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# CASE STUDY

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# WATER PURIFICATION TECHNOLOGY FOR WASTEWATER TREATMENT SOLUTIONS IN SIHANOUKVILLE

The transformation of Sihanoukville in Cambodia into a mega-construction with hotels, casinos and resorts being built in rapid succession has led to discharge of sewage and garbage into stormwater drains and seas leading to environmental hazards for the locals.

By Bernard Chow Kum Thong



Angular View of Wastewater Treatment System\_A

**Keywords: Effluent Treatment Plant, Zero Liquid Discharge, Bulk Drug Plant****Angular View of Wastewater Treatment System\_B****Overview**

Ochheuteal Beach: It is a Wednesday afternoon. I am sending my technical manager a second WhatsApp message that I will be late for our appointment. Traffic has slowed to an ant's crawl upon exit from the airport and my trusted cabbie friend, Bun Theang, is lamenting on the deteriorating road conditions each time we meet. No, I am not in Hanoi, Bangkok or any other traffic-snarled Southeast Asian city. I am in the city of Sihanoukville, caught amidst long vehicles laden with construction materials, cement mixers and 40-foot container trucks all trudging their way through muddied, potholed roads into the city centre.

In recent years, Sihanoukville has been transformed into a mega-construction site where high-rise casinos, hotels and resorts are being built at a frenzied pace. These rapid developments along its once pristine coasts have overwhelmed existing public infrastructure. Indiscriminate discharge of sewage and garbage into stormwater drains and seas have adversely affected the local population and created a huge environmental challenge for the local authorities.

In this article, we share how a Singaporean environment and engineering firm, AnnAik Limited, has been entrusted to bring its know-how in decentralised wastewater treatment solutions to the city.

**Patented Technology**

The company's environmental division has, over the years, successfully built over 5,000 such systems across China. Putting together composite anaerobic treatment, high-efficiency phosphorous-removing fillers, bioactive bio-filters and high-loading constructed wetland into an innovative and reliable solution. Unlike conventional systems, AnnAik's decentralised wastewater treatment systems are efficient and unobtrusive; produces no odour and very little noise. It is fuss-free with no need for specialists to be stationed on-

site and requires only the occasional maintenance to achieve the desired outcome – returning clean water harmlessly to the environment.

**Geography and Climate**

The Kingdom of Cambodia is located in the southern segment of the Indochina Peninsula in Southeast Asia. Monsoon season pours down in May and reaches its peak in September. It is during this wet season where the country receives the bulk of its annual rainfall. Extensive flooding is common in coastal cities and low-lying regions. Following the southwest monsoon is a pronounced dry season between November and April.

**Case Study**

The assigned location is situated along Ochheuteal beach, approximately 40 meters from the high-water mark. Sewage flowing into a manhole in-situ is discharged untreated into the sea. Due to its low-lying relief, the area is also prone to extensive flooding during the monsoon months. Treatment capacity for this location is calculated to be 10m<sup>3</sup>/day.

**Influent Quality**

The influent comprises primarily of human sewage and kitchen wastewater. See Table 1 for Influent Quality.

**Table 1: Influent Quality**

Parameters	Influent quality
CODCR (mg/L)	600
BOD5 (mg/L)	180
TSS (mg/L)	280
NH <sub>3</sub> -N (mg/L)	20
TN (mg/L)	40
TP (mg/L)	4
LAS (mg/L)	20
Oil and grease (mg/L)	30
Coliform (MPN/100ML)	106
pH	6 – 9

**Effluent Quality**

The effluent will be treated to prevailing discharge standards stipulated by the Ministry of Environment, Cambodia. See Table 2 for Effluent Quality.

**Table 2: Effluent Quality**

Parameters	Effluent quality
CODCR (mg/L)	50
BOD5 (mg/L)	30
TSS (mg/L)	80
NH <sub>3</sub> -N (mg/L)	5

WASTE WATER TREATMENT AND REUSE



View of Bio-Filtration

Parameters	Effluent quality
TN (mg/L)	15
TP (mg/L)	1
LAS (mg/L)	7
Oil and grease (mg/L)	5
Coliform (MPN/100ML)	500 – 2500
pH	6 – 8

Design Solution and Treatment Process

Due to the high oil content in the influent, grease traps are employed as pre-treatment to remove oil particles. After removing the large suspended impurities in the grit chamber, sewage is pumped into an anaerobic compartment. Filler materials are added to build an environment conducive



View of Aerobic Basin

for anaerobic bacteria to survive, where organic compounds are hydrolysed, acidified and removed. Wastewater then flows into a contact oxidation tank for aerobic digestion and treatment of ammonia nitrogen. The contact oxidation tank is also the space where organic matter is adsorbed by micro-organisms and degraded. Wastewater quality is continually improved before it flows into the high loading constructed wetland.

The wetland has a high-efficiency bio-filter system to further reduce pollutants such as suspended matter, BOD5, COD, nitrogen, phosphorus, trace metals and pathogens. This purification mechanism is not dependent on a single sub-system. Rather, the quality of the wastewater gets better by the physical, chemical and biological effects of the plant-microbial ecosystem. With the action of aerobic microbes attached to the sub-terranean segments of the plants in the wetland, organic matter is further broken down. Here, a portion of organic matter (such as nitrogen and phosphorus) are absorbed by the plants after mineralisation. Denitrification also takes place in the anoxic zone to purify the wastewater. Precipitable and suspended solids, which were not eliminated in the earlier processes are removed through filtration and sedimentation. The effluent is discharged after ultraviolet disinfection or re-used as non-potable water.

At the time of writing, the wastewater treatment system in this case study is undergoing final installation, testing and commissioning.

About the Author



Bernard Chow Kum Thong is a mechanical engineer by training and graduated from the University of Queensland, Australia in 2002. He joined AnnAik Limited, Singapore in 2018 as a Senior Operations Manager to oversee and grow its environmental business in Southeast Asia. In his previous career, he was looking after multi-disciplinary capability developments in a military organization.

**AnnAik Limited** was incorporated in Singapore on 24 September 1977 and commenced as a stockist and distributor of general hardware products. Under an experienced management team, the company was successfully listed on the Singapore Stock Exchange on 4 September 2003. In 2005, AnnAik ventured into the environmental business by securing contracts to build wastewater treatment plants in Zhejiang province, China.

**Products and Services:** AnnAik Limited has 3 primary business divisions, namely Distribution, Manufacturing and Environment.

**Environment Division:** The environment business division provides consultancy and management services with regard to waste products. The Company currently operates eight industrial wastewater treatment plants under "Build-Own-Transfer (BOT)"/"Build-Own-Operate (BOO)" concepts and one drinking water supply plant, with treatment capacity totaling 150,000 metric tons per day. In recent years, it has ventured into domestic wastewater treatment through its patented technology for rural areas and completed about 5000 projects till date.

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