunctions and ensure efficient operations.

5-5: Reuse of Treated Water

After treatment, the water is discharged and reused for purposes like watering campus plants or as a water source for Mingxiu Lake.

This process ensures effective wastewater management while maintaining compliance with environmental standards.

國立勤益科技大學環境保護及安全衛生中心

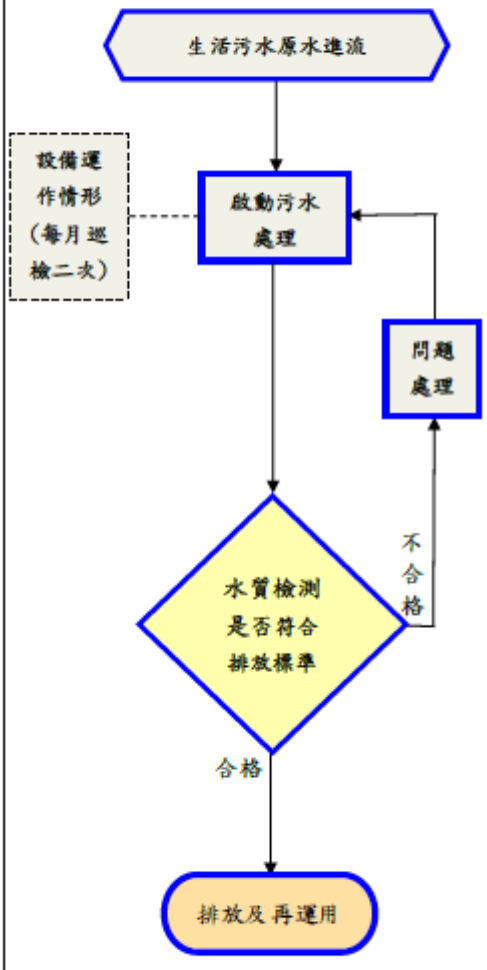
污水處理作業流程

1.目的：針對本校教職員工生之生活污水，以生物處理法作適當之處理，務使排放水符合法訂排放標準。

2.依據：水污染防制法。

3.範圍：全校各棟建築物所排放之生活污水。

4.權責：詳如 5 作業說明.

作業流程	權責單位	執行時間	相關表冊
	環安中心（邱明哲/2576） 環安中心（邱明哲/2576） 環安中心（邱明哲/2576） 環安中心（邱明哲/2576） 環安中心（邱明哲/2576）	即時 即時 即時 每半年 1 次 即時	廢[污]水處理設施之操作、用電每次操作及檢查記錄表。

Campus environment and safety management indicators

1. Specific Practices and Performance of Water-Saving Measures:

- Develop a comprehensive water conservation management plan or implementation strategy and establish a dedicated promotion team.
- Appoint full-time or part-time water conservation management personnel responsible for overseeing and promoting the execution of water-saving initiatives.
- Conduct a thorough analysis of water-saving opportunities, including but not limited to: laboratory water usage, agricultural (forest) farm water consumption, domestic water (dormitories and dining facilities), restroom water usage, condensate recovery from air conditioning systems, rainwater harvesting, and the reuse of discharged water from the sewage treatment plant.
- Enroll staff members in water conservation courses or seminars organized by government agencies or professional institutions to enhance their knowledge and skills.
- Integrate water conservation into routine operations and utilize gatherings or events as opportunities to advocate for water conservation principles and practices.

2. Specific Improvement Measures for Water Conservation:

a. Enhance Water Savings in the Air-Conditioning System:

- Implement more efficient cooling technologies and equipment.
- Regularly inspect and maintain the air-conditioning system to fix leaks and optimize its water usage.
- Consider the installation of condensate recovery systems to recycle water.

b. Enhance Water Saving Methods for Water Equipment:

- Retrofit water equipment with water-saving devices such as low-flow faucets and showerheads.
- Implement a regular maintenance schedule to address leaks and minimize water wastage.
- Investigate the use of smart meters and sensors for real-time monitoring and control of water equipment.

c. Implement Improvement Measures for Water Saving in Toilets:

- Install dual-flush toilets or retrofit existing ones to allow for varying levels of flushing based on need.
- Replace outdated toilet models with more water-efficient ones that meet industry standards.
- Educate users about responsible toilet use and reporting of leaks.

d. Implement Improvement Measures for Water Saving in Dormitories and Restaurants:

- Encourage responsible water use among residents and patrons through awareness campaigns.
- Install water-saving appliances and fixtures in common areas, such as restrooms and kitchens.
- Develop guidelines for efficient laundry and dishwashing practices.

e. Implement Improvement Measures for Water Conservation in Gardens and Green Spaces:

- Utilize drought-resistant plants and xeriscaping techniques to reduce outdoor water demand.
- Employ smart irrigation systems that adjust watering schedules based on weather conditions.
- Capture and reuse rainwater for irrigation purposes.

- Implement mulching to retain soil moisture and reduce evaporation.

These measures aim to comprehensively address water conservation efforts across various areas of the institution.

3. Rainwater Collection and Reclaimed Water Utilization Measures:

Specific Improvement Measures for Rainwater Collection and Reuse:

a. Enhanced Rainwater Harvesting Systems:

- Upgrade and expand rainwater collection infrastructure to capture and store a greater volume of rainwater.
- Implement advanced filtration and purification techniques to ensure collected rainwater meets quality standards for its intended use.

b. Application Diversification:

- Develop a comprehensive plan for utilizing harvested rainwater across the campus, including irrigation, landscape maintenance, and non-potable water needs.
- Investigate the feasibility of using treated rainwater for flushing toilets and other non-potable applications.

c. Maintenance and Monitoring:

- Establish routine maintenance protocols to keep rainwater harvesting systems in optimal working condition.
- Utilize monitoring systems to track rainwater collection, storage levels, and quality to maximize efficiency and ensure reliability.

Reclaimed Water Reuse Improvement Measures:

a. Advanced Treatment Technology:

- Upgrade reclaimed water treatment facilities with state-of-the-art technology to enhance water quality.
- Ensure that reclaimed water meets all safety and regulatory standards for its intended applications.

b. Expanded Usage Scenarios:

- Explore additional opportunities for using reclaimed water, such as cooling systems, landscape irrigation, or industrial processes.
- Develop clear guidelines and protocols for each reclaimed water application to minimize health and environmental risks.

c. Public Awareness and Education:

- Educate the campus community and stakeholders about the benefits and safety of reclaimed water usage to build trust and encourage its responsible use.

Improvement Measures for Reuse of Discharged Water from Sewage Treatment Plants:

a. Enhanced Treatment Processes:

- Upgrade sewage treatment facilities to improve the quality of discharged water, making it suitable for specific reuse purposes.
- Implement tertiary treatment processes to remove contaminants and pathogens effectively.

Targeted Reuse Applications:

- Identify and prioritize potential reuse applications for the treated wastewater, such as irrigation, industrial processes, or groundwater recharge.
- Develop infrastructure and distribution systems to deliver reclaimed water to designated areas.

Regulatory Compliance:

- Ensure that all reuse practices comply with local, regional, and national regulations regarding reclaimed water quality and safety.
- Regularly monitor and report on the quality of discharged water to relevant authorities.

By implementing these measures, the institution can make significant strides in maximizing the utilization of rainwater, reclaimed water, and treated wastewater while promoting sustainability and resource conservation.

4. Water Conservation Performance Evaluation:

a. Reduction in Target Water Consumption:

- Define and monitor specific reduction goals for water consumption in accordance with the institution's water conservation plan.

b. Change in Average Water Consumption per Person per Year:

- Calculate and track the average water consumption per person annually to measure progress and identify trends.

c. Total Water Savings:

- Calculate the total volume of water saved through various conservation initiatives and practices.

d. Achieved Value of Water Consumption Target:

- Determine the extent to which the water consumption reduction goals have been met or exceeded.

e. Total Water Savings (cubic meters/year):

- Express the total water savings achieved in cubic meters per year.

f. Average Water Consumption per Person per Year (liter/year/person):

- Express the average water consumption per person per year in liters.

g. Cost of Water Saving and Improvement Measures:

- Document the expenses associated with implementing water-saving measures, including equipment, maintenance, and personnel costs.

h. Economic Benefits of Water Saving:

- Calculate the financial benefits resulting from reduced water bills throughout the year due to the implemented water conservation measures.

By evaluating these performance metrics, the institution can gauge the effectiveness of its water conservation efforts, measure cost-effectiveness, and demonstrate the economic benefits of sustainable water management practices.

5. Recognition by the Government for Excellence and Special Innovations:

a. "Water Conservation Outstanding Unit and Outstanding Individual Award" by the Water Resources Department of the Ministry of Economic Affairs:

- Acknowledgment and accolades from the Water Resources Department of the Ministry of Economic Affairs for outstanding achievements in water conservation.

b. Commendations from Other Government Departments:

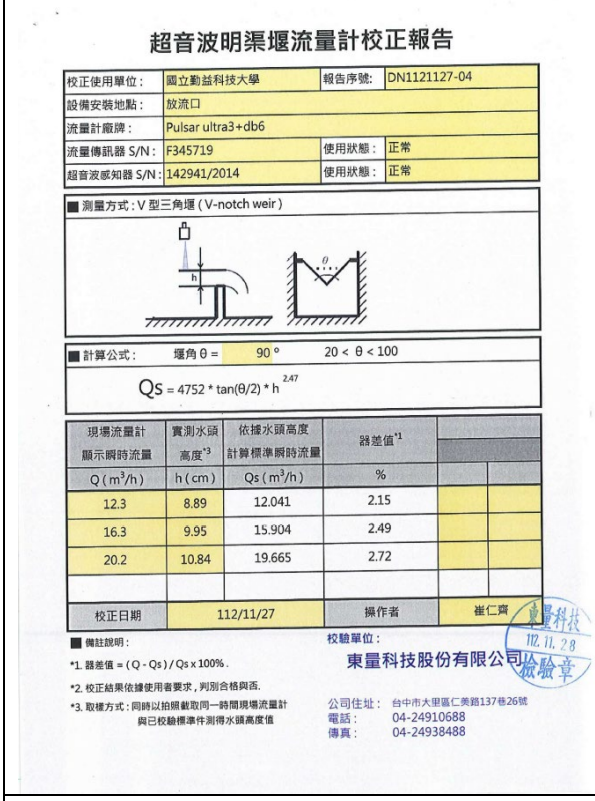
- Receipt of certificates or official documents of commendation from various government departments recognizing excellence in water conservation efforts.

c. Showcasing Innovative Water-Saving Methods:

- Sharing innovative water-saving methods as exemplary models for other educational institutions to follow and adopt.

These recognitions and innovations underscore the institution's commitment to water conservation and serve as inspiration for others

	
Sewage plant central control room	Ultrafiltration device



超音波明渠堰流量計校正報告

校正使用單位：	國立勤益科技大學	報告序號：	DN1121127-04
設備安裝地點：	放流口		
流量計廠牌：	Pulsar ultra3+db6		
流量傳訊器 S/N：	F345719	使用狀態：	正常
超音波感知器 S/N：	142941/2014	使用狀態：	正常

■ 測量方式：V 型三角堰 (V-notch weir)

■ 計算公式： 堰角 θ = 90 ° 20 < θ < 100

$Qs = 4752 * \tan(\theta/2) * h^{2.47}$

現場流量計顯示瞬時流量	實測水頭高度*3	依據水頭高度計算標準瞬時流量	器差值*1		
Q (m^3/h)	h (cm)	Qs (m^3/h)	%		
12.3	8.89	12.041	2.15		
16.3	9.95	15.904	2.49		
20.2	10.84	19.665	2.72		
校正日期	112/11/27		操作者	崔仁齊	

■ 備註說明：

*1. 器差值 = (Q - Qs) / Qs x 100% .

*2. 校正結果依據使用者要求，判別合格與否.

*3. 取樣方式：同時以拍照截取同一時間現場流量計與已校驗標準件測得水頭高度值

校驗單位：

東量科技股份有限公司

公司住址： 台中市大里區仁美路137巷26號

電話： 04-24910688

傳真： 04-24938488

興亞環保科技股份有限公司

環境部國環檢證字第 201 號(原環署環檢字第 201 號)

檢驗室地址：台中市西屯區工業區七路11號1樓 電話：04-23507275 傳真：04-23507280

水質樣品檢測報告

客戶名稱：勤益科技大學 專案編號：MR112WA02145

行業別：大專校院(大專校院) 報告編號：MR112WA02145

採樣單位：興亞環保科技股份有限公司 採樣日期： 112 年 11 月 08 日

採樣方法：NIEA W109.53B 收樣日期： 112 年 11 月 08 日

採樣地點：臺中市太平區坪林里中山路二段57號 報告日期： 112 年 11 月 22 日

採樣行程編號：MRWA23110033 聯絡人：曾仁育

檢測目的：定檢申報

樣品編號		WA112110803					檢測方法	最大限值	備註
		-01	-02						
採樣時間		13:49-13:59	13:43-13:48						
樣品名稱(特性)		原廢水(放流)	放流水(放流)						
檢測項目	單位	檢測值							
氫離子濃度指數(pH)	-	8.0	7.8				NIEA W424.53A	*	
水溫	℃	29.4	29.3				NIEA W217.51A	*	
懸浮固體	mg/L	73.0	24.5				NIEA W210.58A	*	
化學需氧量	mg/L	202	58.8				NIEA W515.55A	*	
生化需氧量	mg/L	52.2	15.2				NIEA W510.55B	*	
大腸桿菌群	CFU/100mL	$2.5X10^5$	$7.5X10^4$				NIEA E202.55B	*	
		以下空白							

備註：1.本報告共 1 頁，分離使用無效。

2.依於方法偵測極限之測定值以"ND"表示，並於備註欄註明其方法偵測極限(MDL)。

3.依於定量極限但大於方法偵測極限之數值，以<QDL表示並說明其定量極限值

4.樣品若由本檢驗室執行採樣，本報告僅對該樣品負責，不得隨意複製並作為宣傳廣告之用，測值僅供參考。

5.當數據為客戶所提供時備註識別，資訊為客戶所提供且可能影響結果有效性，本報告僅對該樣品負責。

6.若檢驗室接收樣品經查驗有不符合規定事項，於檢測報告上備註，測值僅供參考。

7.水污申報系統資料：進出場時間 13:38-14:01

聲明書： 1.茲保證本報告內容完全依照環境部及有關機關之標準方法及品保品管等相關規定，秉持公正、誠實施行採樣、檢測，絕無虛偽不實，如有違反，之行政處分及刑事處罰，就政府機關所受損失願負連帶賠償責任之外，並接受主管機關依法令所為之行政處分及刑事責任。

2.各人絕願如自身受政府機關委任從事公務，亦屬於刑法上之公務員，並瞭解刑法上關利罪、公務員登載不實偽造公文書及貪污治罪條例之相關規定，如有違反，亦為刑法及貪污治罪條例之適用對象，願受最嚴厲之法律制裁。

報告專用章 興亞環保科技股份有限公司 負責人：楊仁治 檢驗室主任：曾仁育

公司名稱： 興亞環保科技股份有限公司

負責人： 楊仁治

檢驗室主管：

（簽名） 11/22

第 1 頁(共 1 頁)

Regular calibration of ultrasonic flow meter water meter	Regular water quality testing

Additional evidence link:

[能源與環境人才培訓 | 國立勤益科技大學 能源與環境科技中心 (igets.org)](https://igets.org)