



Times Higher Education
**Sustainability
Impact Ratings**

SDG

6

Clean Water
and Sanitation



SDG 6.2.1 Water consumption tracking

1. Campus Water Consumption

In 2024, NCUE consumed a total of 499,186 m³ of water, comprising 153,517 m³ of tap water and 345,669 m³ of groundwater, respectively. Tap water and groundwater accounted for 30.75% and 69.25% of total water consumption, respectively as shown in Table 1.

Table 1. Total water consumption of tap water and groundwater in 2023

Water consumption (2024)	Tap water (m3)	Groundwater (m3)	Total (m3)
Jinde Campus	77,774	317,464	395,238
Baoshan Campus	75,743	28,205	103,948
Entire University	153,517	345,669	499,186

2. NCUE's water consumption is recorded daily by the school's electrical staff, who take meter readings, as shown in Figures 1 and 2. The total water consumption of NCUE in 2024 increased slightly because of a series of major earthquakes that caused pipeline leakage throughout the campus (as shown in Figures 3 and 4).

6月份 各棟建築物水錶度數

日期	站點	加壓站前水錶	使用度數	維世館前水錶	使用度數	2-11宿舍前水錶	使用度數	九舍自來水錶1	元舍自來水錶2	十舍自來水錶1	十舍自來水錶2	加壓站自來水錶	使用度數
1		1184088	485	65388	40	14727	0	118141	34546	54220	16514	81326	989
2		1184573	58	65428	7	14727	0	118141	34546	54220	16514	82315	370
3		1184631	104	65435	13	14727	0	118141	34546	54220	16514	82685	339
4		1184735	0	65448	0	14727	0	118141	34546	54220	16514	83024	0
5		1184735	158	65448	20	14727	0	118141	34546	54220	16514	83024	530
6		1184899	0	65468	0	14727	0	118141	34546	54220	16514	83554	0
7		1184899	0	65468	0	14727	0	118141	34546	54220	16514	83554	0
8		1184899	382	65468	35	14727	52	118141	34546	54220	16514	83554	585
9		1185276	64	65503	9	14789	0	118141	34546	54220	16514	84139	362
10		1185342	71	65512	9	14789	0	118141	34546	54220	16514	84501	231
11		1185411	82	65521	8	14789	0	118141	34546	54220	16514	84732	321
12		1185491	96	65529	6	14789	0	118141	34546	54220	16514	85053	325
13		1185587	0	65535	0	14789	0	118141	34546	54220	16514	85378	0
14		1185587	0	65535	0	14789	0	118141	34546	54220	16514	85378	0
15		1185587	469	65535	45	14789	88	118141	34546	54220	16514	85378	486
16		1186056	116	65580	5	14877	0	118141	34546	54220	16514	85864	173
17		1186172	109	65585	4	14877	0	118141	34546	54220	16514	86037	223
18		1186281	0	65589	0	14877	0	118141	34546	54220	16514	86260	0
19		1186281	256	65589	0	14877	0	118141	34546	54220	16514	86260	641
20		1186537	0	65589	0	14877	0	118141	34546	54220	16514	86901	0
21		1186537	0	65589	0	14877	0	118141	34546	54220	16514	86901	0
22		1186537	316	65589	0	14877	87	118141	34546	54220	16514	86901	607
23		1186847	0	65589	0	14934	0	118141	34546	54220	16514	87308	0
24		1186847	248	65589	0	14934	0	118141	34546	54220	16514	87308	334
25		1187095	92	65589	0	14934	0	118141	34546	54220	16514	87842	182
26		1187185	75	65589	0	14934	0	118141	34546	54220	16514	88034	99
27		1187258	0	65589	0	14934	0	118141	34546	54220	16514	88123	0
28		1187258	0	65589	0	14934	0	118141	34546	54220	16514	88123	0
29		1187258	273	65589	0	14934	0	118141	34546	54220	16514	88123	366
30		1187531	107	65589	0	14934	65	118141	34546	54220	16514	88489	172
統計		3550	3550	201	201	262	262	1944	80	2116	813	7335	7335

Figure 1. Daily meter reading records by NCUE's electrical staff



Figure 2: Schematic diagram of water meter reading points recorded daily by the university's

electrical staff



Figure 3. Workers were repairing the deep water well at Jinde Campus



Figure 4. A deep water well motor to be repaired

3. Smart Water Meter Installation and Enhanced Water Management

NCUE plans to install 7 ultrasonic smart water meters on the Jinde Campus and add 23 new ultrasonic smart water meters on the Baoshan Campus by the end of 2025 (schematic diagram shown in Figure 5). On the Baoshan Campus, each building will be equipped with groundwater and tap water meters to monitor water usage data for each building. The university can evaluate the water usage patterns by analyzing the water consumption and event data wirelessly transmitted from smart water meters. The flow trend charts automatically generated by the management system can be used to detect abnormal water usage. Real-time data obtained from smart water meters enables effective management of on-campus water usage and provides instant water resource monitoring information. By installing smart water meters across the campus, NCUE can consolidate various water resource data throughout the campus to serve as a basis for water resource balancing, allocation, leak detection, and management.



Figure 5. Smart water meter diagram

SDG 6.2.2 Water consumption per person

Volume of water used in the university: Inbound (treated/ extracted water)

1. Campus Water Consumption

In 2024, NCUE consumed a total of 499,186 m3 of water, comprising 153,517 m3 of tap water and 345,669 m3 of groundwater, respectively. Tap water and groundwater accounted for 30.75% and 69.25% of total water consumption, respectively as shown in Table 1.

Table 1. Total water consumption of tap water and groundwater in 2023

Water consumption (2024)	Tap water (m3)	Groundwater (m3)	Total (m3)
Jinde Campus	77,774	317,464	395,238
Baoshan Campus	75,743	28,205	103,948
Entire University	153,517	345,669	499,186

2. NCUE's water consumption is recorded daily by the electrical staff, who take meter readings, as shown in Figure 1.

6月份 各棟建築物水錶度數

日期	地點	加壓站前水錶	使用度數	總計宿舍水錶	使用度數	2-11宿舍水錶	使用度數	九舍自來水錶	九舍自來水錶	十舍自來水錶	十舍自來水錶	加壓站自來水錶	使用度數
1	1184085	485	65388	485	14737	0	118141	34546	54220	16514	83336	180	
2	1184775	50	65428	7	14737	0	118141	34546	54220	16514	83115	370	
3	1184631	104	65435	11	14737	0	118141	34546	54220	16514	83085	330	
4	1184735	0	65448	0	14737	0	118141	34546	54220	16514	83034	0	
5	1184735	158	65448	30	14737	0	118141	34546	54220	16514	83024	530	
6	1184839	0	65468	0	14737	0	118141	34546	54220	16514	83354	0	
7	1184839	0	65468	0	14737	0	118141	34546	54220	16514	83354	0	
8	1184839	363	65468	35	14737	35	118141	34546	54220	16514	83354	365	
9	1185276	64	65503	9	14789	0	118141	34546	54220	16514	84134	360	
10	1185343	71	65512	9	14789	0	118141	34546	54220	16514	84501	231	
11	1185411	80	65521	8	14789	0	118141	34546	54220	16514	84732	321	
12	1185491	96	65529	6	14789	0	118141	34546	54220	16514	85073	325	
13	1185587	0	65535	0	14789	0	118141	34546	54220	16514	85378	0	
14	1185587	0	65535	0	14789	0	118141	34546	54220	16514	85378	0	
15	1185587	449	65535	45	14789	88	118141	34546	54220	16514	85378	480	
16	1186096	116	65580	5	14877	0	118141	34546	54220	16514	85864	173	
17	1186172	109	65585	4	14877	0	118141	34546	54220	16514	86037	223	
18	1186261	0	65589	0	14877	0	118141	34546	54220	16514	86380	0	
19	1186261	256	65589	0	14877	0	118141	34546	54220	16514	86380	641	
20	1186337	0	65589	0	14877	0	118141	34546	54220	16514	86561	0	
21	1186337	0	65589	0	14877	0	118141	34546	54220	16514	86561	0	
22	1186337	310	65589	0	14877	37	118141	34546	54220	16514	86561	407	
23	1186847	0	65589	0	14934	0	118141	34546	54220	16514	87508	0	
24	1186847	248	65589	0	14934	0	118141	34546	54220	16514	87508	334	
25	1187095	90	65589	0	14934	0	118141	34546	54220	16514	87842	182	
26	1187185	73	65589	0	14934	0	118141	34546	54220	16514	88024	99	
27	1187258	0	65589	0	14934	0	118141	34546	54220	16514	88123	0	
28	1187258	0	65589	0	14934	0	118141	34546	54220	16514	88123	0	
29	1187258	323	65589	0	14934	0	118141	34546	54220	16514	88123	366	
30	1187251	107	65589	0	14934	65	118141	34546	54220	16514	88489	172	
總計	3350	3350	201	201	262	262	1944	85	2116	813	7334	7335	

Figure 1. Daily meter reading records

Campus population

1. Number of campus population

(1) Total number of students: 9,146

Data source: Annex 6.2.2A September 2024 Student Population Statistics)

Statistical data webpage:

<https://acadaff.ncue.edu.tw/p/412-1002-2142.php?Lang=zh-tw>

https://cee.ncue.edu.tw/about_statistics.php?page_num=2&masn=1

(2) Total number of employed staff (including project-based personnel): 804

Data source: Annex 6.2.2B September 2024 Faculty and Staff Population Statistics

Statistical data webpage: <https://personnelweb.ncue.edu.tw/p/405-1001-22763,c2452.php?Lang=zh-tw>

(3) Total campus population: 9,950

2. Per capita water consumption:

(1) The average daily per capita water consumption of NCUE (both campuses) in 2024 was approximately 137 L. ($499,186,000\text{L} / 365 \text{ days} / 9,950 \text{ people} = 137\text{L}$).

This was lower than the country's average daily per capita water consumption of 289 L (data source: Water Resources Agency, Ministry of Economic Affairs website: https://www.wra.gov.tw/News_Content.aspx?n=2868&s=6999)

(2) Due to a series of major earthquakes in 2024 that caused increased pipeline leakage throughout the campus (as shown in Figures 2 and 3), NCUE's daily per capita water consumption showed a slight increase.



Figure 2. Workers were repairing the deep water well at Jinde Campus



Figure 3. A deep water well motor to be repaired

3. Smart Water Meter Installation and Enhanced Water Management

NCUE plans to install 7 ultrasonic smart water meters on the Jinde Campus and add 23 new ultrasonic smart water meters on the Baoshan Campus by the end of 2025 (schematic diagram shown in Figure 4). On the Baoshan Campus, each building will be equipped with groundwater and tap water meters to monitor water usage data for each building. The university can evaluate the water

usage patterns by analyzing the water consumption and event data wirelessly transmitted from smart water meters. The flow trend charts automatically generated by the management system can be used to detect abnormal water usage. Real-time data obtained from smart water meters enables effective management of on-campus water usage and provides instant water resource monitoring information. By installing smart water meters across the campus, NCUE can consolidate various water resource data throughout the campus to serve as a basis for water resource balancing, allocation, leak detection, and management.



Figure 4. Smart water meter diagram

SDG 6.3.1 Wastewater treatment

1. The wastewater treatment procedures for NCUE's two campuses on Jinde and Baoshan are as follows:

(1) Jinde Campus:

In accordance with the Waste Disposal Act, the university has commissioned the disposal of laboratory wastewater as industrial waste. The university has also applied to the Changhua County Environmental Protection Bureau for approval to revoke the Jinde campus's water pollution control permit and remove it from the regulated water pollution control system. Therefore, the existing wastewater treatment facilities remain operational.

(2) Baoshan Campus : Primarily treats domestic wastewater.

2. All wastewater on campus is channeled through a centralized wastewater treatment plant and discharged through outlets approved and regulated by NCUE. In compliance with the Water Pollution Control Act (<https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=O0040001>) and Water Pollution Control Act Enforcement Rules (<https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=O0040002>) , the University submits reports every July covering water quality testing results for both raw wastewater and discharged wastewater from the campus sewage treatment plant for the period from January to June of the current year, and submits reports every January of the following year covering water quality testing results for both raw wastewater and discharged wastewater for the period from July to December of the preceding year.

(1) The following is a screenshot of NCUE's reporting on the webpage of the "Wastewater Management System for Industrial and Sewerage Systems" (WPMIS) of Taiwan's Ministry of Environment as shown in Figure 1.

序號	案件編號	申報期間(起)	申報期間(迄)	首次確認上修日期	最後設計日	案件狀態	操作
1	543878	114-01-01	114-06-30			核准過審	核准
2	524959	113-07-01	113-12-31	114-01-07	114-03-03	許可	核准 廢止下修 查詢
3	512948	113-01-01	113-06-30	113-07-22	113-07-22	許可	核准 廢止下修 查詢
4	494331	112-07-01	112-12-31	113-01-16	113-01-16	許可	核准 廢止下修 查詢
5	481439	112-01-01	112-06-30	112-07-13	112-08-11	許可	核准 廢止下修 查詢
6	462824	111-07-01	111-12-31	112-01-10	112-07-21	許可	核准 廢止下修 查詢
7	449406	111-01-01	111-06-30	111-07-21	111-08-18	許可	核准 廢止下修 查詢
8	435627	110-07-01	110-12-31	111-01-30	111-02-24	許可	核准 廢止下修 查詢
9	418572	110-01-01	110-06-30	110-07-29	110-08-16	許可	核准 廢止下修 查詢
10	401183	109-07-01	109-12-31	110-01-25	110-02-23	許可	核准 廢止下修 查詢
11	387794	109-01-01	109-06-30	109-07-24	109-10-05	許可	核准 廢止下修 查詢
12	372848	108-07-01	108-12-31	109-01-18	109-02-25	許可	核准 廢止下修 查詢
13	359889	108-01-01	108-06-30	108-07-27	108-09-02	許可	核准 廢止下修 查詢

Figure 1. Screenshot of the "Wastewater Management System for Industrial and Sewerage Systems"

reporting page of the Ministry of Environment

(2) Reporting Website: Environmental Management System of Taiwan's Ministry of Environment:
<https://ems.moenv.gov.tw/>

(3) Figures 2-5 show photos of the sewage treatment plants.



Figure 2. Sewage Treatment Plant on Jinde Campus



Figure 3. Sewage Treatment Plant on Jinde Campus



Figure 4. Sewage Treatment Plant on Baoshan Campus



Figure 5. Sewage Treatment Plant on Baoshan Campus

(4) In accordance with the Water Pollution Control Act, NCUE calibrates all the water meters of the university's sewage treatment plant once a year. Figures 6-7 the water meter calibration reports for NCUE's sewage treatment plant discharged wastewater issued by inspection institutions accredited by the Ministry of Environment.

校驗校正報告
Calibration Report

景鈞企業有限公司
Amount Jun Enterprise Co., Ltd.
42011 台中市南區南興東路391號7-12樓
TEL: 04-22050053 FAX: 04-22050077

報告序號	AJ-1140402-01	校驗日期	2025/4/2
檢驗客戶	國立彰化師範大學寶山校區	產品名稱	棒子式流量計
產品型號	F1-T1 + D075	產品序號	S/N: 20140011
產品尺寸	DN 80 / 3"	校驗人員	林益傑

現場校驗校正相關資訊

現場受測總量測數值為 47.80 M³/hr，標準量測計量量測數值為 47.802 M³/hr

標準量測計量儀器型號為流量計 (MAG 500 可校正實驗室儀器，該儀器經溯源至 114/4/9)

現場受測總校正率數 $\pm 0.01\%$ ，其計算值計算如下：

$(47.80 - 47.802) / 47.802 \times 100\% = -0.07\%$

備註：

1. 流量係數 $Q = (Q_1 - Q_2) / Q_2 \times 100\%$
2. 為現場受測總量測數值
3. 為標準量測計量儀器量測數值
4. 為標準量測計量儀器量測數值，內附分數與百分數
5. 現場受測總校正率數值為現場量測值與標準量測值之百分比計算，其計算值計算如下：
6. 現場受測總校正率數值為現場量測值與標準量測值之百分比計算，其計算值計算如下：
7. 現場受測總校正率數值為現場量測值與標準量測值之百分比計算，其計算值計算如下：

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Figure 6. Water meter calibration report for NCUE's sewage treatment plants (Page 1)

圖一：現場受測流量計安裝現況

圖二：標準量測計量儀器型號為流量計

圖三：現場受測總量測數值

圖四：標準量測計量儀器量測數值

圖五：現場受測總校正率數

圖六：標準量測計量儀器

AJ-1140402-01 P. 2/2

Figure 7. Water meter calibration report for NCUE's sewage treatment plants (Page 2)

(5) In accordance with the Water Pollution Control Act, water quality testing is conducted every six months (as shown in Figures 8-9).



Figure 8. A worker is testing the discharged water quality treated by the sewage treatment plant on Jinde Campus



Figure 9. Workers are testing the discharged water quality treated by the sewage treatment plant on Baoshan Campus

(6) In accordance with the Water Pollution Control Act and Waste Disposal Act, sludge removal and treatment operations are conducted once every 2 years (as shown in Figures 10-13)



Figure 10. Sludge removal operations on Jinde Campus's sewage treatment plant



Figure 11. Sludge removal operations on Jinde Campus's sewage treatment plant



Figure 12. Sludge removal operations on Baoshan Campus's sewage treatment plant



Figure 13. Sludge removal operations on Baoshan Campus's sewage treatment plant

3. The treatment situation of the sewage treatment plants on both campuses, the regular inspection and reporting records of the sewage treatment plants, and various operations of the sewage treatment plants were all reviewed and tested in 2024, passing the inspections and operating normally. For details, please refer to Annex 6.3.1A: Reports of the Regular Inspection of the Sewage Treatment Plants and Photos of Various Operations of the Sewage Treatment Plants.

SDG 6.3.2 Preventing water system pollution

1. The water supply and sewage pipe networks in NCUE are installed independently. The principles for the installation of water supply and sewage pipes, as stipulated by the Taiwan Water Corporation, have been fully adhered to. Since the sewage pipeline is built at a lower position than the water supply pipeline, the water supply system will not be polluted.
2. Drinking water for our staff and students is supplied through well-distributed public water dispensers. There are a total of 249 such dispensers, with 180 and 69 dispensers on the Jinde and Baoshan Campus, respectively.
3. NCUE conducts water quality testing of the dispensers in accordance with the provisions of the Regulations on the Use and Maintenance of water dispensers. The manufacturer is commissioned to select 25% of all our water dispensers for inspection per quarter each year. 60 dispensers are inspected per quarter (no repeated selections for inspection). The inspection item is the number of escherichia coli colonies. The maximum limit of such colonies, as stipulated in the provisions of the Drinking Water Quality Standards issued by the Ministry of Environment, Executive Yuan, is 6 CFU per 100 ml. The water quality test results from NCUE's water dispensers all meet the drinking water quality standards, with a 100% passing rate. Examples of NCUE's drinking water inspection reports for 2024 are shown in Figures 1-2, and these reports are placed next to each water dispenser for assuring users to review and use, as shown in Figure 3.

 安美隆德環保股份有限公司
地址：台中市西區中興路五十八號210室(舊博一)
電話：(04)2550-7790
傳真：(04)2550-6326

檢驗報告

實地查核品編號: 983-2024-11000791 報告日期: 2024/11/21
報告編號: AR-24-MY-015192-01 專案編號: GE113DW15129

客戶名稱: 國立彰化師範大學
樣品名稱: 飲用水
客戶地址: 彰化縣彰化市博愛路1號
地址: 彰化縣彰化市博愛路1號AD1133辦公中心4F
檢驗項目: 自評參考
檢驗方法: NIEA W101.57A
檢驗單位: 安美隆德環保股份有限公司(許可證字號: 環檢部 環檢發證字第006號)

MY002 大腸桿菌 方法: NIEA E200.55B
大腸桿菌數
CFU/100 mL

檢驗結果: <1

報告專用章
安美隆德環保股份有限公司
負責人: 邱子耀
檢驗室主管: 廖曉琳

報告日期: 2024/11/21

AR-24-MY-015192-01 1/1 頁

Figure 1: Inspection report 983-2024-11000791 for water dispensers on the Jinde Campus

安美謙德環保股份有限公司
 經銷商名稱：安美謙德環保股份有限公司
 地址：台中市西區大德路二二五號(11樓) (郵寄)

報 告 序 號：2024011000772
 2024年1月10日
 報 告 序 號：2024011000772
 報 告 序 號：2024011000772

檢驗報告

實地定檢品編號	983-2024-11000772	報告日期	2024/11/21
報告編號	AR-24-MY-G15195-01	報告編號	GE113DN15133

客戶名稱：國立彰化師範大學	採購時間：2024/11/13 14:41
品 別：飲用水	取樣時間：2024/11/13 17:14
產品名稱：飲用水	報 告 人：林清泰
客戶地址：彰化縣彰化市	產品特性：潔淨
檢驗目的：自來水	採樣方法：NIEA W101.07A
採樣地點：彰化縣彰化市新大德路二二五號(11樓)二樓4F	檢驗單位：安美謙德環保股份有限公司(許可證字號：環檢第 15133 號)
檢驗項目：飲用水(自來水)(飲用)	

項目	規格	單位	測量範圍	儀器型號	最大誤差
MY002 大腸桿菌數	方法：NIEA E201.55B				
大腸桿菌數	CFU/100 mL	1	1	1	±5

檢驗結果：

1.本報告係由安美謙德環保股份有限公司(以下簡稱本公司)之檢驗人員，依據國家標準(以下簡稱國標)及本公司之檢驗方法，對客戶送檢之樣品進行檢驗，並出具本報告。

2.本報告之檢驗結果，僅供客戶參考，不作為法律依據。如有任何爭議，請向本公司洽詢。

3.本報告之檢驗結果，僅對送檢之樣品負責，不對其他樣品負責。

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報告專用章

安美謙德環保股份有限公司

負責人：邱子耀

檢驗室主管：廖麗娟

報告編號：AR-24-MY-G15195-01

1/1 頁

Figure 2: Inspection report 983-2024-11000772 for water dispensers on the Baoshan Campus

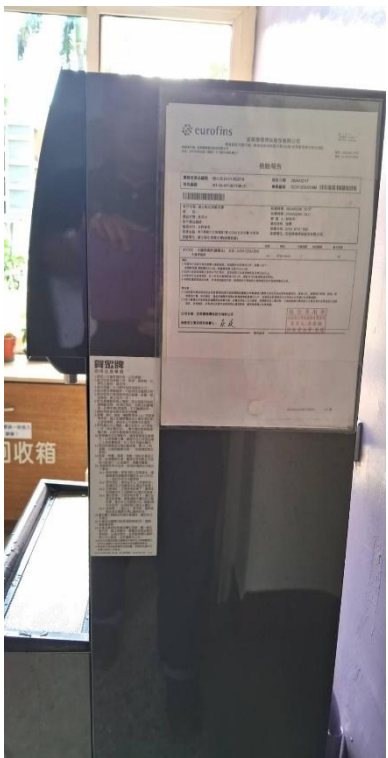


Figure 3. Inspection report is placed next to water dispensers for users to review

- For the full reports, please refer to Annex 6.3.2A-Inspection of water dispensers for Q4 2024 (Jin-De) and Annex 6.3.2B-Inspection of water dispensers for Q4 2024 (Bao-Shan).

SDG 6.3.3 Free drinking water provided

1. Each floor in every building on our campus has at least one water dispenser, totaling 249 units across NCUE. These are provided for **free** use by students, faculty, staff, and visitors, allowing them to fill their containers with drinking water, as shown in Figures 1-2.



Figure 1. Water dispenser on the 2nd floor of the Jieying Building on the Jinde Campus



Figure 2. A water dispenser on the 1st floor of the School of Engineering on the Baoshan Campus

2. NCUE's water dispensers are maintained twice a month, with the filter cartridges replaced every quarter. The dispensers are maintained regularly to provide **free** and clean drinking water for staff and students on campus, as shown in Figures 3-5. Date information for filter cartridge replacement is posted next to the water dispensers to inform users, as shown in Figure 6.

113年12月 國立彰化師範大學飲用水設備保養表											
序號	編號	裝設單位	備用機	備用機	備用機	備用機	備用機	備用機	備用機	備用機	備用機
121	AD124	學務處-2F	✓	✓	✓	✓	✓	✓	✓	✓	✓
122	AD125	學務處-2F	✓	✓	✓	✓	✓	✓	✓	✓	✓
123	AD126	學務處-2F	✓	✓	✓	✓	✓	✓	✓	✓	✓
124	AD127	學務處-2F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
125	AD128	學務處-4F	✓	✓	✓	✓	✓	✓	✓	✓	✓
126	AD129	圖書館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
127	AD130	圖書館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
128	AD131	圖書館-2F	✓	✓	✓	✓	✓	✓	✓	✓	✓
129	AD132	圖書館-2F	✓	✓	✓	✓	✓	✓	✓	✓	✓
130	AD133	圖書館-4F	✓	✓	✓	✓	✓	✓	✓	✓	✓
131	AD134	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
132	AD135	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
133	AD136	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
134	AD137	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
135	AD138	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
136	AD139	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
137	AD140	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
138	AD141	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
139	AD142	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
140	AD143	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
141	AD144	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
142	AD145	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
143	AD146	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
144	AD147	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
145	AD148	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
146	AD149	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
147	AD150	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
148	AD151	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
149	AD152	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓
150	AD153	體育館-1F(茶水間)	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 3. Maintenance table for water dispensers on the Jinde Campus



Figure 4. Operation of maintaining dispenser

國立彰化師範大學 114 年 5 月份進德校區飲用水設備更換濾心清冊

一、本次更換濾心總計 178 台

AD001	AD002	AD003	AD004
			
AD005	AD006	AD007	AD008
			
AD009	AD010	AD011	AD012
			

1

Figure 5. The list of drinking water equipment filter cartridge replacement



Figure 6. Date information for filter cartridge replacement is posted on the upper right side of the water dispenser

3. For the complete location map of all water dispensers on campus, please refer to Annex 6.3.3A-Table for the location of water dispensers.

SDG 6.3.4 Water-conscious building standards

1. In accordance with Taiwan's Building ACT and related regulations, all new buildings on our campus costing NT\$50 million or more must be awarded the green building certification. Under Taiwan's current Green Building certification system, if a building is intended to obtain the "Green Building Certificate" or "Candidate Green Building Certificate," it must meet at least two key indicators: "Daily Energy Saving" and "Water Resources," and at least two out of seven optional indicators. Since 2003, NCUE has four completed buildings and one building that is still under construction. All these buildings meet related regulations and are awarded the Green Building Certificate. Related information about green building and certifications are shown in Table 1, buildings' names and their certifications shown in Figures 1-10.

Table 1. List of green buildings at NCUE and related information

No.	Information on green building		Green Building Certification number
1	Building name	Main Teaching Building, Jinde Campus	Candidate green building certificate number (Figure 1) (93)CGB355
	Official opening	Approximately 2006	
2	Building name	College of Engineering Building, Baoshan Campus	Green building certificate number (Figure 3) GB0100602
	Official opening	Approximately 2012	
3	Building name	Wang Jin-pyng Activity Centre, Jinde Campus	Green building certificate number (Figure 5) GB-BC-01-00773
	Official opening	Approximately 2019	
4	Building name	Construction of new student dormitory, Baoshan Campus	Green building certificate number (Figure 7) GB-RS-01-00317
	Official opening	Approximately 2021	
5	Building name	College of Science Building (phase 1)	Candidate green building certificate number (Figure 9) CGB-BC-01-02148
	Official opening	It is completed in 2025	



Figure 1: Green Building Candidate Certificate for Jinde campus teaching building, NCUE



Figure 2.the Teaching Building at Jinde Campus

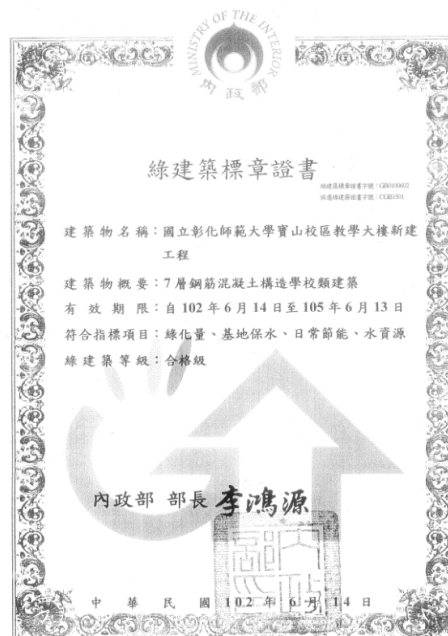


Figure 3. Green Building Candidate Certificate for the College of Engineering Building at Baoshan Campus, NCUE



Figure 4. The College of Engineering at Baoshan Campus, NCUE



Figure 5: Green Building Candidate Certificate for NCUE Wang Jin-pyng Activity Center



Figure 6. Wang Jinping Activity Center



Figure 7: Green Building Certificate for Student Dormitory New Construction Project at Baoshan Campus



Figure 8. NCUS's 10th Student Dormitory



Figure 9: Green Building Candidate Certificate for the first phase of the Building of College of Science construction project



Figure 10. The first phase of the Building of College of Science construction project

2. The following are the water conservation indicators for the nine Green Building Labels, all of which have been fully implemented in new buildings on campus. Existing buildings are being retrofitted with water-saving fixtures to achieve water conservation goals.

(1) Adopting water-saving appliances: new types of taps and water-saving faucets, water-saving and dual-stage flushing toilet bowls, water-saving shower heads, and sensing systems for automatic flushing.

(2) Installation of rainwater-storage and rainwater-supply system: rainwater is intercepted and stored by making use of the natural terrain or artificial methods, before being subjected to simple purification treatments and reused as miscellaneous domestic water. The reutilization of rainwater serves as an alternative supplementary water source for domestic water, a water storage source for firefighting, and a way to help reduce peak loads during urban floods.

(3) All the above projects have been implemented in NCUE's new buildings.

3. Smart Water Meter Installation and Enhanced Water Management

NCUE plans to install 7 ultrasonic smart water meters on the Jinde Campus and add 23 new ones on the Baoshan Campus by the end of 2025 (schematic diagram shown in Figure 11). On the Baoshan Campus, each building will be equipped with groundwater and tap water meters to monitor water usage data for each building. The university can evaluate the water usage patterns by analyzing the water consumption and event data wirelessly transmitted from smart water meters. The flow trend charts automatically generated by the management system can be used to detect abnormal water usage. Real-time data obtained from smart water meters enables effective management of on-campus water usage and provides instant water resource monitoring information. By installing smart water meters across the campus, NCUE can consolidate various water resource data throughout the campus to serve as a basis for water resource balancing, allocation, leak detection, and management.



Figure 11. Smart water meter diagram

SDG 6.3.5 Water-conscious planting

1. All the plant cultivation, and removal activities are discussed and implemented after the Campus Construction Review Committee meetings. To implement water conservation and ecological sustainability, the landscape design extensively deploys grass vegetation to reduce water evaporation and loss, and NCUE selects drought-tolerant plants as the main cultivation types, including Comphor Tree, Podocarpus macrophyllus, Melia azedarach, Dragon Chinese Juniper, Osmanthus fragrans, Podocarpus costalis, Lagerstroemia indica, Dwarf Ixora, Garden Croton, Duranta Erecta, Common Jasmin Orange, Azalea, Aglaia odorata, and Ficus pumila (Figures 1 and 3), to effectively reduce irrigation water demand while balancing the green aesthetics with sustainable water resource utilization.



Figure 1. Jinde Campus - Extensive grass vegetation to reduce water loss



Figure 2. Jinde Campus - Buddhist pines grown along the trail near the Baisha Building



Figure 3. Baoshan Campus - comphor trees grown at the entrance of the campus

2. Additionally, sprinkler irrigation systems have been installed at both campuses (Figures 4-7). The systems were designed based on the principle of using the minimum possible number of sprinklers with maximum possible coverage area, and the daily irrigation time is strictly controlled to ensure optimal water supply for plants as well as to effectively save water consumption.
3. With a donation of US\$500,000 from NCUE's alumnus Chairman Jui-fen Shiao, NCUE has been promoting landscaping and planting improvements on both the Jinde and Baoshan campuses since 2023, adding diverse drought-tolerant and landscape plants, including common crepe myrtles, Buddhist pines, sargent junipers, black pines, Taiwan pines, crepe myrtles, green ebonies, pink shower trees, bald cypresses, 'white cloud trees, silver junipers, Cherry blossoms, Camellias, paper flowers, and sweet olives. To date, a total of 6,395 trees have been planted (1,920 at Jinde Campus and 4,475 at Baoshan Campus), further enhancing campus green coverage and ecological resilience.

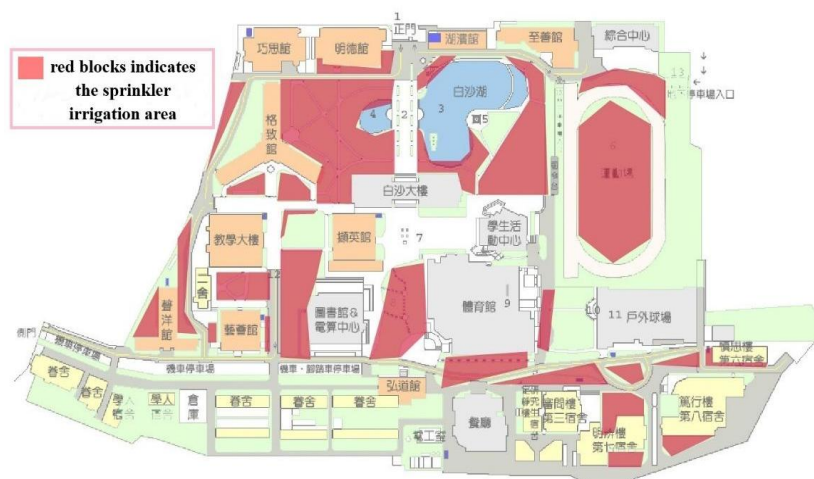


Figure 4. Jinde Campus irrigation area map (red blocks)

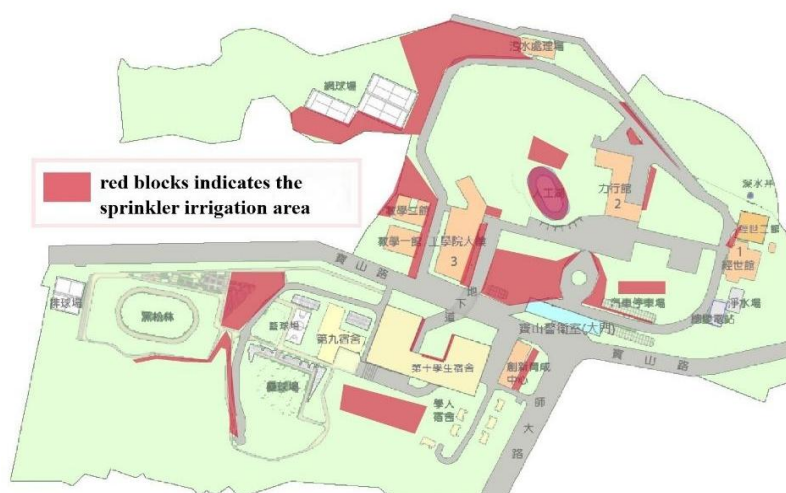


Figure 5: Baoshan Campus sprinkler irrigation area map (red blocks)



Figure 6. Jinde Campus - Sprinkler irrigation system is in the flower bed of the Baisha Building



Figure 7. Baoshan Campus - Sprinkler irrigation system is in the flower bed of Student Dormitory
No. 10

4. By prioritizing drought-tolerant plants, applying scientific irrigation systems, and continuously optimizing planting projects, our school has successfully improved the quality of campus greening and minimized water consumption, achieving the multiple goals of water conservation, sustainability, and landscaping.

SDG 6.4.1 Water reuse policy

1. NCUE has established smart campuses that operate on a sustainable living platform and has implemented various strategic tools in accordance with the United Nations' sustainable development indicators. The main effects focus on smart governance and education, public safety, water resources, smart energy, healthcare, and intelligent transportation. Regarding water resources, conductivity and pH values are monitored at the three wells on campus. Real-time data are obtained through water quality detection sensors, and the detected data are then transmitted to the water resources monitoring system in real time on the Internet. These facilitate the effective management of the wells' water quality and the optimal distribution and utilization of the water resources.
2. The requirements stipulated under the Green Building Label certification have been implemented for all new buildings. Those constructed and completed after 2003 are equipped with rainwater recovery ponds, and the recovered rainwater is used for sprinkler irrigation, thereby effectively recycling the precipitation received on campus. Since 2003, NCUE has four completed buildings and one building that is still under construction. All new buildings meet regulations and are awarded Green Building Labels. Related green building and certificate data are shown in Table 1, with individual green buildings and certificates shown in Figures 1-10.

Table 1. List of green buildings at NCUE and related information

No.	Information on green building		Green Building Certification number
1	Building name	Main Teaching Building, Jinde Campus	Candidate green building certificate number (Figure 1) (93)CGB355
	Official opening	Approximately 2006	
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	Official opening	Approximately 2021	
5	Building name	College of Science Building (phase 1)	Candidate green building certificate number (Figure 9) CGB-BC-01-02148
	Official opening	It is completed in 2025	



Figure 1: Green Building Candidate Certificate for the Teaching Building at Jinde campus



Figure 2. Teaching Building at Jinde Campus

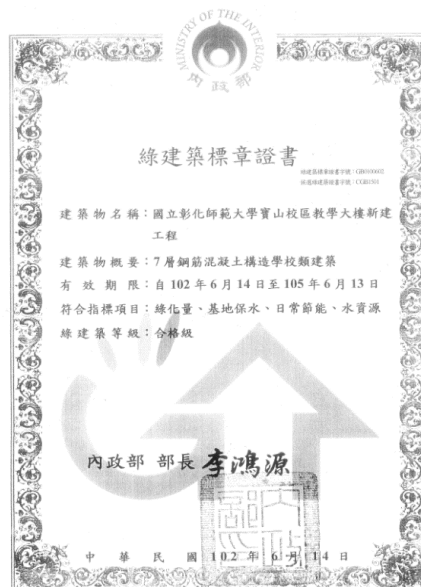


Figure 3. Green Building Candidate Certificate for the Building of College of Engineering at Baoshan Campus



Figure 4. College of Engineering at NCUE's Baoshan Campus



Figure 5: Green Building Candidate Certificate for Wang Jinping Activity Center



Figure 6. Wang Jinping Activity Center



Figure 7: Green Building Certificate for NCUE Baoshan Campus's Student Dormitory New Construction Project



Figure 8. 10th Student Dormitory



Figure 9: Candidate Green Building Certificate for Phase 1 of the College of Science Building project



Figure 10. the Building of College of Science

3. The artificial Baisha Lake sited on the Jinde Campus has an area of approximately 9,000 m³, and the detention basin in the Baoshan Campus is 4,500 m³. NCUE is currently implementing the regulations and policies for installing rainwater recycling pools for sprinkler irrigation in new buildings. The rainwater recycling pools in Dormitory 10 and the School of Engineering have a total capacity of 275.72 m³. These two features serve the functions of flood storage during precipitation and enable the collection of rainfall and the absorption of drainage discharged from the surrounding buildings and green spaces. After collection, the rainwater and drainage are used in the sprinkler irrigation for the lawns and flowerbeds on campus. As shown in Figures 11-12.



Figure 11. NCUE's Baisha Lake, a storage tank with landscape characteristics



Figure 12: Detention basin at the Baoshan Campus

4. NCUE plans to install 7 ultrasonic smart water meters at the Jinde Campus and add 23 new ones at the Baoshan Campus by the end of 2025 (schematic diagram shown in Figure 13). At the Baoshan Campus, each building will be equipped with groundwater and tap water meters to monitor water usage data for each building. The university can evaluate the water usage patterns by analyzing the water consumption and event data wirelessly transmitted from smart water meters. The flow trend charts automatically generated by the management system can be used to detect abnormal water usage. Real-time data obtained from smart water meters enables effective management of on-campus water usage and provides instant water resource monitoring information. By installing smart water meters across the campus, NCUE can consolidate various water resource data throughout the campus to serve as a basis for water resource balancing, allocation, leak detection, and management.



Figure 13. Smart water meter diagram

SDG 6.4.2 Water reuse measurement

1. NCUE has an artificial lake called "Baisha Lake" with an area of approximately 9,000 m². It serves as a retention pond during rainy weather, collecting rainwater and runoff from the surrounding buildings and green spaces. The collected rainwater is then utilized for irrigation of the lawns and gardens (Figure 1).



Figure 1. NCUE's Bai-Sha Lake, a storage tank with cultural characteristics

2. In addition, since 2003, all newly constructed buildings on campus have rainwater recovery ponds built in accordance with the requirements of the green buildings policy. The recovered rainwater is used for toilet flushing or the irrigation of landscape plants. The total capacity of the rainwater recovery ponds in the four completed main buildings is 400.5 m³, which saves a lot of tap water and raw water from the campus' wells from being used as domestic or irrigation water each year, as shown in Table 1.

Table 1. Campus, building names, and rainwater recovery pond capacities

No.	Campus	Name of building	Capacity of rainwater recovery tank
1	Jin-De	Wang Jinping Activity Center	35 m ³
2	Jin-De	Main Teaching Building	89.78 m ³
3	Bao-Shan	College of Engineering Building	203 m ³
4	Bao-Shan	10th Student Dormitory	72.72 m ³
5	Jin-De	College of Science Building (phase 1) (under construction)	23.4 m ³

3. Since 2005, all buildings have been equipped with rainwater recovery ponds, in accordance with the regulation, as shown in Figures 2-3.

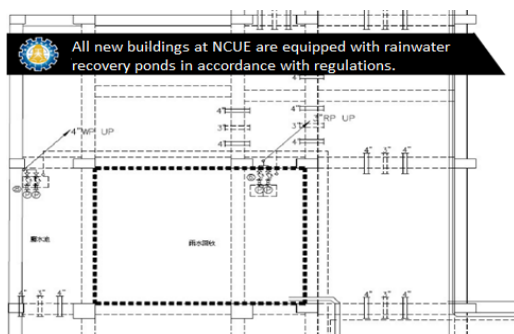


Figure 2. Rainwater recovery pond at 10th Dormitory at the Baoshan Campus



Figure 3. Irrigation system at 10th Dormitory at the Baoshan Campus

4. All buildings on campus have been retrofitted with water-saving appliances. These include new types of taps and water-saving faucets, water-saving and dual-stage flushing toilet bowls, water-saving shower heads, and sensing systems for automatic flushing. These reduce the consumption of domestic water by students and staff.
5. NCUE plans to install 7 ultrasonic smart water meters at the Jinde Campus and add 23 new ones at the Baoshan Campus by the end of 2025 (schematic diagram shown in Figure 4). At the Baoshan Campus, each building will be equipped with groundwater and tap water meters to monitor water usage data for each building. The university can evaluate the water usage patterns by analyzing the water consumption and event data wirelessly transmitted from smart water meters. The flow trend charts automatically generated by the management system can be used to detect abnormal water usage. Real-time data obtained from smart water meters enables effective management of on-campus water usage and provides instant water resource monitoring information. By installing smart water meters across the campus, NCUE can consolidate various water resource data throughout the campus to serve as a basis for water resource balancing, allocation, leak detection, and management.



Figure 4. Smart water meter diagram

SDG 6.5.1 Water management educational opportunities

1. To assist the sustainable development of the environment in the local community, help residents understand sustainable development goals and effective strategies to achieve them, and provide the local community with professional knowledge about water management, NCUE's Environmental Education Center promotes environmental education in local communities, enabling local residents to develop environmental awareness and consciousness. From July to October 2024, NCUE provided related educational courses for local and national communities, offering Environmental Education Personnel 24-hour and 100-hour core certification courses to cultivate local environmental education teachers and jointly focus on local environmental issues. These courses are open not only to school faculty and students but also for community members, providing them with knowledge about water resource management and water quality protection. Course information is shown in Table 1, and photos are shown in Figures 1-2.

Course image information links:

(1) <https://www.facebook.com/media/set/?set=a.1080081833905178&type=3>

(2) <https://www.facebook.com/media/set/?set=a.1082290977017597&type=3>

Table 1: Environmental Education Course Activities

Course Activity	Date	Number of Participants
NCUE's special class for Environmental Education Personnel 24-hour Certification	August 2024	20
Environmental Education Personnel 100-hour Class	July-October 2024	8



Figure 1. NCUE's special class for Environmental Education Personnel 24-hour Certification



Figure 2. Environmental Education Personnel 100-hour Class Conducting Classroom Learning

2. Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change, and Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project

- (1) Under these projects, NCUE offers "Coastal Biological Resources" and " Sustainable Development and Practice for Coastal Biological Resources " courses, which combine theories and practices. These courses discuss coastal biodiversity, eco-friendly aquaculture techniques, water quality and sediment testing, fish-eating culture, and low-carbon aquaculture promotion, while collaborating with local communities to promote marine conservation and sustainable fisheries. In the same year, NCUE implemented the industry-academia cooperation " Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project," conducting marine citizen scientist series courses at Xinbao Wetland and Wang-gong Fishing Harbor. Related **free** activities and thematic courses are summarized in Table 2 and Figure 3.
- (2) The courses and practices include water quality testing, biodiversity surveys, bivalve classification, coastal tourism, and conservation education promotion, collaborating with Cao-Hu Junior High School, Hanbao Elementary School, and Lukang Elementary School to integrate scientific investigation with local education. Project results show that sediment improvement significantly promotes the growth of benthic indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. With the participation of citizens the survey data and community conservation awareness effectively increases, and it shows a demonstration model that combines science and education.

Table 2. 2024 Course/Activity Topics, Number of Sessions, and Participants

NO.	Course/Activity Topic	Number of Sessions	Number of Participants
1	Aquaculture Probiotics Workshop	1	25
2	Water Quality Investigator Workshop	1	25
3	Aquaculture Association Environmental Education Promotion	1	300
4	Marine Seed Citizen Scientist Workshop	1	34
5	Junior Citizen Scientist Workshop	1	25
6	Cao-Hu Junior High School Environmental Education Promotion Activity	1	500
7	Sustainable Aquatic Product Supply Chain Seminar	1	50
8	Aquaculture Water Quality Investigator Workshop	1	26
9	Minglun Junior Wetland Citizen Scientist Workshop	1	40
10	Hard Clam Citizen Survey Workshop	1	23
11	Taiwan Coastal Fisheries and Aquaculture Workshop	1	36

12	Eco-friendly Aquaculture Workshop	1	36
13	Cheng-Kung Senior High School Fish Education Workshop	1	30
14	Teachers' Green Energy Fish Education Workshop	1	18
15	Cao-Hu Junior High School Green Energy Fish Education	1	25
16	Changhua Coastal Resources Survey Workshop	1	36
17	Changbin Water Park Environmental Education Conference	1	36



Figure 3: Water Quality Survey Educational Training Activities with Local Primary and Secondary Schools.

(3) Activity Information Links:

- (a) "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" Project Website: <https://www.facebook.com/NCUEUSR/>
- (b) "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" - Album URL: https://www.facebook.com/NCUEUSR/photos/?tab=album&ref=page_internal
- (c) NCUE's Innovation Incubation Center actively collaborates with local industries. In 2024, it organized low-carbon net-zero talent training courses, working with Yunlin County Labor Union, Changhua County Industrial Association, and workers to provide basic concepts of net-zero carbon emissions. This course aligns with the international community's main purpose of promoting low-carbon net-zero initiatives to create a "leave no one behind" net-zero future (Figure 4).

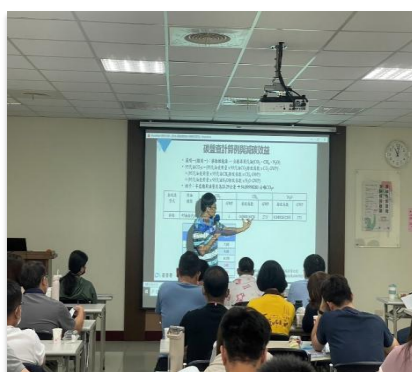


Figure 4. 2024 Low-carbon Net-zero Talent Training Course Co-organized with Yunlin Labor Union

SDG 6.5.3 Off-campus water conservation support

NCUE has established a designated organization to assist in guiding industries, local residents, and relevant stakeholders in Central Taiwan on strategies and methods for water conservation. This ensures that our students, staff, and local residents obtain knowledge related to sustainable water resources management and that local industries improve their water utilization efficiency, which fosters a sustainable supply and the recycling of fresh water.

1. Administrative organization:

(1) Established the Research Center for GIS and Disaster Prevention (Figure 1):

Natural disasters are frequent in Taiwan. To minimize their impacts, NCUE plans to improve the effectiveness of disaster management and governance through geographic knowledge and the data provided by geographic information science, technologies, and knowledge management. The goals of water saving and conservation are further achieved through the planning and implementation of disaster prevention, mitigation, and relief. Website: <https://geo3w.ncue.edu.tw/rcgdp/>

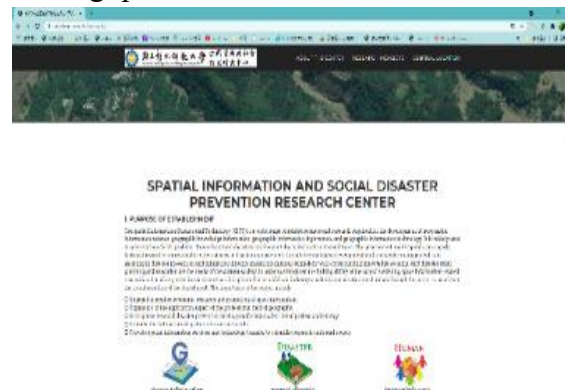


Figure 1: Research Center for GIS and Disaster Prevention

(2) Established the Innovation Incubation Center (Figure 2):

NCUE has established the Innovation and Incubation Centre to effectively connect with local industries and to advise and improve the local plumbing hardware and other traditional industries, thereby achieving the goals of water saving and conservation. These goals are also realized through active contacts with local industries and by counselling and participating in the SBIR plan. Website: <https://iic.ncue.edu.tw/>



Figure 2: Innovation Incubation Center

2. Research:

(1) Faculty appointment:

NCUE's Department of Geography hires faculty members who are experts in environmental and ecological conservation and who specialize in hydrology. These faculty start from hydrology and ecological education to achieves the goals of disaster prevention, mitigation, water saving, and conservation.

(2) National level

(a) NCUE actively encourages faculty members to utilize their research to assist in national-level disaster prevention and mitigation goals, ultimately achieving water conservation objectives and supporting Taiwan's sustainable water resource management and development.

(b) NCUE encourages relevant departments to undertake projects from the National Science and Technology Council. For example, the Department of Geography is executing the project "Impacts of Large-scale Circulation Changes on Precipitation in the Asian Monsoon Region under Global Warming (II)," and the Graduate Institute of History is executing "Tamsui River Water Culture Research - Water Environment Change and Disaster Adaptation Project." Through the research, NCUE aims to encourage industries conserve water, enabling better utilization of water resources.

For related information, please refer to following webpages:

i. <https://www.grb.gov.tw/search/planDetail?id=16551737>

ii. <https://www.wra.gov.tw/wrap/cp.aspx?n=39953>

iii. https://web.wra.gov.tw/wralib/WraLib/wSite/books_96414

(c) NCUE's Department of Geography undertakes the National Science and Technology Council project "Taiwan Western Coastal Wetland Agricultural and Fisheries Social-Ecological System Monitoring". The project selects Fangyuan as the observation core to establish locally-based demonstration observation research and conduct long-term fundamental and critical observation of social-ecological system core components. The observation station conducts water quality, ecological, and topographic surveys at Fangyuan Wetland, Hanbao Wetland, and Wanggong Wetland. The complete annual survey was completed in 2024 and will be monitoring in the future.

Through in-depth interviews with key local stakeholders, the project systematically collects experiences and observations of local social and ecological complex changes, establishing important social-ecological data foundations for the LTSER platform. The observation station designs questionnaires through in-depth interviews and local literature to further understand local residents' perceptions of environmental and water resource issues, actively participates in local activities to identify related issues, and collaborates with localities to respond to local water conservation needs. Activities are shown in Figures 3-4.

Taiwan Long-term Social-ecological Research Changhua Station LTSER Changhua related webpages:

<https://www.facebook.com/profile.php?id=100083565782372#>

<https://ltsertwchanghua.org/>



Figure 3. Changhua Coastal Wetland Conservation Wetland Seminar



Figure 4. Hanbao Wetland Topographic Monitoring

3. Industry Collaboration

NCUE's Innovation Incubation Center actively collaborates with local industries. In 2024, it organized “low-carbon net-zero talent training courses,” working with Yunlin County Labor Union, Changhua County Industrial Association, and workers to provide basic concepts of net-zero carbon emissions. This aligns with the international community's main purpose of promoting low-carbon net-zero initiatives, which is to create a "leave no one behind" net-zero future (Figure 5).



Figure 5. 2024 Low-carbon Net-zero Talent Training Course Co-organized with Yunlin Labor Union

In summary, through a comprehensive administrative organization, in-depth academic research, and close industry-academia cooperation relationships, NCUE comprehensively supports off-campus water conservation work. From basic research to applied promotion, from technology development to talent training, NCUE establishes a complete water resource sustainable management support system, effectively assisting industries and residents in central Taiwan to enhance water conservation and achieve the goal of sustainable water resource utilization.

SDG 6.5.4 Sustainable water extraction on campus

Regarding technologies for sustainable water extraction from aquifers, lakes, and rivers, NCUE focuses on the storage and utilization of rainwater and the use of abundant local underground aquifers to meet the water needs of our staff and students. We ensure that they can access and understand the concepts of sustainable development and water resources management, thereby facilitating the protection and restoration of water-related ecosystems.

1. Constructed a detention basin:

The artificial Baisha Lake, with an area of approximately 9,000 m³, functions as a detention basin when it rains. It collects rainwater and absorbs water discharged from the surrounding buildings and green spaces. The collected water is used in sprinkler irrigations for the lawns and flowerbeds on campus (Figures 1-3).



Figure 1: NCUE's Baisha Lake, a storage tank with landscape characteristics.



Figure 2. - Water Pumping Equipment at Baisha Lake



Figure 3. Irrigation Equipment near Baisha Lake

2. Installed devices for a sustainable water circulation system:

The rainwater storage and water supply system involves the intercepting and storing of rainwater by tapping on the natural terrain or using artificial methods. The rainwater is then reused as miscellaneous domestic water after a simple purification treatment. The reutilization of rainwater serves as an alternative and supplementary source of domestic water and a source of water storage for firefighting (Figure 4).



Figure 4: Rainwater detention basin: Rainwater is recycled for use in the sprinkler irrigation system

3. In 2024, NCUE consumed a total of 499,186 m³ of water, comprising 153,517 m³ of tap water and 345,669 m³ of groundwater, respectively. Tap water and groundwater accounted for 30.75% and 69.25% of total water consumption, respectively as shown in Table 1.

Table 1. Total water consumption of tap water and groundwater in 2024

Water consumption (2024)	Tap water (m3)	Groundwater (m3)	Total (m3)
Jinde Campus	77,774	317,464	395,238
Baoshan Campus	75,743	28,205	103,948
Entire University	153,517	345,669	499,186

4. Smart Water Meter Installation and Enhanced Water Management

NCUE plans to install 7 ultrasonic smart water meters at the Jinde Campus and add 23 new ones at the Baoshan Campus by the end of 2025 (schematic diagram shown in Figure 5). At the Baoshan Campus, each building will be equipped with groundwater and tap water meters to monitor water usage data for each building. The university can evaluate the water usage patterns by analyzing the water consumption and event data wirelessly transmitted from smart water meters. The flow trend charts automatically generated by the management system can be used to detect abnormal water usage. Real-time data obtained from smart water meters enables effective management of on-campus water usage and provides instant water resource monitoring information. By installing smart water meters across the campus, NCUE can consolidate various water resource data throughout the campus to serve as a basis for water resource balancing, allocation, leak detection, and management.



Figure 5. Smart water meter diagram

SDG 6.5.5 Cooperation on water security

1. NCUE actively collaborates with various levels of government and relevant units to jointly promote water resource safety and protection works. Through multiple projects and **free** activities, the school particularly emphasizes the management and sustainable development of coastal and freshwater resources, and strengthens water safety education, striving to improve local water resource utilization and protect the ecological environment.

(1) Local and Regional Cooperation: Industry and Environment Sustainability Project

(a) Coastal Water Resource Protection and Industry Support

NCUE collaborates with the Changhua County local government and Aquaculture Development Association to conduct water quality testing and manage aquaculture water source safety. Through the "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" project and "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project," the school conducts water quality surveys of fishponds and coastal waters, and monitors and conducts sediment improvement experiments in the upper, middle, and lower reaches of rivers to ensure water source safety. Simultaneously, through educational activities, we raise local community awareness of water resource protection and promote local non-toxic, eco-friendly aquatic products.

(b) Youth Water Education Promotion: NCUE Geography Exploration Camp

NCUE organizes geography exploration camps for junior high school students, using "learning by doing" to guide students in understanding Taiwan's water resources and natural disaster issues. The camp includes:

- i. Visiting Shigang Dam and Water Resource Museum to introduce dam earthquake damage and domestic water management
- ii. Exploring green energy equity issues against the 2050 net-zero emissions background, conducting field surveys of Fangyuan Wetlands Trail, and wind power generation facilities.
- iii. Experiencing oyster harvesting activities to understand wetland ecology and local aquaculture culture. These activities cultivate correct understanding of water resources and the environment.

Camp links:

- i. <https://sites.google.com/view/2th-ncue-stu-geo-camp/%E6%B4%BB%E5%8B%95%E5%85%A7%E5%AE%B9/%E4%B9%9D%E4%BA%8C%E4%B8%80-%E5%A4%A7%E5%9C%B0%E5%89%B5%E5%82%B7%E9%9C%87%E5%BE%8C%E7%BE%A4>
- ii. <https://sites.google.com/view/2th-ncue-stu-geo-camp/%E6%B4%BB%E5%8B%95%E5%85%A7%E5%AE%B9/%E5%A6%82-%E8%8B%91-%E4%BB%A5%E5%98%97-%E8%9A%B5-%E5%8F%A3%E6%B5%B7%E5%91%B3>

(c) Water Safety Cooperation Training

NCUE's swimming pool is leased and operated by New Image Enterprise Co., Ltd., which

established Xinxiang Swimming Academy and is committed to collaborating with government and schools to promote water activity safety training and actively develop water domain safety education. Specific achievements are shown in Table 1.

Table 1. 2024 Water Safety Education Courses

No.	Cooperative Unit	Course Name	Participants
1	Special Police Fourth Headquarters, NPA, MOI	Police Special Examination Swimming Course Training	600
2	24 Elementary Schools in Changhua County	Water Self-rescue Ability Course	16,956
3	Elementary to High School Students	Xinxiang Swimming Team	80

(2) International Exchange: Promoting Local Culture and Sustainability Education

Collaborating with the Office of International and Cross-strait Affairs, NCUE invited 16 foreign faculty and students to survey Fangyuan Township, Changhua County. Through the activity they experienced the distinctive charm and culture of Taiwan's Changbin area, learned coastal community water resource utilization and industrial characteristics, and promote water safety and sustainability concepts to the international level (Figure 1).



Figure 1. Northwest Normal University Cultural Tour - In-depth Experience of Local Wetlands and Fishery Culture

(3) Central Government Cooperation: Water Culture Construction and Policy Support

- (a) The Graduate Institute of History undertakes the Water Resources Planning Institute's "Tamsui River Water Culture Research - Water Environment Change and Disaster Adaptation Project." The project focuses on the water environment changes and cultural formation of the Tamsui River basin over the past century, analyzing river channel changes, resource utilization, disaster adaptation, and watershed governance contexts, and summarizing water culture development characteristics.

For related information, please refer to webpages:

- i. <https://www.wra.gov.tw/wrap/cp.aspx?n=39953>
- ii. https://web.wra.gov.tw/wralib/WraLib/wSite/books_96414

(b) The Department of Geography undertakes the National Science and Technology Council's "Taiwan Western Coastal Wetland Agricultural and Fisheries Social-Ecological System Monitoring" project. The department established long-term observation stations at Fangyuan, Hanbao, and Wanggong wetlands, conducting water quality, ecological, topographic, and local public perception surveys, and integrating social-cultural and ecological change contexts to provide scientific data support for government sustainable governance.

Taiwan Long-term Social-ecological Research Changhua Station LTSER Changhua related webpages:

- i. <https://www.facebook.com/profile.php?id=100083565782372#>
- ii. <https://ltsertwchanghua.org/>

(4) Water Resource Professional Course Promotion:

NCUE's Department of Geography offers the " Special issues of hydrology and water resource in Taiwan " course to promote water resource concepts and water cycle knowledge, and helping NCUE's students learn Taiwan's and international water resource issues and challenges. In the "Hydrology" course, students can learn fundamental hydrological concepts and analytical methods, understanding groundwater and surface water relationships and their impact on water resource management. During the semester, the course also arranges students to visit important central Taiwan water resource engineering sites such as Shigang Dam, Jiji Weir, and Zhonggua Creek for geographical field experience and learn how to achieve the dual goals of water resource protection and renewable energy through reservoir management, further supporting regional water security development. Course outlines:

- (a) https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1131/43035_1ARGR3137430.pdf
- (b) https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1131/43018_1ARGR0009230.pdf

Through the above projects and courses, NCUE actively participates in water resource safety and protection, contributes to promoting sustainable water resource utilization, and demonstrates achievements in educational promotion and professional talent cultivation, laying the foundation for Taiwan's water resource sustainability and water culture heritage.

2. Explanation of various project activities:

(1) NCUE's "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" project:

- (a) Fangyuan Township, located in the southwest of Changhua County and close to the sea, is the second largest administrative area in the county. It used to be prosperous before. The township has the largest wetlands in the intertidal zone in Taiwan. At the mouth of the Jhuoshuei River, Fangyuan has a six-kilometer coastline, an emblematic Taiwanese fishing

village that connects to the local rivers and faces strong northeast monsoon. Clam aquaculture is the main industry in the area. In recent years, environmental problems, such as pollution of coastal wetlands and climate change, have had a tremendously negative impact on local industries. Therefore, it is crucial to promote environmental education to spread awareness about environmental protection. In response to the call of the Ministry of Education, NCUE has launched courses and activities to train local teachers in environmental education to assist in the joint focus on environmental issues (Figure 2). The statistics for class openings and participants in 2024 are shown in Table 2:

Table 2. 2024 Course/Activity Topics and Participant Statistics

NO.	Course/Activity Topic	Number of Sessions	Number of Participants
1	Aquaculture Probiotics Workshop	1	25
2	Water Quality Investigator Workshop	1	25
3	Aquaculture Association Environmental Education Promotion	1	300
4	Marine Seed Citizen Scientist Workshop	1	34
5	Junior Citizen Scientist Workshop	1	25
6	Cao-Hhu Junior High School Environmental Education Promotion Activity	1	500
7	Sustainable Aquatic Product Supply Chain Seminar	1	50
8	Aquaculture Water Quality Investigator Workshop	1	26
9	Minglun Junior Wetland Citizen Scientist Workshop	1	40
10	Hard Clam Citizen Survey Workshop	1	23
11	Taiwan Coastal Fisheries and Aquaculture Workshop	1	36
12	Eco-friendly Aquaculture Workshop	1	36
13	Chengkung Senior High School Fish Education Workshop	1	30
14	Teachers' Green Energy Fish Education Workshop	1	18
15	Caohu Junior High School Green Energy Fish Education	1	25
16	Changhua Coastal Resources Survey Workshop	1	36
17	Changbin Water Park Environmental Education Conference	1	36



Figure 2. Participating in the Beach Shellfish and Fish Education Workshop with local residents

(b) This research project collaborates with the Changhua Aquaculture Association to develop a series of services and surveys for aquaculture industry adaptation strategies in Changhua under climate change. In addition to assisting association members with water resource safety testing for fishponds, coastal water intake channels, and groundwater wells, this project has also expanded its services to include golden clam farmers based on stakeholder feedback collected through the USR program. The project has also added new survey areas covering the upper, mid, and lower reaches of the rivers that feed fish ponds. All the above services are provided **free** of charge, aiming to maintain sustainable safety of water resources for aquaculture operators and coastal areas. Related activity photos are shown in Figures 3-4.



Figure 3. 2024/03 Water Quality Survey Team - 2024 Department of Biology conducts USR project, investigating water quality of rivers and coastal fishpond inlet and outlet waters.



Figure 4. 2024/04 Cao-Hu Junior High School Environmental Education Promotion Activity, assisting Cao-Hu Junior High School in promoting environmental education to help local junior and

elementary school students understand the importance of water quality environment.

Link to the FB page of the projects:

https://www.facebook.com/NCUEUSR/photos/?tab=album&ref=page_internal

- (c) "Sustainable Development and Practices of Coastal Biological Resources": The course includes workshops on "The Application of Beneficial Bacteria in Aquaculture" and "Aquaculture and Greenhouse Gases". Participants include course students, teachers, local aquaculture operators, and organizations, working together to maintain the health and sustainability of local aquatic ecosystems. Related activity photos are shown in Figure 5 and Figure 6.



Figure 5. 2024/04 Course workshop: faculty and students learned from the aquaculture operators about the use of beneficial bacteria which is helpful for maintaining good water quality and improving aquatic product quality.



Figure 6. 2024/04 The course shares environmentally friendly aquaculture concepts. Participants include teachers, students, and local aquaculture practitioners. It promotes environmentally friendly industrial production strategies and works together to maintain the health and sustainability of local aquatic ecosystems.

- (d) Related activity information links:

- i. "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and

Environment Project of Changhua's Two Cities Amid Climate Change" Project Website:
<https://www.facebook.com/NCUEUSR/>

- ii. "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" - Album URL:
https://www.facebook.com/NCUEUSR/photos/?tab=album&ref=page_internal

(2) NCUE promotes the "Changhua Coastal Hard Clam Habitat Survey and Conservation Education Promotion Project," using an industry-academia cooperation model to combine local communities, schools, and government units to jointly promote water safety and ecological conservation.

- (a) Marine citizen scientist series courses are conducted at Xinbao Wetland and Wanggong Fishing Harbor (Figure 7), including four-season "Hard Clam Habitat Surveys" (including sediment improvement experiments), volunteer investigator training, "seed teacher training", and "Hard Clam Detective Squad." These courses enhance the attention of coastal community residents, faculty and students, and local governments to water quality monitoring and water safety.
- (b) The courses and practices cover water quality testing, biodiversity surveys, bivalve classification, coastal tourism and conservation education. They also integrate with local schools such as Caohu Junior High School, Hanbao Elementary School, and Lukang Elementary School to promote local education, incorporating water resource investigation and water safety knowledge into teaching to deepen public understanding of sustainable water resource utilization.
- (c) Project results show that sediment improvement effectively promotes the growth of coarse-sediment indicator species such as hard clams and corbicula, suppresses the dominance of ring clams, and enhances carbon sequestration potential and benthic biodiversity. In addition, the participation of citizen scientist also effectively increases survey data and strengthens community water resource safety and conservation awareness, successfully establishing a demonstration model that combines scientific research with educational promotion.
- (d) Project activity Facebook page link: <https://www.facebook.com/NCUEUSR/>



Figure 7. Marine citizen scientists in Seed Teacher Training Workshop for marine ecological quantitative surveys, focusing on identification and counting of common shellfish in Changhua coastal wetlands

(3) NCUE Geography Exploration Camp Activities

- (a) Earthquakes and Water Resources: Shigang Dam supplies daily water to the greater Taichung area. Through dam explanations and visits to the Water Resources Museum (as shown in Figures 8-10), students learn how natural disasters and resources affect people's lives.

Activity highlights webpage:

https://photos.google.com/share/AF1QipPlQwKwVS0coobzGhenf4Y-uLbWHscJNICbnci-MR2PREXmNysVKzpFe0l7X1RC_w?key=aIJETGR4NFJPM1ZrSEh2NFpuQ0ROZGd0TzZ6Y3Zn



Figure 8. Visiting the Shigang Dam



Figure 9. Shigang Dam



Figure 10. Visiting the Water Resources Museum

(b) Wetlands and Energy:

The "Taste of Yuan" · "Oyster" Coastal Flavors" camp arranged students to visit the Fangyuan Wetlands Trail and experience local oyster harvesting activities to deeply understand Fangyuan's wetland ecology and aquaculture fisheries (Figures 11-13), leading them to explore renewable energy such as wind turbines and solar power, further reflecting on energy and social justice issues.

Activity highlights webpage:

https://photos.google.com/share/AF1QipPg_19fi4xhORzopiz023TwVVwCKDBS5x-wnKxeB4704jLMyUMDMZ3Q_locPdnAhg?pli=1&key=blIzdlpDZjVRN19POHM3VWczVFFFWIJSYm14VVZR



Figure 11. Wind Turbines along Fangyuan Coast



Figure 12. Fangyuan Wetlands Trail



Figure 13. Oyster harvesting activity

(4) Water Safety Cooperation Training

- (a) From September to December 2024, NCUE co-organized "Police Special Examination Swimming Course Training" with Special Police Fourth Headquarters, NPA, MOI (as shown in Figure 14), with 600 participants completing the training, achieving significant results in enhancing professional training for police personnel.



Figure 14. Police Special Examination Swimming Course

- (b) In 2024, water self-rescue ability courses for 24 elementary schools were conducted at NCUE's swimming pool, with Professional coaches from Xinxiang Swimming Academy teach and guide primary school students, enabling them to acquire the ability to save themselves in the water or improve their swimming skills (as shown in Figure 15), with a total of 16,956 participants throughout the year.



Figure 15. Elementary and Junior High School Water Self-rescue Ability Courses

- (c) To cultivate swimming expertise among youth in Changhua City and nearby communities and train future top swimmers, the "Xinxiang Swimming Training Team" was established, currently with about 80 students from elementary to high school, conducting regular weekly training with good results (as shown in Figure 16).



Figure 16. Xinxiang Swimming Training Team Practice Highlights

(5) Field Investigation of Department of Geography's "Hydrology":

In the first semester of Academic Year 2024, a hydrology course was offered in the Department of Geography with approximately 43 students enrolled. The course content covered understanding of water cycles and water resource balance, along with field investigations. The investigation site was the Zhongguakeng Stream watershed in Nantou County (as shown in Figure 17), and the observation targets are the crises of mountain streams under the impact of climate change and possible actions to take. Nature-based solutions are an adaptive strategy option for responding to climate change. The activity introduced the advantages and disadvantages of nature-based solutions for stream governance, while helping students understand sustainable wild stream governance strategy options available for consideration today. Zhongguakeng Stream is a tributary of the Wu River. In the past, traditional engineering caused damage to the stream environment. Now, concrete is being removed to create a naturally friendly environment, seeking a win-win outcome for both humans and natural ecology. Students can fully appreciate the pleasure that natural streams bring to people and observe water flow velocity, water depth, and aquatic organisms on site. This field investigation activity allows reflection on how individuals and society should respond to climate change impacts and the possible effects of response strategies from a sustainable perspective.



Figure 17. Group discussions at the Zhongguakeng Stream.

SDG 6.5.6 Promoting conscious water usage on campus

1. NCUE has established smart campuses that operate on a sustainable living platform and has implemented various strategic measures in accordance with the United Nations' sustainable development indicators. Regarding water resources, conductivity and pH values are monitored at the three wells on campus. Real-time data are obtained through water quality detection sensors, and the detected data are then transmitted to the water resources monitoring system in real time on the Internet. These facilitate the effective management of the wells' water quality and the optimal distribution and utilization of the water resources. The sustainable living platform allows staff and students to grasp real-time water monitoring data, understand the importance of water resources management, and learn to value water resources.
2. We promote an awareness of water conservation regularly through public announcements (Figure 1) and requests that all staff and students assist by reporting water leakages of any equipment inside the buildings via the internal maintenance system. This leads to the timely and effective elimination of faulty and leakage issues. In addition, campus electricians conduct daily readings of the main water meters. Upon detecting any abnormal readings, they will initiate a campus-wide inspection to determine if there are any leaks. If a leak is found, immediate action is taken to address the issue (Figure 2). Water Conservation Awareness Announcements:

https://apss.ncue.edu.tw/odedi/doc_page.php?id=6221/-63/0-



Figure 1. 10 Great Water-Saving Habits



Figure 2: water meter readings, which are recorded by NCUE electrical staff daily

3. For facilities with higher levels of water consumption, water utilization measures are adjusted according to demand. For example, the sprinkler irrigation system will not activate when it detects rain, and the lease contract of the campus swimming pool requires the tenant to cooperate with the government's water conservation measures. These measures ensure the rational utilization of water (Figure 3).



Figure 3: The above picture shows that NCUE uses rain sensors to control the sprinkler irrigation system to achieve the benefits of effective use of water resources.

4. To cultivate awareness of reasonable water use and water resource sustainability among faculty and students, NCUE actively integrates "water resource conservation" and "environmental sustainability" issues into curricula and practical experiences. Through courses, experimentation, field research, and service learning, students develop correct concepts and action capabilities for water use. Related measures are as follows:

(1) Center for General Education Courses

- (a) The "Water Resources and Human Civilization" course offered by the General Education Center in 2024 focuses on introducing global and Taiwan's water resource challenges. Through this course, students explore the historical and contemporary significance of water for human society and its key role in sustainable development. The course examines the impact of water resource changes on human history. Students learn how to understand sustainable water use and reflect on how individuals and society should conserve water in daily life.
- (b) The " Water and Electricity Energy Saving in Modern Life " course introduces students to the basic principles of water resources and power sources to understand their importance and environmental impact, while cultivating students' water and electricity conservation capabilities.

(c) Related course syllabus information:

- i. https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1131/00243_0CCGE017

5120.pdf

ii. https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1122/0232_0CCGE0178720.pdf

(2) Courses from the "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change"

(a) The project offers "Coastal Biological Resources" and "Sustainable Development and Practice of Coastal Biological Resources" courses, which combine theory and practice. By introducing coastal environmental characteristics, marine ecological diversity, and human environmental impact, students could understand the limitations and vulnerability of water resources, thereby establishing concepts of cherishing and reasonable utilization. The courses cover friendly aquaculture techniques, water quality and sediment testing (Figure 4), fish-eating culture, and low-carbon aquaculture promotion, allowing students to understand the importance of water resource monitoring and management through practical operations, and NCUE even cooperates with local communities to promote marine conservation and sustainable fisheries.

(b) Course syllabus information:

i. https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1131/24004_1SCBI0220930_EN.pdf

ii. https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1132/24004_1SCBI0221030_EN.pdf

(c) Project activity Facebook page link: <https://www.facebook.com/NCUEUSR/>



Figure 4. Coastal Biological Resources Sustainable Development and Practice course: teachers and students were conducting water quality and sediment testing in Changhua waters

(3) Department of Geography "Hydrology" Course Geographic Field Investigation: In the first semester of Academic Year 2024, a hydrology course was offered in the Department of Geography with approximately 43 students enrolled. The course content covered understanding of water cycles and water resource balance, along with field investigations. The investigation site was the Zhongguakeng Stream watershed in Nantou County (as shown in Figure 5),

observing the crises faced by mountain streams under the impact of climate change and possible actions to take. Nature-based solutions are an adaptive strategy option for responding to climate change. Through the activity, students learned the advantages and disadvantages of nature-based solutions for stream governance and understand sustainable wild stream governance strategy options available for consideration today.

Zhongguakeng Stream is a tributary of the Wu River. In the past, traditional engineering caused damage to the stream environment. Now, concrete is being removed to create a naturally friendly environment, seeking a win-win outcome for both humans and natural ecology. Students on-site can fully appreciate the pleasure that natural streams bring to people and observe water flow velocity, water depth, and aquatic organisms. The field investigation activity reflects on how individuals and society should respond to climate change impacts and the possible effects of response strategies from a sustainable perspective.



Figure 5. Group discussions at the Zhongguakeng Stream.

5. Smart Water Meter Installation and Enhanced Water Management

NCUE plans to install 7 ultrasonic smart water meters at the Jinde Campus and add 23 new ones at the Baoshan Campus by the end of 2025 (schematic diagram shown in Figure 6). At the Baoshan Campus, each building will be equipped with groundwater and tap water meters to monitor water usage data for each building. The university can evaluate the water usage patterns by analyzing the water consumption and event data wirelessly transmitted from smart water meters. The flow trend charts automatically generated by the management system can be used to detect abnormal water usage. Real-time data obtained from smart water meters enables effective management of on-campus water usage and provides instant water resource monitoring information. By installing smart water meters across the campus, NCUE can consolidate various water resource data throughout the campus to serve as a basis for water resource balancing, allocation, leak detection, and management.



Figure 6. Smart water meter diagram

6. Through diverse measures including smart water meter installation, smart campus sustainable life platform real-time monitoring, public announcements, repair reporting systems, and water-saving facility adjustments, NCUE has not only effectively strengthened campus water resource management mechanisms but also enabled faculty and students to grasp water resource conditions in real-time, enhancing awareness of water resource conservation and reasonable utilization. In addition, the university integrates "water resource conservation" and "environmental sustainability" concepts into curriculum teaching, field investigations, and community cooperation, allowing students to develop from knowledge understanding to action practice, cultivating civic literacy that combines professional capabilities with sustainability awareness, promoting reasonable campus water use and water resource sustainability.

SDG 6.5.7 Promoting conscious water usage in the wider community

1. Although Taiwan is surrounded by sea, its unique climate and geographical conditions result in a severe shortage of freshwater resources. National Changhua University of Education (NCUE) recognizes the importance of sustainable resource management and biodiversity, actively promoting the sustainable development of water resources, with a particular focus on the protection and rational use of freshwater resources. To address the issue of water scarcity, our university's interdisciplinary professional faculty and environmental teachers, in collaboration with external scholars and local organizations, conduct various **free** workshops in line with the Ministry of Education's plans. We actively cultivate local environmental education seed teachers to jointly address local environmental issues. Through the promotion of environmental education, we bring together local residents, students, and educators, aiming to raise public awareness of water resource protection and promote more responsible water usage behavior.

2. Cooperating with Communities to Promote Environmental Education and Cultivate Water Use Awareness

The Environmental Education Center regularly organizes various environmental education courses, including 24-hour and 100-hour professional certification courses. These courses cover topics such as freshwater ecosystems, indicator species observation, and water quality testing. They are open not only to school faculty and students but also benefit community members, providing them with knowledge about water resource management and water quality protection, thereby raising public awareness of water resource protection.

(1) Cultivating Local Environmental Education Talents

The Environmental Education Center cultivates relevant environmental education talents. In conjunction with the "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" project, we provided relevant educational courses for local and national communities from July to October 2024. Information is shown in Table 1, and activities are shown in Figures 1-3.

Course image information links:

(a) <https://www.facebook.com/media/set/?set=a.1080081833905178&type=3>

(b) <https://www.facebook.com/media/set/?set=a.1082290977017597&type=3>

Table 1: Environmental Education Course Activities

Course Activity	Date	Number of Participants
Environmental Education Personnel 24-hour Certification NCUE Special Class	July 2024	20
Environmental Education Personnel 100-hour Class	July-October 2024	8



Figure 1. Environmental Education Personnel NCUE Special Class



Figure 2. the 100-hour Class for Environmental Education Personnel

(2) USR Projects to Promote Water Resource Education Courses and Community Participation

(a) NCUE organized multiple courses and workshops focused on aquaculture, water quality surveys, citizen science, and wetland education under the "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" Project, which enhanced community residents' awareness and knowledge of water pollution, aquaculture water source management, and aquatic sustainability. **Free** educational courses related to water quality testing and surveys offered in 2024 are shown in Table 2, with activities shown in Figures 3-4. Reference information link: https://www.facebook.com/NCUEUSR/photos/?tab=album&ref=page_internal

Table 2. 2024 Course/Activity Topics and Participant Statistics

NO.	Course/Activity Topic	Number of Sessions	Number of Participants
1	Aquaculture Probiotics Workshop	1	25
2	Water Quality Investigator Workshop	1	25
3	Aquaculture Association Environmental Education Promotion	1	300
4	Marine Seed Citizen Scientist Workshop	1	34
5	Junior Citizen Scientist Workshop	1	25

6	Caohu Junior High School Environmental Education Promotion Activity	1	500
7	Sustainable Aquatic Product Supply Chain Seminar	1	50
8	Aquaculture Water Quality Investigator Workshop	1	26
9	Minglun Junior Wetland Citizen Scientist Workshop	1	40
10	Hard Clam Citizen Survey Workshop	1	23
11	Taiwan Coastal Fisheries and Aquaculture Workshop	1	36
12	Eco-friendly Aquaculture Workshop	1	36
13	Chengkung Senior High School Fish Education Workshop	1	30
14	Teachers' Green Energy Fish Education Workshop	1	18
15	Caohu Junior High School Green Energy Fish Education	1	25
16	Changhua Coastal Resources Survey Workshop	1	36
17	Changbin Water Park Environmental Education Conference	1	36

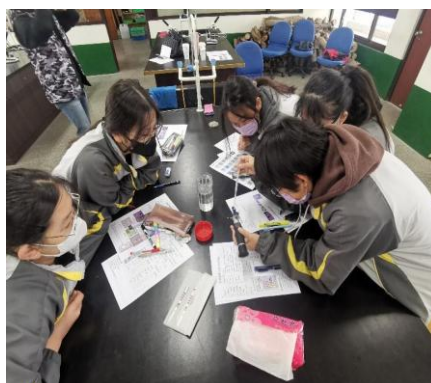


Figure 3. July 2024 Cao-Hu Junior High School Water Quality Testing and Analysis Course



Figure 4. Little Citizen Scientist Training Activities with Local elementary and junior high Schools

(b) Furthermore, the "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" project emphasizes the impact of pollution and climate change on local industries such as aquaculture. This initiative promotes environmental education to foster community awareness and action.

NCUE in line with the Ministry of Education's plans, promotes various **free** workshops and actively cultivates local environmental education seed teachers to jointly address local environmental issues (Figure 5). We bring together local residents, students, and educators to collectively address water pollution issues and their impact on coastal ecosystems.

Appendix:

- i. "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" Project Website: <https://www.facebook.com/NCUEUSR/>
- ii. "Beautiful and Treasured Clams in Fangyuan and Dacheng: Sustainable Industry and Environment Project of Changhua's Two Cities Amid Climate Change" - Album URL: https://www.facebook.com/NCUEUSR/photos/?tab=album&ref=page_internal



Figure 5. Local residents were participating in the Beach Shellfish and Fish Education Workshop

- (3) NCUE's "Changhua Coastal Clam Habitat Survey and Conservation Education Promotion Project" combines local schools and communities through industry-academia cooperation to cultivate awareness of reasonable water use and water resource conservation.
 - (a) "Clam Habitat Surveys" are conducted in four seasons at Xinbao Wetland and Wanggong Fishing Harbor (including sediment improvement experiments), along with volunteer training, "seed teacher training", and "Clam Treasure Detective Teams," enabling community residents and students to participate in water quality testing, biodiversity surveys, and bivalve classification.
 - (b) In addition, NCUE also cooperated with schools such as Caohu Junior High School, Hanbao Elementary School, and Lukang Elementary School, combining scientific surveys with local educational curricula to promote the importance of coastal environmental protection and reasonable water use, and enhance community residents' understanding of water resource sustainability (Figure 6).
 - (c) Project results show that sediment improvement effectively promotes the growth of coarse sediment indicator species such as hard clams and Asiatic hard clams, suppresses the dominance of *Cyclina sinensis*, enhances carbon sequestration potential and benthic

biodiversity. Moreover, citizen scientist participation effectively increases survey data volume and strengthens community water resource and ecological conservation awareness, and the project successfully established a demonstration model that combines scientific research with educational promotion.



Figure 6. Cao-Hu Junior High School: Clam Treasure Detective Team Water Quality Survey Workshop

3. Integration into General Education to Expand Water Resource Issues into the Classroom

The Center for General Education offers specialized water resource courses to strengthen students' comprehensive understanding of global and Taiwan's water resource issues.

- (1) The "Water Resources and Human Civilization" course introduce the water resource challenges faced globally and in Taiwan. Through this course, students explored the historical and contemporary significance of water to human society and its key role in sustainable development. They also investigated the impact of water resource changes on human history. Students learned how to understand the sustainable use of water resources and reflected on how individuals and society should conserve water in daily life.
- (2) The "Water and Energy Conservation in Modern Life" course introduces students to the basic principles of water resources and power sources to understand their importance and environmental impact, while cultivating students' abilities to conserve water and electricity.
- (3) The "An introduction to Marine Life Sciences" course combines off-campus field research and beach cleaning service learning, allowing students to understand the impact of human activities on water resources and the environment from the perspective of marine pollution and coastal ecological conservation, and to practice waste sorting, beach cleaning, and marine conservation actions, further strengthening awareness of cherishing water resources.
- (4) Course syllabus information links:
 - (a) https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1121/00248_0CCGE0175120.pdf
 - (b) https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1122/0232_0CCGE0178720.pdf

(c) https://webap0.ncue.edu.tw/DEANV2/UploadDEAN/SUBJECT/1132/00252_OCCGE0169820_EN.pdf

4. Promoting Water Resource Awareness in the Community

(1) Faculty and students jointly participate in water resource field learning

In 2024, the Department of Geography's geographical fieldwork course arranged visits to Shihgang Dam, Nantou's Zhongguakeng Stream, and other important water resource projects in central Taiwan. Through on-site observation, students learned about reservoir management, waterfront governance, and water conservation strategies, enhancing practical experience and consensus on water resource conservation (Figure 7).



Figure 7. Group discussions at the Zhongguakeng Stream.

(2) Promotion through the junior high school student camp: Geography Exploration Camp

NCUE organizes Geography Exploration Camps for junior high school students. The camps incorporate two major themes of "Earthquakes and Hydrology" and "Wetlands and Energy," combining course and field research (such as visiting Shihgang Dam and oyster harvesting experiences at Fangyuan Wetland), and using games and experiential teaching methods to strengthen water resource awareness among the younger generation (Figures 8-9).

Camp webpage link:

<https://sites.google.com/view/2th-ncue-stu-geo-camp/%E6%B4%BB%E5%8B%95%E5%85%A7%E5%AE%B9>



Figure 8. Visiting the Shihgang Dam



Figure 9. Fangyuan Wetlands Trail

5. Overall, NCUE actively promotes more conscious water resource usage behavior through the courses and community engagement. Through these efforts, the university not only enhances the awareness of water resource protection among faculty, students, and the community but also contributes to the sustainable development of water resources for the entire society.