FIELD VISIT (Trip 1) REPORT

ON

WATER ISSUES IN URBAN AREAS – HO CHI MINH CITY

Submitted by: Group 3

(Rohit Sharma, Jinyan Li, Li Yee LIM, Thi Kim Chi Do)

2017 ProSPER.Net Young Researchers' School

'Water Security for Sustainable Development in a Changing Climate'

International University – Viet Nam National University, Ho Chi Minh City, Vietnam

6-15 March 2017

Introduction:

Ho Chi Minh City (HCMC) is the largest and one of the most densely populated city in Vietnam, with approximately 10 million people residing in it. More than 65% of the land is below sea- level, meaning the city is easily flooded, making it prone to impacts from climate change. HCMC has a subequatorial monsoon tropical climate, which is why the city receives a large amount of rainfall every year. Recently, not only the frequency of rainfall has increased but also the total amount of rainfall, especially during the rainy season. Most of the city's infrastructure for water drainage was built 20 years ago, and with the rapid population growth and urbanisation, the infrastructure has failed to manage the high levels of domestic wastewater and rainwater during rainy season. And now due to inadequate flood management systems and out-dated infrastructure, the city gets flooded even when there is a small amount of rainfall. Today, HCMC is facing issues like water contamination (ground water, surface water and rainwater) with Arsenic (As), as well as contamination from domestic waste, agricultural residues, and industrial waste. Hence, there is an utmost need for increased water security in the province so as to sustain life in the city. Every day, the city discharges nearly 2 million m^3 of domestic waste, but there are only two sewage treatment plants with a total designed capacity of 171,000 m^3/day, which is less than 10% of the wastewater produced in the city.

So as to better understand the water demand and the supply with respect to the quantity and the quality of water in the city, participants of the ProSPER.Net YRS 2017 visited the following sites as a part of their first field visit on March 08, 2017, and interacted with experts working there:

1) Nhieu Loc - Thi Nghe (NLTN) Pumping Station
2) Binh Hung Waste Water Treatment Plant
3) Tide control sluice gate in Ho Chi Minh city
4) Southern Institute of Water Resources Research

A brief of each location is discussed below.

I. Nhieu Loc - Thi Nghe (NLTN) Pumping Station

Figure 1: Nhieu Loc - Thi Nghe (NLTN) Pumping station

Nhieu Loc - Thi Nghe (NLTN) Pumping Station is a newly developed pumping station located in So 10 Nguyen Huu Canh, Phuong 19, Quan Binh Thanh. Under the funding of Official Development Assistance (ODA, Vietnam), this station functions to pump domestic wastewater and storm water from an area of 33 km^2 with a population of 1.2 million in the NLTN basin into the Sai Gon River. The canal runs through seven urban districts in HCMC, including districts 1, 3, 10, Phu Nhuan, Tan Binh, Go Vap and Binh Tanh. The pumping station is currently in Phase 1 of the project, only treating about 20 % of

the wastewater in HCMC. The mixed domestic wastewater and storm water are collected in the station and a screening process is done to remove trash and other large objects from the water. After that, deodorisation with hydrogen sulfide (H_2S) of the wastewater is done before discharge back into the Sai Gon River. The station also functionally cleans the canal by refreshing the water via the pumping of stagnant water into the station. This project will contribute to the reduction of flooding in the area.

The second phase of the system will implement a more developed wastewater treatment system, in which the mixed wastewater will be transferred to the wastewater treatment plant after the screening and deodorisation process. Similar plants will be implemented in the future, with the goal of treating more than 80 % of the wastewater in HCMC.

II. Binh Hung Waste Water Treatment Plant (WWTP)

The total area of Binh Hung WWTP is 47 ha, while the construction area of Phase 1 is 14 ha. Construction started in November of 2004 and completed in December of 2008. Binh Hung WWTP uses modified activated sludge technology, with a capacity of 141.000 m^3 / day in Phase 1, a capacity of 469.000 m^3 / day in Phase 2, and a capacity of 512.000 m^3 / day in Phase 3. The activated sludge process is a biological treatment process that involves the conversion of organic matter and/or other constituents in the wastewater into gases and constituent cell tissue by a large mass of aerobic microorganisms maintained in suspension though mixing and aeration. The microorganisms form flocculent particles that are separated from the process effluent in a sedimentation tank (clarifier) or by membranes and are returned subsequently to the aeration process or removed. An important feature of the activated sludge process is the formation of flock particles, ranging in size from 50 to 200 mm, which can be removed by gravity though settling, leaving a relatively clear liquid as the treated effluent. Typically, greater than 99 % of the suspended solids can be removed in the clarification step.

Figure 2: WWTP visit by the participants.

The wastewater treatment process is shown as below.

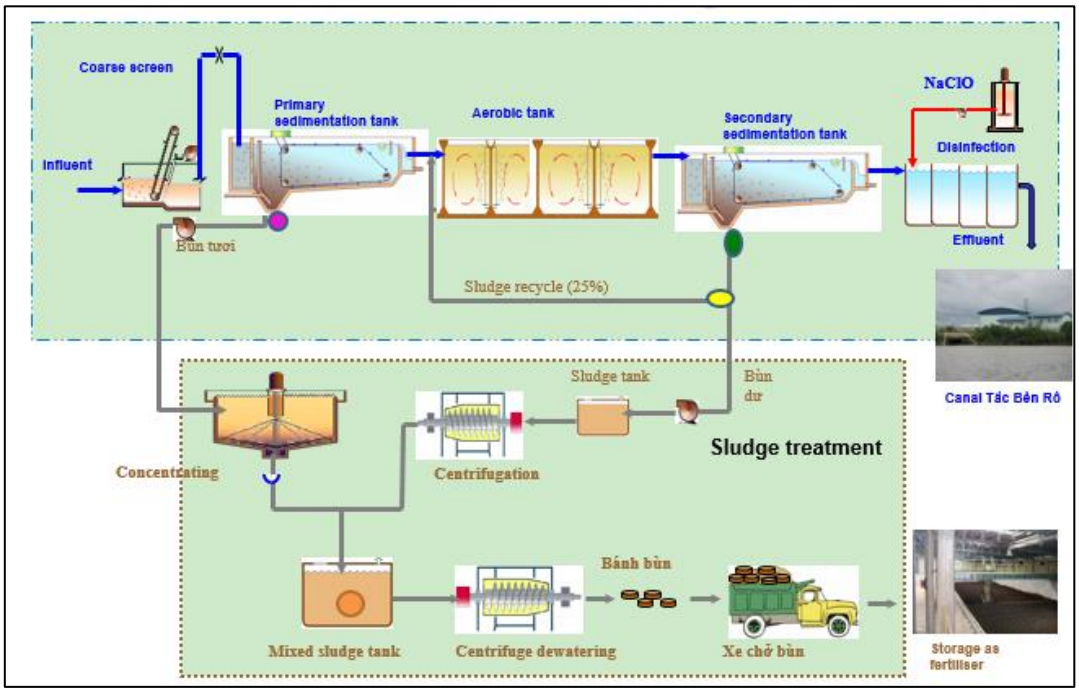

Figure 3: Wastewater Treatment Process Flowchart

The quality of treated water based on the activated sludge technology is shown below.

S.No	Parameter	Unit	Influent	Effluent	QCVN 40:2011/BTNMT, cột B
1	**pH**		6,11 – 6,77	5,62 – 6,73	5,5 – 9
2	**SS**	mg/l	28 – 388	2 – 18	81
3	**COD**	mg/l	49 – 274	14 – 44	122
4	**BOD5**	mg/l	14 – 109	1 – 6	41
5	**Coliform**	MPN/100ml	4,3×105 – 24×106	0 – 2400	4.050
6	**TN**	mg/l	4,8 – 17,4	3,6 – 9,1	32,4
7	**TP**	mg/l	0,9 – 4,8	0,5 – 3,6	4,9
8	**Cl**	mg/l	–	0 – 0,25	1,62

Table1: Quality of treated water

Suggestions for activated sludge technology used in Binh Hung WWTP

1) Proposal for a biological treatment process

The removal efficiency could be strengthened by setting up anaerobic and anoxic ponds to combine with the existing aerobic pond in order to get a higher efficiency process. Since the temperature is high during the whole year in Viet Nam, especially in Ho Chi Minh City, it would be advantageous to use the high temperature to remove nitrogen pollutants and phosphorus pollutants. The removal of N and P can be accomplished in combination reactions such as A^2/O, SBR, and other kinds of processes. The high temperature will be beneficial to the high efficiency of both nitrification and denitrification,

since the reaction rate will be higher in higher temperatures. From here, aiding the transformation using existing infrastructure is easy and feasible. In addition to the existing activated sludge pond, anaerobic and anoxic ponds can be built, or the existing pond can be divided into several zones and their conditions can be controlled separately.

2) Proposal for sludge disposal and treatment

The operation of the wastewater treatment plants is accompanied by a large amount of surplus sludge, which needs to be disposed of and/or treated properly. As much water as possible should be removed from the sludge, since the moisture content of sludge is often up to about 90% or more. With such a high water percentage, the sludge volume can be very big and it is difficult to dispose of such a large amount of sludge. At the same time, attention should be paid to the heavy metal pollutants in sludge, since arsenic pollution is becoming more and more severe in the area. Advanced heavy metal removal technology should be implemented in wastewater treatment plants in HCMC.

III. Tide controlling sluice gate in Ho Chi Minh city

The Sai Gon River is affected by semidiurnal tides of East Sea. There are two high tides and two low tides each day. Tidal water can penetrate deeply into canal systems of the city and reduce water drainage capacity of the inner city. All domestic wastewater and run-off water in the immediate basin is collected by drainage system and flow to the pumping station. During high tide, inner areas can be inundated by high water levels, and the sluice gates will be close in order to keep water out and protect the low-lying areas in the city. In rainy season, high water levels together with heavy rainfall can make the problem more severe so that more pumps need to be operated to pump excess water out of the city.

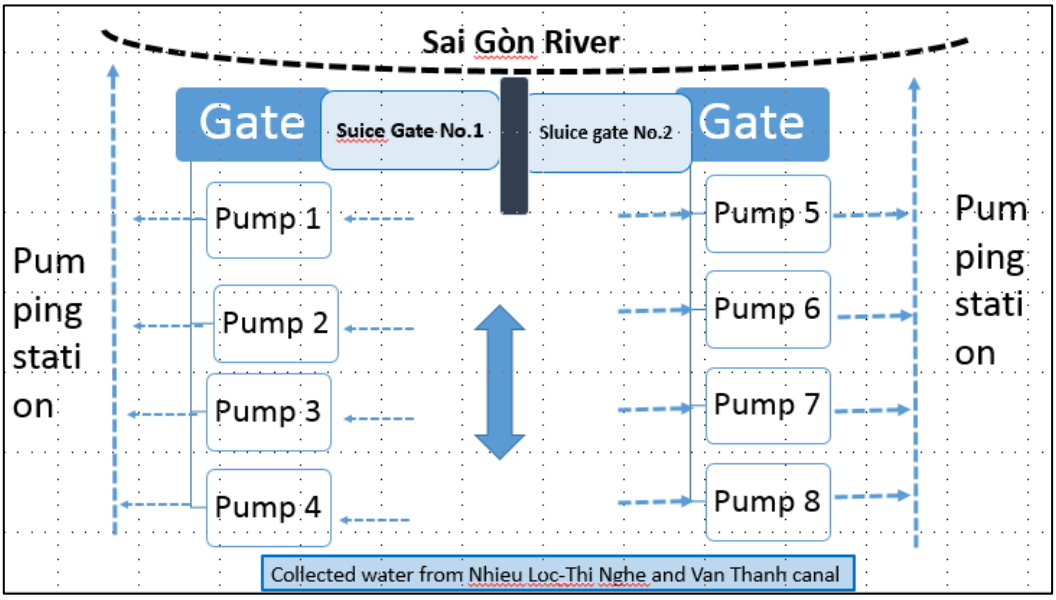

Figure 4: Operational Flow Chart of the Sluice Gates.

The Sluice gates over the Sai Gon River were constructed with the prime objective of controlling the water level of the river with respect to the high tidal and flood conditions within the city. These gates improve the drainage efficacy of the city and helps in keeping the water level managable.

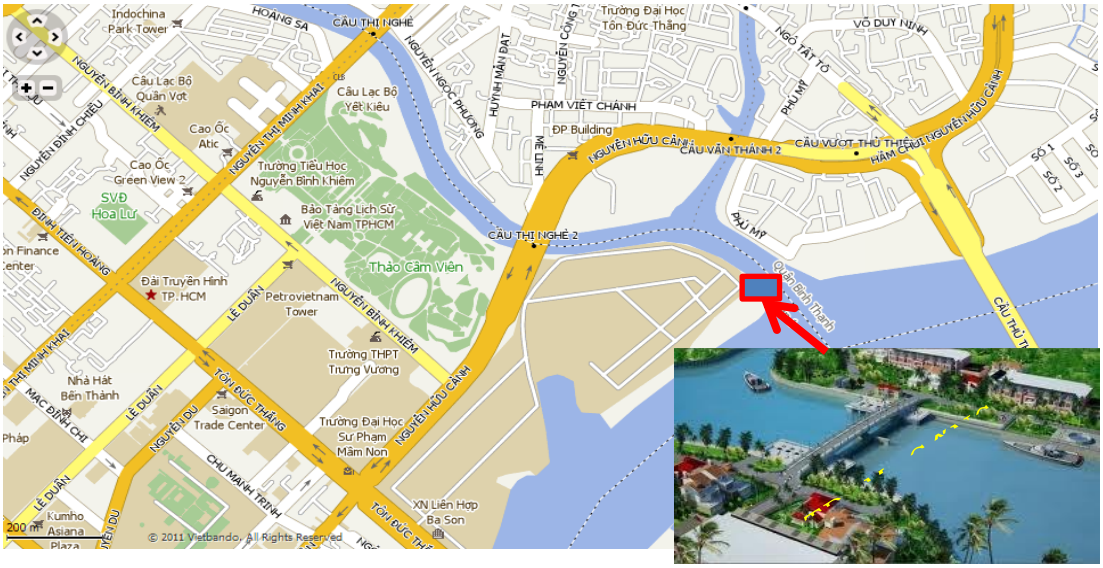

Figure 5: Location map of the sluice gates

IV. Southern Institute of Water Resources Research (SIWRR)

SIWRR was established in 1978 as a state agency of scientific/technological research and training programmes for the southern provinces of Vietnam. The institute is charged with the following duties and functions:

- Research on water resources, science, and technology
- International cooperation on training, science, and technologies in relation to water
- Post graduate training for MSc levels with links to universities
- Consultation on water resource projects

The institute is equipped with laboratories, such as the Binh Duong general experimental lab, an environmental chemistry lab, a hydraulic and hydro dynamic lab, a construction materials lab, and a geo-technical lab. The labs focus broadly on the water resources and research planning, quality and quantity assessment, saline intrusion from the sea, irrigation and drainage system for the provinces, and also designs hydraulics works such as sluice gates, hydropower generators, and dyke systems as well.

The institute director and his colleagues later briefed the participants about the different projects undertaken by the institute with respect to the Mekong Delta and related water issues.

Conclusion:

The field trip was very comprehensive and educated the participants on different water related issues in urban Ho Chi Minh City. Also, the participants were able to interact with field experts and learning how water resources for the city have been maintained and how the ever increasing water demand is been managed within the city. The most interesting part of the trip was the visit to the sluice gates, where participants could easily understand the role and functioning of the gates under flooded conditions. The WWTP visit gave a practical insight of the different steps undertaken for water treatment in the city. Finally, the discussions with experts from the SIWRR allowed the participants to better relate to urban water issues and the solutions to solve them.