Di An Water Treatment Plant

Binh Duong, Vietnam

1. Background information

Binh Duong Water Supply Sewerage – Environment Co, Ltd. (BIWASE) is located at Thu Dau Mot town in Binh Duong province. The company was established in April 1997, as a governmental company. Currently, seven water treatment plants, one wastewater treatment plant and four construction companies are being managed by BIWASE.

Di An Water Treatment Plant (DAWTP) is one of seven WTP plants being owned by BIWASE. The plant was constructed in 2000 and its operation began in 2004. DAWTP is located at An Phu ward, Thuan An district, which shares the border with Ho Chi Minh City. DAWTP has a capacity of 30,000 m^3/day and the raw water source of this treatment plant is Dong Nai River which is the longest river in Vietnam. Dong Nai River is the source for Tri An lake from where the raw water is pumped for DAWTP. This lake functions to stabilize the flow of Dong Nai River in both dry and rainy seasons.

Table 1 Overall information of Di An Water Treatment Plant

Constructed Year	2000
Operational Year	2004
Water Source	Dong Nai River
Design capacity (m^3/d)	30,000
Treated water standard	ACVN 01:2009/BTNMT
Automation	SCADA
Date of access of the source information	22 August 2015
Reference	www.biwase.com.vn

Primary pumping station is located at Tan Uyen district and it pumps raw water from Dong Nai River. The raw water is pumped to the secondary pumping station located in the main treatment plant. Treatment facilities lies at higher elevation to avoid the surface flow entering the WTP. The clean water is supplied to the residents of Di An ward and the industrial park located near the WTP.

2. Water treatment process flow

The major water treatment unit processes are presented as below (**Figure 1**):

- Raw water extraction (Dong Nai River) →Bar screen → Primary raw water pumping station→ Chemical mixing tank → Reaction tank → Horizontal sedimentation → Rapid filtration tank → Clean water tank → Secondary pumping station →Distribution network
- The sludge generated from sedimentation tank is collected and treated by sludge drying beds.
- The backwash water from both filters (each with the capacity of 15000 m^3/d) is sent back to the chemical mixing tank.

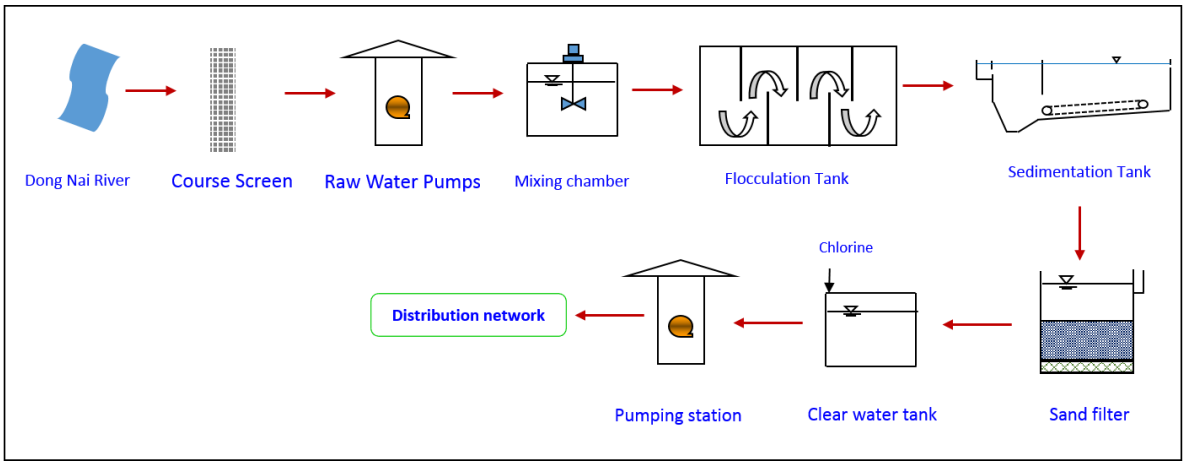

Figure 1 Water Treatment Process

2.1 Primary Pumping Station

Primary pumping station is located in the Tan Ba Commune, Thai Hoa ward, Tan Uyen district, Binh Duong province. It transfers the raw water from Dong Nai River to the treatment plant. There are 5 submerged pumps with following specification: motor power= 155 kW, capacity= 700 m^3/h and total head = 70 m.

The raw river water passes through a bar screen system (which is installed higher than the surface water level by 0.5 m) to remove the coarse size suspended solid (mainly plastic bags). Then two pipes, each with the diameter of 500 mm and length of 45m, transfers water into the vertical sand sedimentation well (L = 2.5 m, W = 1,6 m, H = 10 m). The pumping station is automatic and keeps running all the time. The flow and pumping pressure depends on the demand of the main treatment site. The chlorine is injected at this primary station at the dosage of 1 g/m^3, to prevent the algae and microorganisms growth.

2.2 Chemical Mixing Tank

Poly-aluminium chloride (PAC) and Lime (**Figure 2**) is added in the water pumped from the primary pumping station in this tank. The SCADA (Supervisory Control and Data Acquisition) system receives the signal from pH and Turbidity meter (installed directly in this tank) and then automatically calculates and apply the chemical dose. The water is then transferred to the coagulation and flocculation unit through the distribution tank (**Figure 3**).

Figure 2 Chemical mixing tank and Lime & PAC adding facility

Figure 3 Distribution tank

2.3 Chemical reaction tank

Coagulation and flocculation process takes place in this tank, to support settling of the particles. There are two reaction tanks, each with the dimensions of 9 m x 13 m x 5.5 m (W x L X H). The hydraulic retention time is 1.03 hour. The effluent of this tank is then transferred to the horizontal sedimentation tank with the velocity less than 0.05 mm/s.

Figure 4 Chemical reaction tank

2.4 Horizontal Sedimentation Tank

The horizontal sedimentation tank is divided into three working zones

- Zone 1: Stores the water received from the chemical reaction tank
- Zone 2: Settling zone. Majority of the length of the tank is occupied by this zone. However, normally particles settle in the first half of the tank. At the bottom, there is a belt sludge removal system (D114 is used to collect the settle sludge).
- Zone 3: Settled water. The clean water is collected by a weir system. This equipment is installed from the middle of the horizontal tank, below the surface level of water.

There are 2 sedimentation tanks, each with the dimension of: L x W x H = 39 x 6 x 3.5 (m). The water moving velocity is around 6-12 mm/s and the average settling velocity is around 0.5-0.8 mm/s. The particle concentration of settled water is maintained at less than 12 mg/L, to ensure the high efficiency of the followed filtration tank. The generated sludge is transferred to the sludge drying beds.

Figure 5 Sedimentation tank and weir system

Figure 6 Maintaining of sedimentation tank

2.5 Rapid filtration tank

There are 5 rapid sand filters. The filter media contains: 0.3 m of course stone layer at the bottom and 1.2 m of fine sand (effective diameter of 0.8-1.2 mm). The filtration rate is in the range from 5 – 15 m/h. There are two basic types of filter backwashing system: fluidized-bed backwash with surface wash and air scour and water backwash. Adopted backwash method is water backwash with air scour, using backwashing pump. The average filter run time is around 2 days. The turbidity of filtered water is less than 0.5 NTU

Figure 7 Rapid filtration tank

Figure 8 Another filtration tank with water spray to clean the wall

2.6 Clean Water storage tank

The treated water is then stored in this tank (**Figure 9**). There are two tanks with the dimension of 27 X 27 m. Chlorination is carried out in the treated water in this unit.

Figure 9 Treated storage tank

2.7 Secondary pumping station

The SCADA system ensure this pumping station is operated 24/24 h. There are 5 pumps (3 operating, 2 standby) with the technical information as follows:

- Motor: Capacity= 160 kW, f= 50 Hz, U= 400V, I= 285 A, n = 1450 rpm
- Brand: SIEMENS, type 300 x 250 CNHA, Q = 700 m^3/h, H = 50m

Figure 10 Secondary pumping station

Figure 11 Distribution pump (black) and backwash pump (blue)

2.8 Sludge drying beds

This system (**Figure 12**) was constructed mainly by concrete. It is divided into 7 beds and each bed has the area of 488 m^2 (16 x 42 m). There are 2 pumps (capacity of 250 m^3/h) to collect the drained water which is pumped back to the treatment process.

Figure 12 Sludge drying beds

2.9 Backwashed water collection tank

This tank has the volume of 300 m^3 (10 x 12 x 2.5 m). The bottom of the tank has inclined slope to collect the settled sludge. The backwash water is stored for 4 hour and then the water is pumped to the mixing tank while the settled sludge is sent to sludge drying beds

Figure 13 Backwashed water collection tank

2.10 PAC mixing tank

PAC from the manufacturer has the concentration of 10%. It is stored in two 4 m^3 PVC tanks (connected together). PAC is dissolved at 2-5 %, mixing 30 minute. It is then pumped into the chemical mixing tank in the treatment process.

Figure 14 PAC storage tank

Figure 15 Chemical dosing pump

2.11 Lime warehouse

Lime is bought from the manufacturer at the solid form. Prior using, it is kept submerging in the water tank of 4.5 m^3 volume for about 30 minute. At this tank, the lime has the concentration of 85% is dissolved to 5%.

Figure 16 Solid Lime

Figure 17 Lime dissolve tank

2.12 Chlorine warehouse

There are two chlorine dosing systems in the warehouse, 5 chlorine tanks are in use (900 kg per tank). The maximum pressure of the tank is 33 kg/cm^2. The pressure is usually maintained at 6 kg/cm^2 at 27^{o}C.

Figure 18 Chlorine tank

3. Aspects of treatment processes posing most difficulty for daily operation

Table 2. Some common operating problems

Units	Problems	Solutions
Primary pumping station	Low water pressure Sometimes have noise	Check the solid waste clogged the pump and piping system
Chemical mixing tank	Sludge appeared in the tank Hard-solid waste flow in (from river)	Always check the piping system
Chemical reaction tank	Algae grow inside the tank Inefficient coagulation and flocculation	Clean the tank manually and add chlorine
Sedimentation tank	Settled water has high turbidity	Check the PAC concentration and weir system, change the HRT
Filtration tank	Filtered water has high turbidity Sludge layer on the surface of media	Increase the thickness of sand layer Distribute the sand layer evenly (after backwashing) Check the backwash step to ensure the filtration tank works well

4. Aspects of water services management in general posing most difficulty at the moment

Table 3: Aspects of water service management posing threat

Problems	Causes	Solutions
High turbidity in settled water	High turbidity in river water in rainy season	Check and adjust PAC concentration
	Not enough PAC concentration Short HRT	Change the HRT
High turbidity in	The filter media gets clogged	Conduct the backwash step

filtered water	High filtration rate	Check the filtration rate Increase the number of filtration tank in the operating mode
High Alkalinity in treated water	Low pH in river water Exceed PAC in use	Change the PAC concentration
Algae grow in filtration tank	Warm weather	Add Chlorine
	High P and N concentration	Check the N , P concentration in water

5. Measures taken now to cope with 3) and 4)

Refer to **Table 2 and 3**

6. Recent investment made for the plant's improvement

Di An WTP 2 is been constructed to meet the raising demand. The construction is being carried out in two phases:

- Phase 1 : capacity 50,000 m^3/d – completed
- Phase 2: capacity 100,000 m^3/d

7. Technologies, facilities or other types of assistance needed to better cope with operational and management difficulties in 3) and 4).

- The filter media is replaced every 10 years
- Constructed a micro electricity generator, to prevent power cut off
- Before the year of 2000, the plant used vertical sedimentation tank. After 2000, it was changed to horizontal shape

8. Customer's opinion on water quality and water services in general

- The DAWTP has a decentralized complain office
- 99 % are satisfied with the service (water quality, water pressure, price)
- Most of the complaint issue are broken pipe and water meter problem.

9. Advanced technology used in this water treatment plant or any points to improve the process, water quality and capacity.

Supervisory control And Data Acquisition (SCADA) system is installed to monitor various parameters.

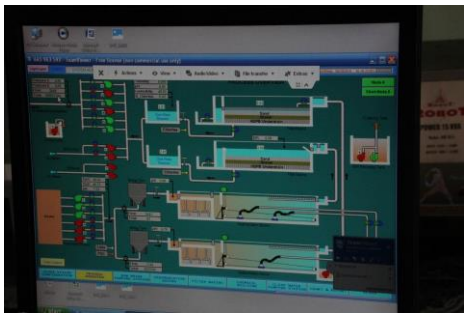

Figure 19 SCADA system

10. Other Highlights

The water level of Dong Nai River is around 4 m and almost stable due to the equalization of Tri An Lake. However, the turbidity varies as the season changes. In the dry season, it ranged from 10-18 NTU while in the rain season it can be higher than 100 NTU. The highest flow of the river is about 1,140 m^3/s (from August to November), and the lowest flow is about 40 m^3/s (in April).

11. Water quality data

The turbidity and conductivity of treated water are 0.1 NTU and 39.4 µs/cm. Chlorine concentration inside the storage tank is 1.9 mg/L. All the water quality parameters must be under the national standard for drinking water (QCVN 01:2009/ BTNMT).

Figure 20 Laboratory at ADWTP

12. References

Binh Duong Water Supply Sewerage Environment Limited Company (BIWASE). Retrieved on 6 December, 2015, from http://biwase.com.vn/english/XNCN-DA.aspx

Di An Water Treatment Plant. (2014). *Annual Report in 2014*. Binh Duong Vietnam

Nhung, H.T.H. (2015). *Internship Report of Di An Water Treatment Plant*. Thu Dau Mot University, Vietam

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Disclaimer:

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