SWITCH: LOCAL DEMONSTRATIONS FOR GLOBAL CHANGE

CHONGQING:
DESIGNATION AND PROSPECT OF CHENGDU MEDICAL COLLEGE GREYWATER DEMOCHENGDU DEMO-PROJECT

SWITCH

SIXTH FRAMEWORK PROGRAMME

BACKGROUND

INTRODUCTION OF CMC NEW CAMPUS

- Chengdu Medical College (CMC) was founded in 1947 and was detached in August, 2004 from the Third Military Medical University as an independent undergraduate college. CMC expropriates new land in Xindu district for new campus to improve the college construction. Xindu is a satellite town of Chengdu City,about 25 km to the center of Chengdu.
- * The new campus will be constructed in two periods. The first phase will occupy 437487.2m2(which includes 70400.3m2 for other use and 367086.8m2is available for construction), and the second phase will occupy 293183.1m2(which includes 46933.6m2 for other use and 246249.6m2is available for construction).
- Design scale of new campus is: 13,000 students, 73.66703 hm2 of total occupied area (which includes 11.73339hm2 for other use and 61.93364hm2is available for construction), and 380,700m2of total building area.

CLIMATIC CONDITIONS

CMC new campus will locate in subtropical zone with monsoon climate. Means annual temperature is 16.2°C, extreme maximum annual temperature is 37.3°C, extreme minimum annual temperature is -5.9°C, more than 337 days of one year is frostless day, and mean temperature of the coldest mouth (January) is 5.6°C. It has abundant rainfall, and the mean annual precipitation is 828.4mm, most of which falling between July to August. December and January has lowest rainfall in whole year. The mean annual evaporation is 1021.3mm. Table 1 lists the meteorological elements of CMC new campus.

Table 1 A Statistical of CMC New Campus Precipitation and Evaporation (mean value of 1970~2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
precipitation (mm)	7.8	12.6	19.9	42.1	69.9	101.3	216.0	192.5	110.5	33.4	17.3	5.1
evaporation (mm)	30.1	36.8	65.8	105.4	149.8	138.1	132.8	133.6	92.3	63.8	44.0	28.8


Fig. 1 The site location of CMC New Campus


Fig. 2 The Master Plan of CMC New Campus


Fig. 3 The Construction Phase Distribution of CMC New Campus


Fig. 4 The Function Distribution of CMC New Campus

DESIGN OBJECTIVES AND CONTENTS

DESIGN OBJECTIVES

The design objective is to develop a sustainable water system for CMC New Campus. Sub-objectives are:

- Sustainable cycle of water, nutrient, and energy;
- Making full use of grey water and rainwater to maintain qualified aquatic eco-environment in community and control soil erosion;
- Using reclaimed water for landscape irrigation, road sprinkle and complementary of the artificial lake.
- Best Management Practices (BMPs) for storm water management.

DESIGN CONTENTS

This sustainable water system design will focus on the Phase 1 of the new campus. The design contents include:

- Design of the grey water collection pipeline networks from the western student dormitory.
- Design of the grey water treatment station.
- Design of the rainwater harvesting and purifying system of teaching area.
- Water quality maintenance for the artificial lake in campus.

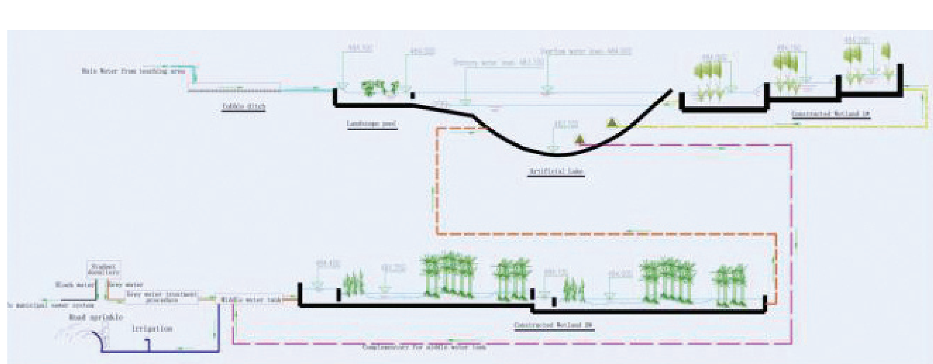
Fig.5 The procedure of the whole system

DESIGNED WATER QUALITY

GREY WATER

Table 2 the Designed Grey Water Quality Parameter

Parameters	COD	BOD	SS	TN	TP
Water quality (mg/L)	100	60	80	10	15

RAINWATER

Table 3 the Designed Rain Water Quality Parameter

No.	Water-quality index/unit	Roof rainwater	Ground rainwater
1	Turbidity/NTU	20~200	20~200
2	Suspended solid SS	50~150	80~500
3	colourity	20	40
5	PH	5.8~7.0	5.8~7.0
6	COD_{Cr} / $mg.L^{-1}$	20~150	50~300
7	NH3-N / $mg.L^{-1}$	2.5~15	3.0~40
8	free residual chlorine/ $mg.L^{-1}$	0	0
9	The total number of bacillus coli (n/L)	0	10

RECLAIMED WATER

Table 4 Recycled Water Quality Standards and Design Values

No.	Items (mg/L)		Toilet Flushing	Road cleaning, fire fighting	Urban Planting	Landscaping	Designed values
1	Basic requirements		——			No floating objects	No floating objects
2	pH	≤	6.0~9.0				6~9
3	color (chroma)	≤	30				30
4	smell		No offensive odor				
5	SS	≤	——			10	10
6	turbidity (NTU)	≤	5	10	10	——	10
7	Soluble total solid	≤	1500	1500	1000	——	1000
8	BOD5	≤	10	15	20	6	10
9	Total phosphor	≤	——			0.5	0.5
10	Total nitrogen	≤	——			15	15
11	Nitrogen, ammonia (based on N)	≤	10	10	20	5	5
12	anion surface active agent	≤	1.0	1.0	1.0	0.5	0.5
13	petroleum	≤	——			1.0	1.0
14	Fe	≤	0.3	——			0.3
15	Mn	≤	0.1	——			0.1
16	dissolved oxygen	≥	1.0			1.5	1.5
17	Faecal coliform bacteria (quantity/L)	≤	——			2000	2000
18	Total coliform bacteria (quantity/L)	≤	3			——	3

EXTENDED DESIGN CONTENTS

DESIGN OF GREY WATER COLLECTION PIPE NETWORKS

All grey water from student dormitory is collected. Two pipe networks are set indoor. One is connected with grey water (shower and wash water) and another is connected with black water (other sewer except shower and wash water).Grey water is collected and discharge into the baffle tank of the treatment system. The black water from student dormitory and wastewater from teaching building, office building, and other buildings discharge into municipal sewer system.

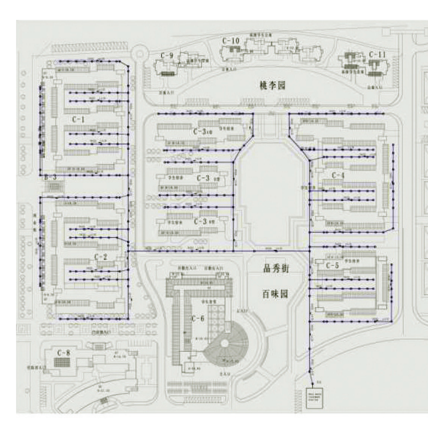
Fig.6 grey water collection pipe networks

DESIGN OF GREY WATER TREATMENT STATION

MAIN DESIGN POINTS OF EACH PART:

- Baffle Tank: Regulating flow and quality of grey water. Regulation Volume is 35% of the treatment capacity. (200 m^3/d) (Based on the data from Chinese design guideline for reclaimed water (GB50336-2002)
- Hair Filter: Removing hairs and bigger suspending articles from showering. Hair filter is set in the outlet pipe of the pump. Specification: DN200; main part height is 500mm; Reference weight 35kg.
- Coagulation and Sedimentation Tank: The suspended substance is removed and the flow is regulated. Using Complete Sets of Equipment (including flocculation tank, sedimentation tank, filtration tank, disinfection tank, metrical instrument etc.)
- Biological Aerated Filter: The rector is a high load immobilized biofilm and three-phase reactor, which have the advantages of both activated sludge process and biofilm process. There are fillers and air blast. Oxic wastewater is purified through bio-membrane. Design flow is 200 m^3/d (12.5m^3/h, operating time is 16h/d).
- Sand Filter: Using Complete Sets of Equipment. Filtering area is 1.5m^2. (Diameter of the sand granule 0.6~1.2mm).
- Middle water tank: The Volume is 30% of the of the reclaimed water consumption (Based on the data from Chinese design. guideline for reclaimed water (GB50336-2002)
- Sludge tank: The sludge from the grey water treatment station and wastewater is stored in sludge tank and transported to municipal sewage treatment plant regularly
- Dosing and mixing equipment: Dosing system use complete sets of equipment; mixing equipment use Tubular Static Mixer.
- Disinfection equipment: using chlorine dioxide disinfection, dosing quantity is 0.8mg/L

EXTENDED DESIGN CONTENTS *(CONTINUED)*

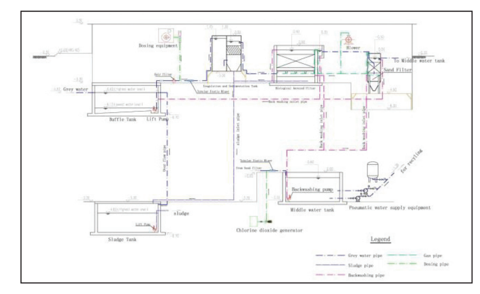
Fig.7 Design schematic drawing of grey water Treatment Procedure

DESIGN OF RAINWATER HARVESTING AND PURIFYING SYSTEM

- Cobble ditch

a) Road-side Cobble ditch (Rectangle Style) the width has three kinds b=400mm, 600mm, 680mm Divide in two-stage filling:
on surface: Φ=40-50mm, Cobble;
at the base: Φ=15-30mm, gravel
The design degree of slope is < 0.2%

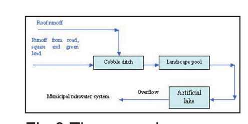
Fig.8 The procedure of rainwater harvesting and treatment

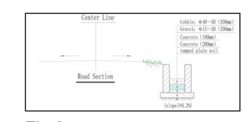
Fig.9 Road-side Cobble ditch

b) Building-around Cobble ditch (Rectangle Style) the width has three kinds b=400mm, 600mm, 680mm Divide in two-stage filling:
on surface: Φ=40-50mm, Cobble
at the base:Φ=15-30mm, gravel
The design degree of slope is i<0.2%

c) Square-side Cobble ditch (Rectangle Style) the width has three kinds b=400mm, 600mm, 680mm. Divide in two-stage filling:
on surface: Φ=40-50mm, Cobble at the base: Φ=15-30mm, gravel
The design degree of slope is i<0.2%

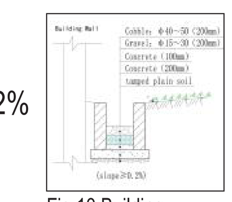
Fig.10 Building-around Cobble ditch

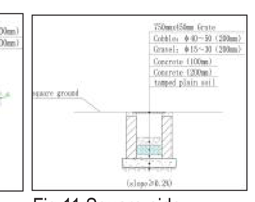
Fig.11 Square-side Cobble ditch

- Landscape pools
After being treated by green billabong and cobble ditch, rainwater is treated through landscape pool. There are five decentralized landscape pools. The size of the landscape pools are designed according to the 13mm runoff of the corresponding catchment area.

DESIGN OF RAINWATER HARVESTING AND PURIFYING SYSTEM

In order to ensure the water quality of the artificial lake and recycling water, it is necessary to construct ecological lake bank. And It is also necessary to apply circulation wetland treatment for artificial lake.i.e, lake water in the artificial lake will be pumped to wetland system 1# with circulation pumps and then treated through wetland system 1#. After that the water discharge into artificial lake again.

INNOVATION AND SIGNIFICANCE

INNOVATION

- Integration scheme of grey water reuse and landscape/aesthetic.
- A combination of grey water treatment system and rain water purifying system.
- A combination of rain water harvesting and purifying system and landscape design.
- Using ecological theory acts and human-oriented as the foundation of design, to create a clean, safety and comfortable water circumstance.

SIGNIFICANCE

- Training and Dissemination

a) The demo-project can become a partial content of national demonstration as "resource saving campus" and "sustainable building".
b) A successful integration of grey water reuse and landscape/aesthetic purpose will be a paradigm for Universities/Colleges to learn from.
c) The demo-project will also become a study case for students, who will influence the future society with the idea in their mind.
d) The demo-project can be hopefully selected as a demonstration of "resource saving campus" in China, and training activities can be implemented after the construction work in Chongqing.

- Water Saving, Environmental and Economic Benefits Analysis

a) When utilizing greywater and rainwater, 97702.3 m^3/year municipal water will be replaced. Assume costs for rainwater and greywater collection and treatment are RMB 0.2 /m^3, municipal water supply price, according to Xindu city domestic water charge, is RMB 1.35/m^3. Therefore, for each ton, RMB 1.15 /m^3 will be saved, RMB 112,400 water charges will be saved in a year. Considering that water charges will be increased in the future, the potential economical benefits are remarkable.
b) After using greywater, annual sewage discharge reduction will be 82252.8m^3/year, bringing remarkable environmental benefits. Nowadays, Xindu is increasing sewage charges, from RMB 0.15/m^3 to RMB0.35 /m^3. By reusing greywater, sewage charge reduction will be 82252.8×0.35=RMB 28788. Water saving has great benefits.
c) In this project, total rainwater reused is24787.4 m^3/year, reducing 36% of total rainwater in teaching building area. Municipal rainwater network size can be reduced accordingly, and environmental impacts from pollutants on receiving waters can be controlled.

3rd SCIENTIFIC MEETING
BELO HORIZONTE BRAZIL
DECEMBER 2008