Water Malaysia



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Featured Articles

The Sungai Dua Water Treatment Plant supplies more than 80% of the treated water that is distributed in the State of Penang daily. Its maximum treatment capacity has been upgraded nine-fold (900%), from 136 million litres per day (MLD) in 1973 to 1,228 MLD today.

Sungai Dua: Penang's Most Highly Evolved Water Treatment Plant

by Dato' Ir. Jaseni Maidinsa, Chief Executive Officer, PBA Holdings Bhd (PBAHB) and Perbadanan Bekalan Air Pulau Pinang Sdn Bhd (PBAPP)

1. Historical Perspective

Quote: "Planning for the Sungai Muda (Water) Scheme was initiated in early 1968, and site works began in 1970 with loans from the Asian Development Bank and the Federal Government. With the launching of Phase 1, this plant will supply about 136 million litres per day (MLD). With the launching of Phase 2 and subsequent stages, Penang will have an excellent in-state water supply scheme that is projected to meet development needs until Year 2000."

By the late Tun Dr. Lim Chong Eu, Chief Minister of Penang, and Chairman of the Penang Water Authority Official Opening of the Sungai Muda Water Scheme, 9th November 1973.

The Sungai Muda Water Scheme was officially opened by the late Tun Abdul Razak bin Hussein, the second Prime Minister of Malaysia.

Phase 1 of the scheme comprised Penang's abstraction of 136 MLD of raw water from Sungai Muda. The raw water was then pumped to the Sungai Dua Water Treatment Plant (SDWTP) through a 14km canal from Lahar Tiang.

Treated water from the plant was then transported through 27.2km of steel pipelines laid in Seberang Prai for

distribution to Butterworth and Prai, and through 3.66km of twin submarine pipelines to Penang Island.

The official opening of the Sungai Muda Water Scheme and the commissioning of the Sungai Dua Water Treatment Plant heralded the beginning of Penang's age of 'high-tech industry'.

And, the words penned by Tun Dr. Lim, for the official opening of the Sungai Muda Water Scheme, have been proven to be both far-sighted and judicious.

2. Meeting Penang Water Supply Needs

In 1971, Penang's population was estimated to be about 800,000 people and the Gross Domestic Product (GDP) per capita was RM1,025.00*. In 2015, the population estimate was 1.663 million people** while the GDP per capita was projected to be RM42,251.00***.

A 107.8% growth in population and 402.2% growth in per capita GDP over a period of just 45 years represent significant socio-economic progressions. Today, Penang is recognised as a high-tech international manufacturing centre, a South-East Asian hub for services (powered by information and communications technology), and Lonely Planet's 4th ranked 'Top 10 Cities to Visit in 2016'.

Continuous good water supply, 24/7, was, and still is, one of the fundamental elements driving Penang's growth. There has been no incidence of water rationing in recent history, although water consumption has increased by 469.2%, from 52,120,428 cu.m. in 1973 to 296,662,323 cu.m. in 2015.

Since its corporatisation in 1999, Perbadanan Bekalan Air Pulau Pinang Sdn Bhd (PBAPP) has been expanding and upgrading the Sungai Dua Water Treatment Plant (SDWTP) to meet all of Penang's water supply needs. Today, more than 80% of Penang's treated water is produced at this plant daily. In other words, the SDWTP is the most 'highly evolved' water supply installation in Penang's history.

- * PDC 20th Anniversary Book (Sept 1990)
- ** Department of Statistics (2015)
- *** Speech by Penang Chief Minister YAB Lim Guan Eng at Merton College, Oxford University, UK (Oct 2015)

3. Summary of Plant Expansion/Upgrades

Table 1 summarises the evolution of the SDWTP:

| Year | Project | Max. Treatment Capacity (MLD) | |
|--|--|----------------------------------|-----|
| 1973 | Phase 1 | 136 | |
| | (Horizontal Settling Tanks) | | |
| 1994 | Phase 2 | 272 | |
| | (Horizontal Settling Tanks) | | |
| 1999 | 399 Phase 1 Upgrade (HDPE Multi-Trays) | | 318 |
| | Phase 2 Upgrade (HDPE Multi-Tra | ays) | 454 |
| Phase 4A | | | |
| 2004 | Package 3 (Dissolved Air Flotation) | | 114 |
| 2011 | 11 Package 10 (Stainless Steel Lamella Plates) | | 114 |
| 2013 Package 11 (Stainless Steel Lamella Plates) | | 114 | |
| 2016 Package 12 (Stainless Steel Lamella Plates) | | | 114 |
| Total | | | |

The SDWTP is located on an 18.2-hectare site in Seberang Prai Utara. Raw water from Sungai Muda is delivered to the plant via a 14km canal. Conventional water treatment technology is employed for water treatment, incorporating the processes of rapid mixing, flocculation, sedimentation, rapid gravity sand filtration and disinfection/conditioning (using chlorine, hydrated lime and fluoride).

The SDWTP has undergone seven (7) upgrades since 1973. Its maximum treatment capacity has been increased from 136 MLD to 1,228 MLD. This represents a nine-fold (900%) increase in treatment capacity.

The most significant upgrades occurred from 1999, the year in which PBAPP was corporatised.

In 1999, the conventional rectangular horizontal flow settling tanks were upgraded to HDPE multi-tray settling tanks. Through this upgrade, the surface flow rate was almost doubled, from 1.5 to 2.7 metres per hour (m/hr). Moreover, the maintenance frequency of the settling tanks was reduced from a monthly interval to a bi-monthly interval.

In 2000, PBAPP acquired adjacent land to expand the SDWTP. In 2004, Package 3 of the Phase 4A saw the construction of a 114 MLD Dissolved Air Flotation (DAF) module. However, the automated DAF can only treat raw water turbidity not exceeding 300 NTU.

In 2011, PBAPP chose to implement Stainless Steel Lamella Plate (SSLP) technology for 114 MLD Package 10 (Phase 4A). The installation of automated advanced stainless steel lamella plate settling tanks (with hopper bottom process units) yielded seven key benefits:

- high treatment output and efficiency
- · compact module footprint;
- capability to handle high turbidity raw water;
- affordable build-up and treatment costs;
- proven water quality;
- relatively easier maintenance; and
- long-term durability and reliability.

The surface flow rate can be increased to 8m/hr. The works are operated mainly in automatic mode and the maintenance of the settling tanks was reduced from bi-monthly to six-month intervals.

Table 2: Evolution of Sungai Dua Water Treatment PlantSettling Tank Technology

| Type of Settling Tanks | Surface Flow Rate (m/hr) | Maintenance Frequency (months) |
|-------------------------------------|--------------------------------|--------------------------------------|
| Conventional Horizontal Tanks | 1.5 | 1.0 |
| HDPE Multi-Tray Tanks | 2.7 | 2.0 |
| Stainless Steel Lamella Plate Tanks | 8.0 | 6.0 |

The evolution of the SDWTP settling tanks technology from conventional horizontal settling tanks to HDPE multi-trays, and finally, Stainless Steel Lamella Plates, have improved the surface flow rates from 1.5 m/hr to 2.7 m/hr, and finally to 8 m/hr.

In addition to this, the maintenance frequency of the settling tanks was drastically improved from monthly to bi-monthly, and finally to sixmonthly intervals. These improvements have resulted in making the SDWTP the most efficient PBAPP water treatment plant.

The good results shown by the Package 10 module led to the subsequent construction of SSLP modules for Package 11 (114 MLD) in 2011, and Package 12 (114 MLD) that was recently commissioned in March 2016.

Meanwhile, some of the existing Phase 1 and 2 HDPE multitray settling tanks are also being replaced with SSLP units.

4. Status Report March 2016

| a. | Location | Seberang Prai, Penang |
|----|-----------------------|-----------------------------------|
| b. | Raw Water Sources | • Sungai Muda (primary) |
| | | Mengkuang Dam |
| | | (temporarily |
| | | decommissioned since |
| | | 2012 to facilitate |
| | | expansion project) |
| C. | Maximum Capacity | 1,228 MLD |
| d. | Treatment Technology• | 5 x Conventional |
| | | Treatment Packages |
| | | • 1 DAF Package |
| e. | Water Quality | Exceeds Standards for |
| | | Drinking Water set by the |
| | | Ministry of Health, Malaysia |
| f. | Supply Areas | Seberang Prai |
| | | • Penang Island |
| | | (two twin submarine |
| | | pipelines) |

Table 3: Key Data on the Sungai Dua Water Treatment Plant

Featured Articles

5. Future Plans

On 25th November 2015, PBAPP received an 'ASEAN Outstanding Engineering Achievement Award for the Year 2015' for design and construction of the SDWTP from the 33rd Conference of the ASEAN Federation of Engineering Organisations (CAFEO).

The SDWTP is much more than just a showcase plant. It is a strategic water installation that produces 80% of Penang's treated water and allows PBAPP to sustain 100% urban and 99.7% rural supply coverage. This plant, more than any other, helps a water-stressed state to avoid water rationing at all costs in this age of climate change.

As such, a plot of land has been allocated for Package 12A of Phase 4A, to accommodate the proposed construction of the last water treatment module, featuring the SSLP technology, with a capacity of 136 MLD. This will ultimately increase the total capacity of the SDWTP to 1,364 MLD. So long as Penang is dependent on Sungai Muda as its primary raw water resource, PBAPP will continue to optimise the SDWTP to meet all of its water supply needs.



PBAPP Wins Two ASEAN 'Outstanding Engineering' Awards



25/11/2015: PBAPP and PBAHB CEO Dato' Ir. Jaseni Maidinsa receiving the ASEAN Outstanding Engineering Achievement Award from AFEO Chairman Dato' Ir Lim Chow Hock



25/11/2015: The PBAPP Team at the CAFEO 33 Awards Presentation Ceremony.

ASEAN Federation of Engineering Organisations (AFEO) Awards 2015

Perbadanan Bekalan Air Pulau Pinang Sdn Bhd (PBAPP) received two awards at the 33rd Conference of the ASEAN Federation of Engineering Organisations (CAFEO) on 25 November 2015.

ASEAN Federation of Engineering Organisations (AFEO) Engineering Award

The 'ASEAN Outstanding Engineering Achievement Project Award' (2015) was conferred upon PBAPP for its engineering achievements at the Sungai Dua Water Treatment Plant (Sungai Dua WTP) in Seberang Perai. This award recognises outstanding engineering achievements in ASEAN countries.

ASEAN Federation of Engineering Organisations (AFEO) Honorary Member Award

The second AFEO award for PBAPP is the conferment of the 'AFEO Honorary Member' upon PBA Holdings Bhd and PBAPP Chief Executive Officer Dato' Ir. Jaseni Maidinsa. This award is given to persons 'who have rendered outstanding services to the engineering profession, the institution and/or the nation.'