3.C.6 Specification of River Crossing

LOPBURI

	Item	Unit	No.1 5-2B	No.2 6-2B
Plan Condition	Area Coverage	ha	72.10	157.00
	Design Population	person	1,684	6,290
	Wastewater Flow	m3/s	0.03	0.09
Additional Condition	Dia	mm	200	200x2 line
	Length	m	130	130
	Innert Elevation	mm	12.10	12.80
	Velocity	m/s	0.80	1.46

ANGTHONG

	Item	Unit	No.1 1-5B
Plan Condition	Area Coverage	ha	314.50
	Design Population	person	5,259
	Wastewater Flow	m3/s	0.08
Additional Condition	Dia	mm	200x2 line
	Length	m	210
	Innert Elevation	mm	8.00
	Velocity	m/s	1.27

SENA

	Item	Unit	No.1 1-1C
Plan Condition	Area Coverage	ha	52.40
	Design Population	person	2,476
	Wastewater Flow	m3/s	0.04
Additional Condition	Dia	mm	200
	Length	m	80
	Innert Elevation	mm	5.13
	Velocity	m/s	1.27

3.1.6.2 Comparative Evaluation of Wastewater Treatmend Methods

1. Chainat Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of a series of inflow pump, anaerobic pond, facultative pond and maturation pond. The design effective storage capacity of the pond system is 88,500 m^3 with a total retention time of 15 days. The effective water depths of the ponds for anaerobic, facultative and maturation pond are 4.0 m, 2.0 m and 1.5 m, respectively.

The design net treatment plant area is estimated at 7.6 ha including ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows.

- Inflow pump station : 6.39 m^3/min. x 7.6 m (dry hourly max.)
- Anaerobic pond : 52.5 m x 72.5 m x 4.0 m x 2 units
- Facultative pond : 65.5 m x 115.5 m x 2.0 m x 2 units
- Maturation pond : 61.125 m x 81.125 m x 1.5 m x 4 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment system are estimated in terms of unit wastewater amount per day excluding land acquisition cost. The unit land acquisition cost at the potential treatment plant site is to be 0.30 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Chai Nat are estimated as shown below.

Construction cost : 8.91 million Baht
Land acquisition cost : 14.25 million Baht

Annual O&M cost : 0.13 million Baht/year

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond in series. The design effective storage capacity of the lagoons and pond is 41,300 m^3 with a total retention time of 7 days. The effective water depths of the lagoons and ponds are 4.0 m for aerated lagoon, 4.0 m for facultative aerated lagoon and 1.5 m for polishing pond.

The design net treatment plant area including lagoons and ponds, sludge drying bed, control building yard and buffer zone is about 3.6 ha.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond are as follows.

- Inflow pump station : 6.39 m^3/min. x 7.6 m (dry hourly max.)
- Aerated lagoon : 32.5 m x 67.5 m x 4 m x 2 units
  : Aerator 11 kw x 4 units/lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 2.2 kw x 5 units/lagoon
- Polishing pond : 36.25 m x 56.25 m x 1.5 m x 2 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows:

Construction cost : 14.96 million Baht
Land acquisition cost : 6.75 million Baht
Annual O&M cost : 0.50 million Baht/year

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective storage capacity of ditch is 2,950 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4 hrs with a surface loading of 15 $m^3/m^2/d$.

The design net treatment area including ditch, final sedimentation basin, drying bed and control building is about 2.0 ha.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows:

Inflow pump station	: 6.39 m^3/min. x 7.6 m (dry hourly max.)
Oxidation Ditch	: 4 m(W) x 75 m(L) x 2.5 m(D) x 4 units
Final Sedimentation basin	: ϕ 16 m x 2.5 m(D) x 2 units
Drying Bed	: 8 m x 16 m x 24 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost	: 35.63 million Baht
Land acquisition cost	: 3.75 million Baht
Annual O&M cost	: 3.46 million Baht

2. Sing Buri East Area Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of inflow pump, anaerobic pond, facultative pond and maturation pond in series. The design effective storage capacity of the ponds is 46,500 m^3 with a retention time of 15 days. The effective water depths of the ponds are 4.0 m for anaerobic pond, 2.0 m for facultative pond and 1.5 m for maturation pond.

The design net treatment plant area is estimated to be 4.8 ha including ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows:

- Inflow pump station : 3.26 m^3/min. x 8.5 m (dry hourly max.)
- Anaerobic pond : 37.5 m x 52.5 m x 4.0 m x 2 units
- Facultative pond : 45.5 m x 85.5 m x 2.0 m x 2 units
- Maturation pond : 36.25 m x 71.25 m x 1.5 m x 4 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Sing Buri East are estimated. The unit land acquisition cost of proposed sewage treatment area is 0.2 million Baht/rai in 1993.

Construction cost : 4.53 million Baht
Land acquisition cost : 6.00 million Baht
Annual O&M cost : 0.07 million Baht

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond in series. The design effective storage capacity of the lagoons and ponds is 21,700 m^3 with a retention time of 7 days. The effective water depth of the lagoons and ponds are 4.0 m for aerated lagoon and facultative aerated lagoon and 1.5 m for polishing pond.

The design net treatment plant area is about 2.6 ha including lagoons and ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond are as follows:

- Inflow pump station: 3.26 m^3/min. x 8.5 m (dry hourly max.)
- Aerated lagoon : 27.5 m x 42.5 m x 4 m x 2 units
  : Aerator 5.7 kw x 4 units/lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 1.25 kw x 5 units/lagoon
- Policing pond : 16.25 m x 32.25 m x 1.5 m x 4 units
- Drying bed : 5 m x 7 m x 10 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows:

Construction cost : 8.34 million Baht
Land acquisition cost : 3.25 million Baht
Annual O&M cost : 0.31 million Baht

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective storage capacity of ditch is 1,600 m^3 with a detention time of 12.4 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4.4 hrs with a surface loading of 13.7 $m^3/m^2/d$.

The design net treatment area is about 1.37 ha including ditch, final sedimentation basin, drying bed and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows.

Oxidation Ditch	: 4 m(W) x 80 m(L) x 2.5 m(D) x 2 units
Final Sedimentation basin	: ϕ 12 m x 2.5 m(D) x 2 units
Drying Bed	: 8 m x 12 m x 20 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows.

Construction cost	: 18.72 million Baht
Land acquisition cost	: 1.71 million Baht
Annual O&M cost	: 1.75 million Baht

3. Sing Buri West Area Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of inflow pump, anaerobic pond, facultative pond and maturation pond in series. The design total effective storage capacity of the ponds is 123,000 m^3 with a total retention time of 15 days. The effective water depth of the ponds are 4.0 m for anaerobic pond, 2.0 m for facultative pond and 1.5 m for maturation pond.

The design net treatment plant area including ponds, sludge drying bed, control building yard and buffer zone is 9.85 ha.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows.

- Inflow pump station : 8.82m^3/min. x 4.8 m (dry hourly max.)
- Anaerobic pond : 62.5 m x 82.5 m x 4.0 m x 2 units
- Facultative pond : 85.5 m x 120.5 m x 2.0 m x 2 units
- Maturation pond : 76.25 m x 91.25 m x 1.5 m x 4 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment system per unit wastewater amount per day excluding land acquisition cost were estimated. The unit land acquisition cost of the potential treatment plant site is to be 0.17 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Sing Buri West are estimated as shown below.

Construction cost : 12.58 million Baht
Land acquisition cost : 10.47 million Baht
Annual O&M cost : 0.17 million Baht

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and policing pond in series. The design total effective storage capacity of the lagoons and pond is 57,500 m^3 with a total retention time of 7 days. The effective water depth of the lagoons and pond are 4.0 m of aerated lagoon, 4.0 m for facultative aerated lagoon and 1.5 m for policing pond.

The design net treatment plant area including lagoons and pond, sludge drying bed, control building yard and buffer zone is about 4.7 ha.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and policing pond are as follows.

- Inflow pump station : 8.82 m^3/min. x 4.8 m
  (dry hourly max.)
- Aerated lagoon : 42.5 m x 72.5 m x 4 m x 2 units
  : Aerator 11 kw x 6 units/lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 3.7 kw x 5 units/lagoon
- Policing pond : 41.25 m x 66.25 m x 1.5 m x 2 units
- Drying bed : 6 m x 8 m x 16 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows.

Construction cost : 20.17 million Baht
Land acquisition cost : 4.99 million Baht
Annual O&M cost : 0.63 million Baht

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective total storage capacity of ditch is 4,100 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4 hrs with a surface loading of 15 $m^3/m^2/d$.

The design net treatment area including ditch, final sedimentation basin, drying bed and control building is about 2.25 ha.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows.

Inflow pump station	: 8.82 m^3/min. x 4.8 m (dry hourly max.)
Oxidation Ditch	: 4 m(W) x 70 m(L) x 2.5 m(D) x 6 units
Final Sedimentation basin	: ϕ 16 m x 2.5 m(D) x 3 units
Drying Bed	: 10 m x 17 m x 30 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows.

Construction cost	: 49.52 million Baht
Land acquisition cost	: 2.39 million Baht
Annual O&M cost	: 4.83 million Baht

4. Lop Buri Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of inflow pump, anaerobic pond, facultative pond and maturation pond in series. The design effective storage capacity of the ponds is 247,500 m^3 with a retention time of 15 days. The effective water depths of the ponds are 4.0 m for anaerobic pond, 2.0 m for facultative pond and 1.5 m for maturation pond.

The design net treatment plant area is estimated at 18.24 ha including ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows:

- Inflow pump station : 17.8 m^3/min. x 6.2 m (dry weather)
- Anaerobic pond : 62.5 m x 82.5 m x 4.0 m x 4 units
- Facultative pond : 67.5 m x 102.5 m x 2.0 m x 6 units
- Maturation pond : 56.25 m x 81.25 m x 1.5 m x 12 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment systems are estimated in terms of unit wastewater amount per day excluding land acquisition cost. The unit land acquisition cost of the potential treatment plant site is to be 0.50 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Lop Buri are estimated as shown below.

Construction cost : 26.2 million Baht
Land acquisition cost : 57.0 million Baht
Annual O&M cost : 0.32 million Baht

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond in series. The design effective storage capacity of the lagoons and ponds is 115,500 m^3 with a retention time of 7 days. The effective water depth of the lagoons and pond are 4.0 m for aerated lagoon, 4.0 m for facultative aerated lagoon and 1.5 m for polishing pond.

The design net treatment plant area is estimated at 8.05 ha including lagoons and pond, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond are as follows:

- Inflow pump station : 17.8 m^3/min. x 6.2 m (dry weather)
- Aerated lagoon : 42.5 m x 73.5 m x 4 m x 4 units
  : Aerator 11 kw x 6 units/lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 2.2 kw x 7 units/lagoon
- Polishing pond : 41.25 m x 67.25 m x 1.5 m x 4 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows:

Construction cost : 38.06 million Baht
Land acquisition cost : 25.16 million Baht
Annual O&M cost : 1.07 million Baht

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective storage capacity of ditch is 8,250 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4 hrs with a surface loading of 15 $m^3/m^2/d$.

The design net treatment area is estimated at about 3.75 ha including ditch, final sedimentation basin, drying bed and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows.

Inflow Pump	: 17.8 m^3/min. x 6.2 m (dry weather)
Oxidation Ditch	: 4 m(W) x 138 m(L) x 2.5 m(D) x 6 units
Final Sedimentation basin	: ϕ16 m x 2.5 m(D) x 6 units
Drying Bed	: 10 m x 15 m x 55 units (8,250 ha)

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost	: 99.64 million Baht
Land acquisition cost	: 11.72 million Baht
Annual O&M cost	: 9.78 million Baht

5. Ang Thong Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of inflow pump, anaerobic pond, facultative pond and maturation pond in series. The design effective storage capacity of the ponds is 55,500 m^3 with a retention time of 15 days. The effective water depths of the ponds are 4.0 m for anaerobic pond, 2.0 m for facultative pond and 1.5 m for maturation pond.

The design net treatment plant area is estimated at 5.44 ha including ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows:

- Inflow pump station : 3.96 m^3/min. x 4.8 m
- Anaerobic pond : 42.5 m x 54.5 m x 4.0 m x 2 units
- Facultative pond : 55.5 m x 83.5 m x 2.0 m x 2 units
- Maturation pond : 46.25 m x 67.25 m x 1.5 m x 4 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment systems are estimated in terms of unit wastewater amount per day excluding land acquisition cost. The unit land acquisition cost at the potential treatment plant site is to be 0.2 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Ang Thong are estimated as shown below.

Construction cost : 5.46 million Baht
Land acquisition cost : 6.80 million Baht
Annual O&M cost : 0.09 million Baht

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and policing pond in series. The design effective storage capacity of the lagoons and pond is 25,900 m^3 with a retention time of 7 days. The effective water depths of the lagoons and pond are 4.0 m of aerated lagoon, 4.0 m for facultative aerated lagoon and 1.5 m for polishing pond.

The design net treatment plant area is estimated to be about 2.8 ha including lagoons and pond, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond are as follows:

- Inflow pump station : 3.96m^3/min. x 4.8 m
  (dry, hourly max.)
- Aerated lagoon : 32.5 m x 43.5 m x 4 m x 2 units
  : Aerator 3.7 kw x 8 units / lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 0.75 kw x 10 units / lagoon
- Polishing pond : 26.25 m x 47.25 m x 1.5 m x 2 units
- Drying Bed : 4 m x 6 m x 16 units 384 m^2

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows:

Construction cost : 9.79 million Baht
Land acquisition cost : 3.50 million Baht
Annual O&M cost : 0.35 million Baht

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective storage capacity of ditch is 1,850 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4 hrs with a surface loading of 15 m^3/m^2 /d.

The design net treatment area is estimated at 1.52 ha including ditch, final sedimentation basin, drying bed and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows:

Inflow Pump	: 3.96 m^3/min. with 4.8 m hydraulic head (dry weather, hourly max.)
Oxidation Ditch	: 4 m(W) x 93 m(L) x 2.5 m(D) x 2 units
Final Sedimentation basin	: ϕ 13 m x 2.5 m(D) x 2 units
Drying Bed	: 10 m x 15 m x 14 units 2,100 m^2

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost	: 22.34 million Baht
Land acquisition cost	: 1.90 million Baht
Annual O&M cost	: 2.16 million Baht

6. Pa Mok East Area Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of inflow pump, anaerobic pond, facultative pond and maturation pond in series. The design effective storage capacity of the ponds is 30,000 m^3 with a retention time of 15 days. The effective water depths of the ponds are 4.0 m for anaerobic pond, 2.0 m for facultative pond and 1.5 m for maturation pond.

The design net treatment plant area is estimated to be 3.74 ha including ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows:

- Inflow pump station : 2.16 m^3/min. x 7.6 m (dry)
- Anaerobic pond : 27.5 m x 45.5 m x 4.0 m x 2 units
- Facultative pond : 40.5 m x 62.5 m x 2.0 m x 2 units
- Maturation pond : 36.25 m x 46.25 m x 1.5 m x 4 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Pa Mok East are estimated with a same manner as Pa Mok West and the results are shown below. The unit land acquisition cost of proposed sewage treatment plant area is 0.15 million Baht/rai in 1993.

Construction cost : 2.86 million Baht
Land acquisition cost : 3.51 million Baht
Annual O&M cost : 0.05 million Baht

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond in series. The design effective storage capacity of the lagoons and ponds is 14,000 m^3 with a retention time of 7 days. The effective water depth of the lagoons and ponds are 4.0 m for aerated lagoon and facultative aerated lagoon and 1.5 m for polishing pond.

The design net treatment plant area is estimated to be about 2.1 ha including lagoons and pond, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond are as follows:

- Inflow pump station : 2.16 m^3/min. x 7.6 m (dry)
- Aerated lagoon : 22.5 m x 33.5 m x 4 m x 2 units
  : Aerator 2.2 kw x 7 units/lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 0.75 kw x 5 units/lagoon
- Polishing pond : 21.25 m x 32.25 m x 1.5 m x 2 units
- Drying bed : 4 m x 6 m x 8 units (192 m^2)

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows:

Construction cost : 5.60 million Baht
Land acquisition cost : 1.97 million Baht
Annual O&M cost : 0.22 million Baht

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective total storage capacity of ditch is 1,000 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4.7 hrs with a surface loading of 12.7 $m^3/m^2/d$.

The design net treatment area is estimated at about 1.22 ha including ditch, final sedimentation basin, drying bed and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows:

Oxidation Ditch	: 4 m(W) x 50 m(L) x 2.5 m(D) x 2 units
Final Sedimentation basin	: ϕ 10 m x 2.5 m(D) x 2 units
Drying Bed	: 12 m x 14 m x 6 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost	: 12.08 million Baht
Land acquisition cost	: 1.14 million Baht
Annual O&M cost	: 1.16 million Baht

7. Pa Mok West Area Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of inflow pump, anaerobic pond, facultative pond and maturation pond in series. The design effective storage capacity of the ponds is 25,500 m^3 with a retention time of 15 days. The effective water depths of the ponds are 4.0 m for anaerobic pond, 2.0 m for facultative pond and 1.5 m for maturation pond.

The design net treatment plant area is estimated to be 3.44 ha including ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows:

- Inflow pump station : 1.81m^3/min. x4.9 m (dry)
- Anaerobic pond : 27.5 m x 39.5 m x 4.0 m x 2 units
- Facultative pond : 35.5 m x 60.5 m x 2.0 m x 2 units
- Maturation pond : 31.25 m x 46.25 m x 1.5 m x 4 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment system in terms of unit wastewater amount per day excluding land acquisition cost were estimated. The unit land acquisition cost of the potential treatment plant site is to be 0.15 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Pa Mok West are estimated as shown below.

Construction cost : 2.41 million Baht
Land acquisition cost : 3.23 million Baht
Annual O&M cost : 0.04 million Baht

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond in series. The design effective storage capacity of the lagoons and pond is 11,900 m^3 with a retention time of 7 days. The effective water depths of the lagoons and pond are 4.0 m of aerated lagoon, 4.0 m for facultative aerated lagoon and 1.5 m for polishing pond.

The design net treatment plant area is estimated at about 1.98 ha including lagoons and pond, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond are as follows:

- Inflow pump station : 1.81 m^3/min. x 4.9 m (dry)

- Aerated lagoon : 17.5 m x 37.5 m x 4 m x 2 units
  : Aerator 2.2 kw x 6 units/lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 0.75 kw x 5 units/lagoon
- Polishing pond : 21.25 m x 27.25 m x 1.5 m x 2 units
- Drying bed : 4 m x 5 m x 8 units (160 m^2)

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows:

Construction cost : 4.83 million Baht
Land acquisition cost : 1.86 million Baht
Annual O&M cost : 0.20 million Baht

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective storage capacity of ditch is 850 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4 hrs with a surface loading of 15 $m^3/m^2/d$.
The design net treatment area is estimated at about 1.17 ha including ditch, final sedimentation basin, drying bed and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows:

Inflow Pump	: 1.81 m^3/min. with 4.9 m (dry)
Oxidation Ditch	: 4m(W) x 43m(L) x 2.5m(D) x 2 units
Final Sedimentation basin	: ϕ 9 m x 2.5m(D) x 2 units
Drying Bed	: 10 m x 15 m x 6 units (900 m^2)

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost	: 10.27 million Baht
Land acquisition cost	: 1.10 million Baht
Annual O&M cost	: 0.99 million Baht

8. Sena Wastewater Treatment Plant

(1) Stabilization Pond

1) Structural Design

The stabilization pond system is composed of inflow pump, anaerobic pond, facultative pond and maturation pond in series. The design effective storage capacity of the ponds is 39,000 m^3 with a retention time of 15 days. The effective water depths of the ponds are 4.0 m for anaerobic pond, 2.0 m for facultative pond and 1.5 m for maturation pond.

The design net treatment plant area is estimated at 4.36 ha including ponds, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, anaerobic pond, facultative pond and maturation pond are as follows:

- Inflow pump station : 2.78 m^3/min. x 6.2 m
- Anaerobic pond : 32.5 m x 50.0 m x 4.0 m x 2 units
- Facultative pond : 45.5 m x 71.5 m x 2.0 m x 2 units
- Maturation pond : 36.25 m x 61.25 m x 1.5 m x 4 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment system in terms of unit wastewater amount per day excluding land acquisition cost were estimated. The unit land acquisition cost of the potential treatment plant site is to be 0.2 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the stabilization pond in Sena are estimated as shown below.

Construction cost : 3.77 million Baht
Land acquisition cost : 5.43 million Baht
Annual O&M cost : 0.06 million Baht

(2) Aerated Lagoon

1) Structural Design

The aerated lagoon system consists of inflow pump station, aerated lagoon, facultative aerated lagoon and policing pond in series. The design effective storage capacity of the lagoons and pond is 18,200 m^3 with a retention time of 7 days. The effective water depths of the lagoons and pond are 4.0 m of aerated lagoon, 4.0 m for facultative aerated lagoon and 1.5 m for polishing pond.

The design net treatment plant area is estimated at about 2.35 ha including lagoons and pond, sludge drying bed, control building yard and buffer zone.

The design capacity of the inflow pump station, aerated lagoon, facultative aerated lagoon and polishing pond are as follows:

- Inflow pump station : 2.78 m^3/min. x 6.2 m (dry weather)
- Aerated lagoon : 22.5 m x 43.5 m x 4 m x 2 units
  : Aerator 2.2 kw x 9 units/lagoon
- Facultative aerated lagoon : same as aerated lagoon
  : Aerator 1.5 kw x 4 units/lagoon
- Polishing pond : 21.25 m x 41.25 m x 1.5 m x 2 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the aerated lagoon treatment plant are estimated as follows:

Construction cost : 7.11 million Baht
Land acquisition cost : 2.94 million Baht
Annual O&M cost : 0.27 million Baht

(3) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective storage capacity of ditch is 1,300 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4 hrs with a surface loading of 15 $m^3/m^2/d$.

The design net treatment area is estimated at about 1.33 ha including ditch, final sedimentation basin, drying bed and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows:

Inflow pump station	: 2.78 m^3/min. x 6.2 m (dry weather)
Oxidation ditch	: 4 m(W) x 65 m(L) x 2.5 m(D) x 2 units
Final sedimentation basin	: ϕ 11 m x 2.5 m(D) x 2 units
Drying bed	: 10 m x 15 m x 9 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost	: 15.70 million Baht
Land acquisition cost	: 1.66 million Baht
Annual O&M cost	: 1.52 million Baht

9. Rang Sit Area Wastewater Treatment Plant

(1) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The design effective storage capacity of ditch is 32,000 m^3 with a detention time of 12.3 hours. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4.4 hours with a surface loading of 13.8 $m^3/m^2/d$.

The design net treatment area is estimated at about 9.1 ha including ditch, final sedimentation basin, centrifugal dewatering and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin are as follows:

Inflow Pump	: 67.7 m^3/min. x 7.3 m (dry hourly max.)
Oxidation Ditch	: 4m(W) x 156m(l) x 2.5m(d) x 20 units
Final Sedimentation basin	: ϕ 17 m x 2.5m(D) x 20 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment system in terms of unit wastewater amount per day excluding land acquisition cost were estimated. The unit land acquisition cost of the potential treatment plant site is to be 2 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost	: 484.06 million Baht
Land acquisition cost	: 113.75 million Baht
Annual O&M cost	: 40.73 million Baht

(2) Conventional Activated Sludge (AS)

1) Structural Design

The conventional activated sludge system consists of inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge disposed facilities. Daily maximum wastewater of 75,000 m^3/d is used for design of conventional activated sludge system.

The major mechanical/electrical equipment is inflow pump and surface aerator. Their design capacities are as follows:

- Inflow Pump : 240 kw for dry, 350 kw for wet weather
- Surface Aerator : 11 kw/unit x 18 units
  22 kw/unit x 12 units

The design net treatment plant area is estimated at about 7.5 ha including inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and centrifugal dewatering.

The design capacity of the inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin are as follows.

- Inflow pump station : 67.7 $m^3/min.$ x 7.3 m
  (dry hourly max.)
- Primary sedimentation basin : ϕ16.0 m x 4.0 m(D)
  x12 units
- Aeration tank : 15.0 m(W) x 75.0 m(L) x 3.0 m(D)
  x 12 units
- Secondary sedimentation : ϕ18.5 m x 2.5 m(D)
  x 12 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the AS in Rangsit are estimated as shown below.

Construction cost : 598.75 million Baht
Land acquisition cost : 93.75 million Baht
Annual O&M cost : 38.71 million Baht

(3) Rotating Biological Contactor (RBC)

1) Structural Design

The rotating biological contactor system consists of inflow pump station, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge disposed facilities. Daily maximum wastewater of 75,000 m^3/d is used for design of RBC system.

The major mechanical/electrical equipment is inflow pump and rotating biological contactor. Their design capacity are as follows:

- Inflow pump : 240 kw for dry, 350 kw for wet weather
- Rotating biological contactor : ϕ 3.6 m x 7.5 m(L) x 120 units

The design net treatment plant area is estimated at about 6.7 ha including inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and centrifugal dewatering.

The design capacity of inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin are as follows:

- Inflow pump station : 67.7 $m^3/min.$ x 7.3 m (dry hourly max.)
- Primary sedimentation basin : ϕ16.0 m x 4.0 m(D) x 12 units
- Aeration tank : 3.8 m(W) x 7.8 m(L) x 2.5 m x 120 units
- Secondary sedimentation basin : ϕ18.5 m x 2.5 m x 12 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the RBC treatment plant are estimated as follows.

Construction cost	:	759.62 million Baht
Land acquisition cost	:	83.75 million Baht
Annual O&M cost	:	42.14 million Baht

10. Bang Bua Thong North Area Wastewater Treatment Plant

(1) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The daily average wastewater is used for designing oxidation ditch. The design effective storage capacity of ditch is 9,840 m^3 with a detention time of 12 hrs. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4.2 hrs with a surface loading of 14.2 $m^3/m^2/d$.

The design net treatment area is estimated at about 4.5 ha including ditch, final sedimentation basin, centrifugal dewatering and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin are as follows:

Inflow Pump	: 21.3 m^3/min. 8.0 m (dry hourly max.)
Oxidation Ditch	: 4m(W) x 123m(L) x 2.5m(D) x 8 units
Final Sedimentation basin	: ϕ 21 m x 2.5m(D) x 4 units

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment system in terms of unit wastewater amount per day excluding land acquisition cost were estimated. The unit land acquisition cost of the potential treatment plant site is to be 8 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost : 142.71 million Baht
Land acquisition cost : 225.00 million Baht
Annual O&M cost : 12.20 million Baht

(2) Conventional Activated Sludge

1) Structural Design

The conventional activated sludge system consists of inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge disposal facilities. Daily maximum wastewater of 23,600 m^3/d is used for designing of conventional activated sludge system.

The major mechanical/electrical equipment are inflow pump and surface aerator. Their design capacities are as follows:

- Inflow Pump : 85 kw for dry weather, 187 kw for wet weather
- Surface Aerator : 11 kw/unit x 12 units

The design net treatment plant area is estimated at 3.0 ha including inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and Centrifugal dewatering.

The design capacity of the inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin are as follows:

- Inflow pump station : 21.3 m^3/min. x 8.0 m (dry hourly max.)
- Primary sedimentation basin : ϕ15.0 m x 4.0 m(D) x 4 units
- Aeration tank : 12.0 m(W) x 36.0 m(L) x 3.0 m(D) x 4 units
- Secondary sedimentation basin: ϕ17.0 m x 3.0 m(D) x 4 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of

the AS in Bang Bua Thong North area are estimated as shown below.

Construction cost : 181.26 million Baht
Land acquisition cost : 150.00 million Baht
Annual O&M cost : 12.14 million Baht

(3) Rotating Biological Contactor (RBC)

1) Structural Design

The rotating biological contactor system consists of inflow pump station, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge disposal facilities. daily maximum wastewater of 23,600 m^3/d is used for designing of RBC system.

The major mechanical/electrical equipment is inflow pump and rotating biological contactor. Their design capacity are as follows:

- Inflow pump : 85 kw for dry weather, 187 kw for wet weather
- Rotating biological contactor : ϕ3.6 m x 7.5 m x 35 units

The design net treatment plant area is estimated at about 3.0 ha including inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and centrifugal dewatering.

The design capacity of inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin are as follows:

- Inflow pump station : 21.3 m^3/min. x 8.0 m (dry hourly max.)
- Primary sedimentation basin : ϕ15.0 m x 4.0 m(D) x 4 units
- Aeration tank : 3.8 m(W) x 7.8 m(L) x 2.5 m x 35 units
- Secondary sedimentation : ϕ17.0 m x 3.0m x 4 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the RBC treatment plant are estimated as follows:

Construction cost	:	226.00 million Baht
Land acquisition cost	:	150.00 million Baht
Annual O&M cost	:	13.25 million Baht

11. Bang Bua Thong South Area Wastewater Treatment Plant

(1) Oxidation Ditch

1) Structural Design

The oxidation ditch is a modification of the conventional activated sludge process. It is composed of aeration ditch and final sedimentation basin. The daily average wastewater of 7,900 m^3/d is used for oxidation ditch design. The design effective storage capacity of ditch is 4,000 m^3 with a detention time of 12.2 hours. The effective water depth of ditch is 2.5 m. The sedimentation time of final sedimentation basin is 4.0 hours with a surface loading of 14.9 $m^3/m^2/d$.

The design net treatment area is estimated at about 2.25 ha including ditch, final sedimentation basin, drying bed and control building.

The design capacity of the inflow pump, oxidation ditch, final sedimentation basin and drying bed are as follows:

Inflow Pump	: 8.61 m^3/min. 7.0 m (hourly max. dry)
Oxidation Ditch	: 4 m(W) x 100 m(L) x 2.5 m(D) x 4 units
Final Sedimentation basin	: ϕ13 m x 2.5 m(D) x 4 units
Drying Bed	: 11 m x 15 m x 24 units (3,960 m^2)

2) Construction and O&M Costs

In the previous Section 3.11 in Chapter 2, the construction and O&M costs of several treatment system in terms of unit wastewater amount per day excluding land acquisition cost were estimated. The unit land acquisition cost of the potential treatment plant site is to be 0.50 million Baht/rai. The construction and land acquisition costs, and annual O&M cost of the oxidation ditch are estimated as follows:

Construction cost : 47.71 million Baht
Land acquisition cost : 7.03 million Baht
Annual O&M cost : 4.65 million Baht

(2) Conventional Activated Sludge

1) Structural Design

The conventional activated sludge system consists of inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge disposal facilities. Daily maximum wastewater of 9,500 m^3/d is used for design of conventional activated sludge system.

The major mechanical/electrical equipment is inflow pump and air diffuser. Their design capacities are as follows:

- Inflow Pump : 11.7 kw for dry weather, 34.8 kw for wet weather
- Surface Aerator : 11 kw/unit x 6 units

The design net treatment plant area is estimated at about 0.8 ha including inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge drying bed.

The design capacity of the inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and drying bed are as follows:

- Inflow pump station : 8.61 m^3/min. x 7.0 m (dry hourly max.)
  : 25.8 m^3/min. x 7.0 m (wet hourly max.)
- Primary sedimentation basin : ϕ14.4 m x 2.5 m(D) x 2 units
- Aeration tank : 4.0 m(W) x 30.0 m(L) x 5.0 m(D) x 4 units
- Secondary sedimentation basin : ϕ15.6 m x 2.6 m x 2 units

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the AS in Bang Bua Thong South are estimated as shown below.

Construction cost : 65.42 million Baht
Land acquisition cost : 2.5 million Baht
Annual O&M cost : 4.68 million Baht

(3) Rotating Biological Contactor (RBC)

1) Structural Design

The rotating biological contactor system consists of inflow pump station, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge disposal facilities. Daily maximum wastewater of 9,500 m^3/d is used for design of RBC system.

The major mechanical/electrical equipment is inflow pump and rotating biological contactor. Their design capacity are as follows:

- Inflow pump : 11.7 kw for dry weather
  34.8 kw for wet weather
- Rotating biological contactor : ϕ3.6 m x 7.5 m(L) x 14 units

The design net treatment plant area is estimated at about 0.8 ha including inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge drying bed.

The design capacity of inflow pump, primary sedimentation basin, aeration tank, secondary sedimentation basin and sludge drying bed are as follows:

- Inflow pump station : 8.61 m^3/min. x 7.0 m (dry hourly max.)
- Primary sedimentation basin : ϕ14.4 m x 2.5 m(D)x 2 units
- Aeration tank : 3.8 m(W) x 7.8 m(L) x 2.5 m x 14 units

- Secondary sedimentation : ϕ15.6 m x 2.6 m x 2 units
- Drying bed : 12 m x 15 m x 12 units (2,160 m^2)

2) Construction and O&M Costs

The construction and land acquisition costs, and annual O&M cost of the RBC treatment plant are estimated as follows:

Construction cost : 74.52 million Baht
Land acquisition cost : 2.50 million Baht
Annual O&M cost : 5.14 million Baht

3.1.6.3 Comparison of Treatment Plant Construction Cost by NPV

Net present value is estimated with following conditions.

Project Life	30 Years
Construction Period	2 years of 1996 - 1997
Land Acquisition	in 1996
Operation & Maintenance Period	Start from 1997 to 2025
Annual Discount Rate	8%

(million Baht)

Chai Nat	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	11.67	19.60	46.68
Land Acquisition	17.95	8.50	4.72
O/M Cost	18.20	70.05	484.70
Total	47.82	98.15	536.10

(million Baht)

Sing Buri East	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	5.93	10.92	24.52
Land Acquisition	7.56	4.09	2.15
O/M Cost	9.79	43.42	245.17
Total	23.28	58.43	271.84

(million Baht)

Sing Buri West	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	16.48	26.42	64.88
Land Acquisition	13.19	6.29	3.01
O/M Cost	23.82	88.27	676.60
Total	53.49	120.98	744.49

(million Baht)

Lop Buri	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	34.32	49.86	130.54
Land Acquisition	71.80	31.69	14.76
O/M Cost	44.85	149.90	1,370.02
Total	150.97	231.45	1,515.32

(million Baht)

Ang Thong	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	7.15	12.82	29.27
Land Acquisition	8.57	4.41	2.39
O/M Cost	12.62	49.05	302.56
Total	28.34	66.28	334.22

(million Baht)

Pa Mok East	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	3.75	7.34	15.83
Land Acquisition	4.42	2.48	1.44
O/M Cost	7.02	30.83	162.51
Total	15.19	40.65	179.78

(million Baht)

Pa Mok West	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	3.16	6.33	13.46
Land Acquisition	4.07	2.34	1.39
O/M Cost	5.60	28.01	138.66
Total	12.83	36.68	153.51

(million Baht)

Sena	Stabilization Pond	Aerated lagoon	Oxidation Ditch
Const. Cost	4.93	9.32	20.57
Land Acquisition	6.84	3.70	2.09
O/M Cost	8.40	37.85	212.89
Total	20.17	50.87	235.55

(million Baht)

Rangsit	Oxidation Ditch	Activated Sludge	RBC
Const. Cost	634.17	784.43	995.18
Land Acquisition	143.29	118.10	105.50
O/M Cost	5,705.61	5,422.67	5,903.15
Total	6,483.07	6,325.20	7,003.83

(million Baht)

B B T North	Oxidation Ditch	Activated Sludge	RBC
Const. Cost	186.97	237.47	296.09
Land Acquisition	283.44	188.96	188.96
O/M Cost	1,709.02	1,700.62	1,856.13
Total	2,179.43	2,127.05	2,341.18

(million Baht)

B B T South	Oxidation Ditch	Activated Sludge	RBC
Const. Cost	62.50	85.71	97.63
Land Acquisition	8.86	3.15	3.15
O/M Cost	651.41	655.59	720.01
Total	722.77	744.45	820.79

Table 3.1.6.3 (1) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Chai Nat)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	5.61	17.95		23.56	9.42	8.50		17.92	22.44	4.72		27.16
1997	6.06			6.06	10.18			10.18	24.24			24.24
1998			0.19	0.19			0.73	0.73			5.08	5.08
1999			0.21	0.21			0.79	0.79			5.49	5.49
2000			0.22	0.22			0.86	0.86			5.93	5.93
2001			0.24	0.24			0.93	0.93			6.40	6.40
2002			0.26	0.26			1.00	1.00			6.92	6.92
2003			0.28	0.28			1.08	1.08			7.47	7.47
2004			0.30	0.30			1.17	1.17			8.07	8.07
2005			0.33	0.33			1.26	1.26			8.71	8.71
2006			0.35	0.35			1.36	1.36			9.41	9.41
2007			0.38	0.38			1.47	1.47			10.16	10.16
2008			0.41	0.41			1.59	1.59			10.98	10.98
2009			0.45	0.45			1.71	1.71			11.85	11.85
2010			0.48	0.48			1.85	1.85			12.80	12.80
2011			0.52	0.52			2.00	2.00			13.83	13.83
2012			0.56	0.56			2.16	2.16			14.93	14.93
2013			0.61	0.61			2.33	2.33			16.13	16.13
2014			0.65	0.65			2.52	2.52			17.42	17.42
2015			0.71	0.71			2.72	2.72			18.81	18.81
2016			0.76	0.76			2.94	2.94			20.32	20.32
2017			0.82	0.82			3.17	3.17			21.94	21.94
2018			0.89	0.89			3.42	3.42			23.70	23.70
2019			0.96	0.96			3.70	3.70			25.59	25.59
2020			1.04	1.04			3.99	3.99			27.64	27.64
2021			1.12	1.12			4.31	4.31			29.85	29.85
2022			1.21	1.21			4.66	4.66			32.24	32.24
2023			1.31	1.31			5.03	5.03			34.82	34.82
2024			1.41	1.41			5.43	5.43			37.60	37.60
2025			1.53	1.53			5.87	5.87			40.61	40.61
TOTAL	11.67	17.95	18.20	47.82	19.60	8.50	70.05	98.15	46.68	4.72	484.70	536.10

Table 3.1.6.3 (2) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Sing Buri East)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	2.85	7.56		10.41	5.25	4.09		9.34	11.79	2.15		13.94
1997	3.08			3.08	5.67			5.67	12.73			12.73
1998			0.10	0.10			0.46	0.46			2.57	2.57
1999			0.11	0.11			0.49	0.49			2.78	2.78
2000			0.12	0.12			0.53	0.53			3.00	3.00
2001			0.13	0.13			0.57	0.57			3.24	3.24
2002			0.14	0.14			0.62	0.62			3.50	3.50
2003			0.15	0.15			0.67	0.67			3.78	3.78
2004			0.16	0.16			0.72	0.72			4.08	4.08
2005			0.18	0.18			0.78	0.78			4.41	4.41
2006			0.19	0.19			0.84	0.84			4.76	4.76
2007			0.21	0.21			0.91	0.91			5.14	5.14
2008			0.22	0.22			0.98	0.98			5.55	5.55
2009			0.24	0.24			1.06	1.06			6.00	6.00
2010			0.26	0.26			1.15	1.15			6.48	6.48
2011			0.28	0.28			1.24	1.24			6.99	6.99
2012			0.30	0.30			1.34	1.34			7.55	7.55
2013			0.33	0.33			1.44	1.44			8.16	8.16
2014			0.35	0.35			1.56	1.56			8.81	8.81
2015			0.38	0.38			1.69	1.69			9.51	9.51
2016			0.41	0.41			1.82	1.82			10.28	10.28
2017			0.44	0.44			1.97	1.97			11.10	11.10
2018			0.48	0.48			2.12	2.12			11.98	11.98
2019			0.52	0.52			2.29	2.29			12.94	12.94
2020			0.56	0.56			2.48	2.48			13.98	13.98
2021			0.60	0.60			2.67	2.67			15.10	15.10
2022			0.65	0.65			2.89	2.89			16.31	16.31
2023			0.70	0.70			3.12	3.12			17.61	17.61
2024			0.76	0.76			3.37	3.37			19.02	19.02
2025			0.82	0.82			3.64	3.64			20.54	20.54
TOTAL	5.93	7.56	9.79	23.28	10.92	4.09	43.42	58.43	24.52	2.15	245.17	271.84

Table 3.1.6.3 (3) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Sing Buri West)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	7.92	13.19		21.11	12.70	6.29		18.99	31.19	3.01		34.20
1997	8.56			8.56	13.72			13.72	33.69			33.69
1998			0.25	0.25			0.93	0.93			7.10	7.10
1999			0.27	0.27			1.00	1.00			7.66	7.66
2000			0.29	0.29			1.08	1.08			8.28	8.28
2001			0.31	0.31			1.17	1.17			8.94	8.94
2002			0.34	0.34			1.26	1.26			9.66	9.66
2003			0.37	0.37			1.36	1.36			10.43	10.43
2004			0.40	0.40			1.47	1.47			11.26	11.26
2005			0.43	0.43			1.59	1.59			12.16	12.16
2006			0.46	0.46			1.71	1.71			13.14	13.14
2007			0.50	0.50			1.85	1.85			14.19	14.19
2008			0.54	0.54			2.00	2.00			15.32	15.32
2009			0.58	0.58			2.16	2.16			16.55	16.55
2010			0.63	0.63			2.33	2.33			17.87	17.87
2011			0.68	0.68			2.52	2.52			19.30	19.30
2012			0.73	0.73			2.72	2.72			20.84	20.84
2013			0.79	0.79			2.94	2.94			22.51	22.51
2014			0.86	0.86			3.17	3.17			24.31	24.31
2015			0.92	0.92			3.43	3.43			26.26	26.26
2016			1.00	1.00			3.70	3.70			28.36	28.36
2017			1.08	1.08			3.99	3.99			30.63	30.63
2018			1.16	1.16			4.31	4.31			33.08	33.08
2019			1.26	1.26			4.66	4.66			35.72	35.72
2020			1.36	1.36			5.03	5.03			38.58	38.58
2021			1.47	1.47			5.44	5.44			41.67	41.67
2022			1.58	1.58			5.87	5.87			45.00	45.00
2023			1.71	1.71			6.34	6.34			48.60	48.60
2024			1.85	1.85			6.85	6.85			52.49	52.49
2025			2.00	2.00			7.39	7.39			56.69	56.69
TOTAL	16.48	13.19	23.82	53.49	26.42	6.29	88.27	120.98	64.88	3.01	676.60	744.49

Table 3.1.6.3 (4) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Lop Buri)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	16.50	71.80		88.30	23.97	31.69		55.66	62.76	14.76		77.52
1997	17.82			17.82	25.89			25.89	67.78			67.78
1998			0.47	0.47			1.57	1.57			14.37	14.37
1999			0.51	0.51			1.70	1.70			15.52	15.52
2000			0.55	0.55			1.83	1.83			16.76	16.76
2001			0.59	0.59			1.98	1.98			18.10	18.10
2002			0.64	0.64			2.14	2.14			19.55	19.55
2003			0.69	0.69			2.31	2.31			21.11	21.11
2004			0.75	0.75			2.49	2.49			22.80	22.80
2005			0.81	0.81			2.69	2.69			24.63	24.63
2006			0.87	0.87			2.91	2.91			26.60	26.60
2007			0.94	0.94			3.14	3.14			28.73	28.73
2008			1.02	1.02			3.39	3.39			31.02	31.02
2009			1.10	1.10			3.67	3.67			33.51	33.51
2010			1.18	1.18			3.96	3.96			36.19	36.19
2011			1.28	1.28			4.28	4.28			39.08	39.08
2012			1.38	1.38			4.62	4.62			42.21	42.21
2013			1.49	1.49			4.99	4.99			45.58	45.58
2014			1.61	1.61			5.39	5.39			49.23	49.23
2015			1.74	1.74			5.82	5.82			53.17	53.17
2016			1.88	1.88			6.28	6.28			57.42	57.42
2017			2.03	2.03			6.79	6.79			62.02	62.02
2018			2.19	2.19			7.33	7.33			66.98	66.98
2019			2.37	2.37			7.91	7.91			72.34	72.34
2020			2.56	2.56			8.55	8.55			78.12	78.12
2021			2.76	2.76			9.23	9.23			84.37	84.37
2022			2.98	2.98			9.97	9.97			91.12	91.12
2023			3.22	3.22			10.77	10.77			98.41	98.41
2024			3.48	3.48			11.63	11.63			106.29	106.29
2025			3.76	3.76			12.56	12.56			114.79	114.79
TOTAL	34.32	71.80	44.85	150.97	49.86	31.69	149.90	231.45	130.54	14.76	1,370.02	1,515.32

Table 3.1.6.3 (5) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Ang Thong)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	3.44	8.57		12.01	6.17	4.41		10.58	14.07	2.39		16.46
1997	3.71			3.71	6.66			6.66	15.20			15.20
1998			0.13	0.13			0.51	0.51			3.17	3.17
1999			0.14	0.14			0.56	0.56			3.43	3.43
2000			0.15	0.15			0.60	0.60			3.70	3.70
2001			0.17	0.17			0.65	0.65			4.00	4.00
2002			0.18	0.18			0.70	0.70			4.32	4.32
2003			0.19	0.19			0.76	0.76			4.66	4.66
2004			0.21	0.21			0.82	0.82			5.04	5.04
2005			0.23	0.23			0.88	0.88			5.44	5.44
2006			0.24	0.24			0.95	0.95			5.87	5.87
2007			0.26	0.26			1.03	1.03			6.34	6.34
2008			0.29	0.29			1.11	1.11			6.85	6.85
2009			0.31	0.31			1.20	1.20			7.40	7.40
2010			0.33	0.33			1.30	1.30			7.99	7.99
2011			0.36	0.36			1.40	1.40			8.63	8.63
2012			0.39	0.39			1.51	1.51			9.32	9.32
2013			0.42	0.42			1.63	1.63			10.07	10.07
2014			0.45	0.45			1.76	1.76			10.87	10.87
2015			0.49	0.49			1.90	1.90			11.74	11.74
2016			0.53	0.53			2.06	2.06			12.68	12.68
2017			0.57	0.57			2.22	2.22			13.70	13.70
2018			0.62	0.62			2.40	2.40			14.79	14.79
2019			0.67	0.67			2.59	2.59			15.98	15.98
2020			0.72	0.72			2.80	2.80			17.25	17.25
2021			0.78	0.78			3.02	3.02			18.63	18.63
2022			0.84	0.84			3.26	3.26			20.13	20.13
2023			0.91	0.91			3.52	3.52			21.74	21.74
2024			0.98	0.98			3.80	3.80			23.47	23.47
2025			1.06	1.06			4.11	4.11			25.35	25.35
TOTAL	7.15	8.57	12.62	28.34	12.83	4.41	49.05	66.29	29.27	2.39	302.56	334.22

Table 3.1.6.3 (6) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Pa Mok East)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	1.80	4.42		6.22	3.53	2.48		6.01	7.61	1.44		9.05
1997	1.95			1.95	3.81			3.81	8.22			8.22
1998			0.07	0.07			0.32	0.32			1.70	1.70
1999			0.08	0.08			0.35	0.35			1.84	1.84
2000			0.09	0.09			0.38	0.38			1.99	1.99
2001			0.09	0.09			0.41	0.41			2.15	2.15
2002			0.10	0.10			0.44	0.44			2.32	2.32
2003			0.11	0.11			0.47	0.47			2.50	2.50
2004			0.12	0.12			0.51	0.51			2.70	2.70
2005			0.13	0.13			0.55	0.55			2.92	2.92
2006			0.14	0.14			0.60	0.60			3.15	3.15
2007			0.15	0.15			0.65	0.65			3.41	3.41
2008			0.16	0.16			0.70	0.70			3.68	3.68
2009			0.17	0.17			0.75	0.75			3.97	3.97
2010			0.19	0.19			0.81	0.81			4.29	4.29
2011			0.20	0.20			0.88	0.88			4.64	4.64
2012			0.22	0.22			0.95	0.95			5.01	5.01
2013			0.23	0.23			1.03	1.03			5.41	5.41
2014			0.25	0.25			1.11	1.11			5.84	5.84
2015			0.27	0.27			1.20	1.20			6.31	6.31
2016			0.29	0.29			1.29	1.29			6.81	6.81
2017			0.32	0.32			1.40	1.40			7.36	7.36
2018			0.34	0.34			1.51	1.51			7.94	7.94
2019			0.37	0.37			1.63	1.63			8.58	8.58
2020			0.40	0.40			1.76	1.76			9.27	9.27
2021			0.43	0.43			1.90	1.90			10.01	10.01
2022			0.47	0.47			2.05	2.05			10.81	10.81
2023			0.50	0.50			2.21	2.21			11.67	11.67
2024			0.54	0.54			2.39	2.39			12.61	12.61
2025			0.59	0.59			2.58	2.58			13.62	13.62
TOTAL	3.75	4.42	7.02	15.19	7.34	2.48	30.83	40.65	15.83	1.44	162.51	179.78

Table 3.1.6.3 (7) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Pa Mok West)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	1.52	4.07		5.59	3.04	2.34		5.38	6.47	1.39		7.86
1997	1.64			1.64	3.29			3.29	6.99			6.99
1998			0.06	0.06			0.29	0.29			1.45	1.45
1999			0.06	0.06			0.32	0.32			1.57	1.57
2000			0.07	0.07			0.34	0.34			1.70	1.70
2001			0.07	0.07			0.37	0.37			1.83	1.83
2002			0.08	0.08			0.40	0.40			1.98	1.98
2003			0.09	0.09			0.43	0.43			2.14	2.14
2004			0.09	0.09			0.47	0.47			2.31	2.31
2005			0.10	0.10			0.50	0.50			2.49	2.49
2006			0.11	0.11			0.54	0.54			2.69	2.69
2007			0.12	0.12			0.59	0.59			2.91	2.91
2008			0.13	0.13			0.63	0.63			3.14	3.14
2009			0.14	0.14			0.69	0.69			3.39	3.39
2010			0.15	0.15			0.74	0.74			3.66	3.66
2011			0.16	0.16			0.80	0.80			3.96	3.96
2012			0.17	0.17			0.86	0.86			4.27	4.27
2013			0.19	0.19			0.93	0.93			4.61	4.61
2014			0.20	0.20			1.01	1.01			4.98	4.98
2015			0.22	0.22			1.09	1.09			5.38	5.38
2016			0.23	0.23			1.17	1.17			5.81	5.81
2017			0.25	0.25			1.27	1.27			6.28	6.28
2018			0.27	0.27			1.37	1.37			6.78	6.78
2019			0.30	0.30			1.48	1.48			7.32	7.32
2020			0.32	0.32			1.60	1.60			7.91	7.91
2021			0.35	0.35			1.73	1.73			8.54	8.54
2022			0.37	0.37			1.86	1.86			9.22	9.22
2023			0.40	0.40			2.01	2.01			9.96	9.96
2024			0.43	0.43			2.17	2.17			10.76	10.76
2025			0.47	0.47			2.35	2.35			11.62	11.62
TOTAL	3.16	4.07	5.60	12.83	6.33	2.34	28.01	36.68	13.46	1.39	138.66	153.51

Table 3.1.6.3 (8) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Sena)

(Unit: Million Baht)

Year	Stabilization Pond				Aerated Lagoon				Oxidation Ditch			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	2.37	6.84		9.21	4.48	3.70		8.18	9.89	2.09		11.98
1997	2.56			2.56	4.84			4.84	10.68			10.68
1998			0.09	0.09			0.40	0.40			2.23	2.23
1999			0.10	0.10			0.43	0.43			2.41	2.41
2000			0.10	0.10			0.46	0.46			2.61	2.61
2001			0.11	0.11			0.50	0.50			2.81	2.81
2002			0.12	0.12			0.54	0.54			3.04	3.04
2003			0.13	0.13			0.58	0.58			3.28	3.28
2004			0.14	0.14			0.63	0.63			3.54	3.54
2005			0.15	0.15			0.68	0.68			3.83	3.83
2006			0.16	0.16			0.73	0.73			4.13	4.13
2007			0.18	0.18			0.79	0.79			4.46	4.46
2008			0.19	0.19			0.86	0.86			4.82	4.82
2009			0.21	0.21			0.93	0.93			5.21	5.21
2010			0.22	0.22			1.00	1.00			5.62	5.62
2011			0.24	0.24			1.08	1.08			6.07	6.07
2012			0.26	0.26			1.17	1.17			6.56	6.56
2013			0.28	0.28			1.26	1.26			7.08	7.08
2014			0.30	0.30			1.36	1.36			7.65	7.65
2015			0.33	0.33			1.47	1.47			8.26	8.26
2016			0.35	0.35			1.59	1.59			8.92	8.92
2017			0.38	0.38			1.71	1.71			9.64	9.64
2018			0.41	0.41			1.85	1.85			10.41	10.41
2019			0.44	0.44			2.00	2.00			11.24	11.24
2020			0.48	0.48			2.16	2.16			12.14	12.14
2021			0.52	0.52			2.33	2.33			13.11	13.11
2022			0.56	0.56			2.52	2.52			14.16	14.16
2023			0.60	0.60			2.72	2.72			15.30	15.30
2024			0.65	0.65			2.93	2.93			16.52	16.52
2025			0.70	0.70			3.17	3.17			17.84	17.84
TOTAL	4.93	6.84	8.40	20.17	9.32	3.70	37.85	50.87	20.57	2.09	212.89	235.55

Table 3.1.6.3 (9) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Rangsit)

(Unit: Million Baht)

Year	Oxidation Ditch				Activated Sludge				RBC			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	304.89	143.29		448.18	377.13	118.10		495.23	478.45	105.50		583.95
1997	329.28			329.28	407.30			407.30	516.73			516.73
1998			59.85	59.85			56.88	56.88			61.92	61.92
1999			64.63	64.63			61.43	61.43			66.87	66.87
2000			69.80	69.80			66.34	66.34			72.22	72.22
2001			75.39	75.39			71.65	71.65			78.00	78.00
2002			81.42	81.42			77.38	77.38			84.24	84.24
2003			87.93	87.93			83.57	83.57			90.98	90.98
2004			94.97	94.97			90.26	90.26			98.26	98.26
2005			102.57	102.57			97.48	97.48			106.12	106.12
2006			110.77	110.77			105.28	105.28			114.60	114.60
2007			119.63	119.63			113.70	113.70			123.77	123.77
2008			129.20	129.20			122.79	122.79			133.68	133.68
2009			139.54	139.54			132.62	132.62			144.37	144.37
2010			150.70	150.70			143.23	143.23			155.92	155.92
2011			162.76	162.76			154.69	154.69			168.39	168.39
2012			175.78	175.78			167.06	167.06			181.86	181.86
2013			189.84	189.84			180.43	180.43			196.41	196.41
2014			205.03	205.03			194.86	194.86			212.13	212.13
2015			221.43	221.43			210.45	210.45			229.10	229.10
2016			239.14	239.14			227.28	227.28			247.42	247.42
2017			258.28	258.28			245.47	245.47			267.22	267.22
2018			278.94	278.94			265.10	265.10			288.59	288.59
2019			301.25	301.25			286.31	286.31			311.68	311.68
2020			325.35	325.35			309.22	309.22			336.62	336.62
2021			351.38	351.38			333.96	333.96			363.55	363.55
2022			379.49	379.49			360.67	360.67			392.63	392.63
2023			409.85	409.85			389.53	389.53			424.04	424.04
2024			442.64	442.64			420.69	420.69			457.96	457.96
2025			478.05	478.05			454.34	454.34			494.60	494.60
TOTAL	634.17	143.29	5,705.61	6,483.07	784.43	118.10	5,422.67	6,325.20	995.18	105.50	5,903.15	7,003.83

Table 3.1.6.3 (10) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Bang Bua Thong North)

(Unit: Million Baht)

Year	Oxidation Ditch				Activated Sludge				RBC			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	89.89	283.44		373.33	114.17	188.96		303.13	142.35	188.96		331.31
1997	97.08			97.08	123.30			123.30	153.74			153.74
1998			17.93	17.93			17.84	17.84			19.47	19.47
1999			19.36	19.36			19.26	19.26			21.03	21.03
2000			20.91	20.91			20.81	20.81			22.71	22.71
2001			22.58	22.58			22.47	22.47			24.52	24.52
2002			24.39	24.39			24.27	24.27			26.49	26.49
2003			26.34	26.34			26.21	26.21			28.61	28.61
2004			28.45	28.45			28.31	28.31			30.89	30.89
2005			30.72	30.72			30.57	30.57			33.37	33.37
2006			33.18	33.18			33.02	33.02			36.04	36.04
2007			35.83	35.83			35.66	35.66			38.92	38.92
2008			38.70	38.70			38.51	38.51			42.03	42.03
2009			41.80	41.80			41.59	41.59			45.39	45.39
2010			45.14	45.14			44.92	44.92			49.03	49.03
2011			48.75	48.75			48.51	48.51			52.95	52.95
2012			52.65	52.65			52.39	52.39			57.18	57.18
2013			56.86	56.86			56.58	56.58			61.76	61.76
2014			61.41	61.41			61.11	61.11			66.70	66.70
2015			66.33	66.33			66.00	66.00			72.03	72.03
2016			71.63	71.63			71.28	71.28			77.80	77.80
2017			77.36	77.36			76.98	76.98			84.02	84.02
2018			83.55	83.55			83.14	83.14			90.74	90.74
2019			90.24	90.24			89.79	89.79			98.00	98.00
2020			97.45	97.45			96.98	96.98			105.84	105.84
2021			105.25	105.25			104.73	104.73			114.31	114.31
2022			113.67	113.67			113.11	113.11			123.45	123.45
2023			122.76	122.76			122.16	122.16			133.33	133.33
2024			132.59	132.59			131.93	131.93			144.00	144.00
2025			143.19	143.19			142.49	142.49			155.52	155.52
TOTAL	186.97	283.44	1,709.02	2,179.43	237.47	188.96	1,700.62	2,127.05	296.09	188.96	1,856.13	2,341.18

Table 3.1.6.3 (11) COMPARISON OF PROJECT COST OF TREATMENT PLANT BY PRESENT VALUE (Bang Bua Thong South)

(Unit: Million Baht)

Year	Oxidation Ditch				Activated Sludge				RBC			
	Const.	Land	O/M	Total	Const.	Land	O/M	Total	Const.	Land	O/M	Total
1996	30.05	8.86		38.91	41.21	3.15		44.36	46.94	3.15		50.09
1997	32.45			32.45	44.50			44.50	50.69			50.69
1998			6.83	6.83			6.88	6.88			7.55	7.55
1999			7.38	7.38			7.43	7.43			8.16	8.16
2000			7.97	7.97			8.02	8.02			8.81	8.81
2001			8.61	8.61			8.66	8.66			9.51	9.51
2002			9.30	9.30			9.36	9.36			10.27	10.27
2003			10.04	10.04			10.10	10.10			11.10	11.10
2004			10.84	10.84			10.91	10.91			11.98	11.98
2005			11.71	11.71			11.79	11.79			12.94	12.94
2006			12.65	12.65			12.73	12.73			13.98	13.98
2007			13.66	13.66			13.75	13.75			15.10	15.10
2008			14.75	14.75			14.85	14.85			16.30	16.30
2009			15.93	15.93			16.03	16.03			17.61	17.61
2010			17.21	17.21			17.32	17.32			19.02	19.02
2011			18.58	18.58			18.70	18.70			20.54	20.54
2012			20.07	20.07			20.20	20.20			22.18	22.18
2013			21.67	21.67			21.81	21.81			23.96	23.96
2014			23.41	23.41			23.56	23.56			25.87	25.87
2015			25.28	25.28			25.44	25.44			27.94	27.94
2016			27.30	27.30			27.48	27.48			30.18	30.18
2017			29.49	29.49			29.68	29.68			32.59	32.59
2018			31.85	31.85			32.05	32.05			35.20	35.20
2019			34.39	34.39			34.61	34.61			38.02	38.02
2020			37.14	37.14			37.38	37.38			41.06	41.06
2021			40.12	40.12			40.37	40.37			44.34	44.34
2022			43.33	43.33			43.60	43.60			47.89	47.89
2023			46.79	46.79			47.09	47.09			51.72	51.72
2024			50.53	50.53			50.86	50.86			55.86	55.86
2025			54.58	54.58			54.93	54.93			60.33	60.33
TOTAL	62.50	8.86	651.41	722.77	85.71	3.15	655.59	744.45	97.63	3.15	720.01	820.79

3.2.6 Design of Wastewater Collection System

Table 3.2.6 (1) Distribution of Population and Wastewater Quantity (SING BURI)

No.of Sewers		Commercial Area			Residential Area (Medium)			Residential Area (Low)			Public Land		Industrial Area		Vacant Area		Service Area			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1		0.00	200	0	0.00	100	0	28.50	30	855	11.80	0	0.00	0	86.60	0	126.90	6.74	855	126.90	6.74	856
1/2		0.00	200	0	4.50	100	450	6.00	30	180	13.70	0	0.00	0	0.00	0	24.20	26.03	630	24.20	26.03	630
1/3		0.00	200	0	37.30	100	3,730	0.00	30	0	0.00	0	0.00	0	0.00	0	37.30	100.00	3,730	37.30	100.00	3,730
1/4		0.00	200	0	23.70	100	2,370	27.40	30	822	0.00	0	0.00	0	0.00	0	51.10	62.47	3,192	51.10	62.47	3,192
1/5		0.00	200	0	5.10	100	510	37.30	30	1,119	6.80	0	0.00	0	0.00	0	49.20	33.11	1,629	49.20	33.11	1,629
	1/6																					
2/1		0.00	200	0	0.00	100	0	0.00	30	0	0.00	0	26.40	0	47.30	0	73.70	0.00	0	73.70	3.18	235
2/2		0.00	200	0	0.00	100	0	0.00	30	0	5.30	0	18.50	0	63.70	0	87.50	0.00	0	87.50	3.18	278
2/3		0.00	200	0	0.00	100	0	0.00	30	0	13.90	0	0.00	0	67.40	0	81.30	0.00	0	81.30	3.16	257
2/4		0.00	200	0	0.00	100	0	5.60	30	168	1.70	0	0.00	0	27.30	0	34.60	4.86	168	34.60	3.16	109
1/6		0.00	200	0	0.00	100	0	14.50	30	435	2.20	0	0.00	0	0.00	0	16.70	26.05	435	16.70	3.27	55
1/7		0.00	200	0	0.00	100	0	22.00	30	660	0.00	0	0.00	0	21.00	0	43.00	15.35	660	43.00	3.18	137
1/8	T.P	0.00	200	0	0.00	100	0	0.00	30	0	18.20	0	0.00	0	42.20	0	60.50	0.00	0	60.50	3.18	192
S.T.		0.00		0	70.60		7,060	141.30		4,239	73.60		44.90		355.50		686.00	16.47	11,299	686.00	16.47	11,300
3/1		0.00	200	0	0.00	100	0	65.90	30	1,977	0.00	0	0.00	0	0.00	0	65.90	30.00	1,977	65.90	30.00	1,977
3/2		8.50	200	1,700	24.40	100	2,440	39.80	30	1,194	1.10	0	0.00	0	0.00	0	73.80	72.28	5,334	73.80	72.28	5,334
	3/3																					
4/1		1.90	200	380	2.70	100	270	23.60	30	708	0.00	0	0.00	0	0.00	0	28.20	48.16	1,358	28.20	48.10	1,356
4/2		18.60	200	3,720	31.60	100	3,160	20.00	30	600	0.00	0	0.00	0	12.10	0	82.30	90.89	7,480	82.30	90.90	7,481
3/3		27.40	200	5,480	0.00	100		0.00	30	0	2.40	0	0.00	0	0.00	0	29.80	183.89	5,480	29.80	183.90	5,480
3/4		8.50	200	1,700	17.40	100	1,740	0.00	30	0	9.60	0	0.00	0	0.00	0	35.50	96.90	3,440	35.50	96.90	3,440
3/5		0.00	200	0	11.20	100	1,120	0.00	30	0	22.00	0	0.00	0	0.00	0	33.20	33.73	1,120	33.20	33.53	1,113
	3/6																					
5/1		0.00	200	0	0.00	100	0	31.20	30	936	9.90	0	0.00	0	0.00	0	41.10	22.77	936	41.10	22.77	936
3/6		0.00	200	0	0.00	100	0	0.00	30		0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0
3/7	T.P	0.00	200	0	0.00	100	0	109.10	30	3,273	6.10	0	0.00	0	0.00	0	115.20	28.41	3,273	115.20	28.42	3,274
S.T.		64.90		12,980	87.30		8,730	289.60		8,688	51.10		0.00		12.10		505.00	60.19	30,398	505.00	60.18	30,391
Total		64.90		12,980	157.90		15,790	430.90		12,927	124.70		44.90		367.60		1,191.00	35.01	41,697	1,191.00	35.01	41,691
Adopted		52.20			164.70			493.00			105.30		36.90		338.90		1,191.00		41,700			

Table 3.2.6 (2) Hydraulic Calculation for Design of Sewers (SHING BURI-EAST)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	·	ha	ha	m³/sec	Pe/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-1A		12690	12690	1700	1700							6.74	856	856	0012			0012	300	200	061	0043	1126 1150	9930 6110	100 506	
1-1B		000	12690	0	1700							0.00	0	856	0012			0012	300	200	061	0043	1150 1150	6110 9723	506 145	P.U
1-1C		000	12690	1000	2700							0.00	0	856	0012			0012	300	200	061	0043	1150 1175	9713 7473	145 395	
1-2		2420	15110	250	2950							26.03	630	1486	0022			0022	300	200	061	0043	1175 1165	7463 6905	336 442	
1-3A		3730	18840	0	2950							100.0	3730	5216	0076			0076	400	140	062	0078	1165 1165	6905 10124	431 109	P.U
1-3B		000	18840	1000	3950							0.00	0	5216	0076			0076	400	150	064	0081	1165 1150	10114 8374	110 269	
1-4		5110	23950	1250	5200							62.47	3192	8408	0122			0122	500	130	069	0136	1150 1130	8274 6334	258 442	
1-5A		4920	28870	800	6000							33.11	1629	10037	0146			0146	600	130	078	0221	1130 1201	6234 5004	442 636	
1-5B	1-6	000	28870	0	6000							0.00	0	10037	0146			0146	500	110	064	0125	1201 1132	5519 9400	595 138	P.U
2-1		7370	7370	550	550							3.18	235	235	0003			0003	300	200	061	0043	1201 1313	10580 9445	100 336	
2-2		8750	16120	650	1200							3.18	278	513	0007			0007	300	200	061	0043	1313 1270	9435 7981	337 439	
2-3A		8130	24250	0	1200							3.16	257	770	0011			0011	300	200	061	0043	1270 1270	7981 11411	439 096	P.U
2-3B		000	24250	1900	3100							0.00	0	770	0011			0011	300	200	061	0043	1279 1236	11370 7109	100 492	
2-4A		3460	27710	40	3140							3.16	109	879	0013			0013	300	200	061	0043	1236 1200	5986 5906	604 576	
2-4B		000	27710	0	3140							0.00	0	879	0013			0013	300	200	061	0043	1200 1200	5906 10557	576 191	P.U

Table 3.2.6 (3) Hydraulic Calculation for Design of Sewers (SHING BURI-EAST)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	-	ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
2-4C		000	27710	390	3530							0.00	0	879	0013			0013	300	200	061	0043	1230 1132	10647 9777	192 121	
1-6		1670	58250	550	6550							3.27	54	10970	0160			0160	600	130	078	0221	1132 1232	9300 8456	137 321	
1-7		4300	62550	900	7450							3.18	137	11107	0162			0162	600	130	078	0221	1232 1261	8446 7952	322 491	
1-8	T. PL ANT	6050	68600	100	7550							3.18	193	11300	0165			0165	600	130	078	0221	1261 1200	5579 5430	638 592	

Table 3.2.6 (4) Hydraulic Calculation for Design of Sewers (SHING BURI-WEST)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Pey/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
3-1		6590	6590	1150	1150							30.00	1977	1977	0029			0029	300	200	061	0043	1183 1093	10500 7899	100 270	
3-2	3-3	7380	13970	380	1530							72.28	5335	7312	0106			0106	500	110	064	0125	1093 1075	7699 7178	259 303	
4-1		2820	2820	400	400							48.16	1359	1359	0020			0020	300	200	061	0043	1190 1222	10570 9680	100 221	
4-2		8240	11060	510	910							90.90	7490	8849	0129			0129	600	110	072	0204	1222 1075	9380 8700	219 140	
3-3		2980	28010	700	2230							183.95	479	21640	0315			0315	800	150	102	0512	1075 1081	6878 5738	301 421	
3-4		3550	31560	1100	3330							96.90	3440	25080	0365			0365	800	150	102	0512	1081 1085	5728 3930	422 605	
3-5A		000	31560	0	3330							0.00	0	25080	0365			0365	800	090	079	0397	1085 1085	3830 3900	605 198	P. U
3-5B	3-6	3310	34870	440	3770							33.53	1110	26190	0381			0381	800	150	102	0512	1085 1225	8890 8170	109 321	
5-1		4110	4110	670	670							22.77	936	936	0014			0014	300	200	061	0043	1170 1225	10370 8868	100 305	
3-6		000	38980	23	3793							0.00	0	27126	0395			0395	800	150	102	0512	1225 1059	7225 7192	416 253	
3-7	T. PL ANT	11520	50500	430	4223							28.42	3274	30400	0443			0443	800	150	102	0512	1059 943	7182 6477	254 209	

Table 3.3.6 Design of Wastewater Collection System

Tabel 3.3.6 (1) Distribution of Population and Wastewater Quantity (LOP BURI)

No.of Sewers		Commercial Area			Residential Area (Medium)			Residential Area (Low)			Public Land		Industrial Area		Vacant Area		Service Area			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1		0.00	200	0	57.50	100	5,750	45.20	30	1,356	50.50	0	0.00	0	17.30	0	170.50	41.63	7,106	170.50	42.50	7,246
1/2		51.60	200	10,320	7.10	100	710	0.00	30	0	8.50	0	0.00	0	8.40	0	75.60	145.90	11,030	75.60	136.50	10,319
	1/3																					
2/1		11.90	200	2,380	57.00	100	5,700	25.00	30	750	0.00	0	0.00	0	38.70	0	132.60	66.59	8,830	132.60	38.85	5,152
2/2		0.00	200	0	0.00	100	0	0.00	30	0	0.00	0	0.00	0	0.00	0	0.00		0	0.00		0
1/3		28.20	200	5,640	18.90	100	1,890	0.00	30	0	0.30	0	0.00	0	0.40	0	47.80	157.53	7,530	47.80	136.50	6,525
	1/4																					
3/1		14.80	200	2,960	26.10	100	2,610	0.00	30	0	5.50	0	0.00	0	2.10	0	48.50	114.85	5,570	48.50	136.50	6,620
1/4		0.00	200	0	26.20	100	2,620	9.60	30	288	0.00	0	0.00	0	0.90	0	36.70	79.24	2,908	36.70	71.16	2,612
	1/5																					
4/1		0.00	200	0	10.80	100	1,080	0.00	30	0	22.60	0	0.00	0	0.00	0	33.40	32.34	1,080	33.40	71.16	2,377
1/5		0.00	200	0	0.00	100	0	0.00	30	0	0.00	0	0.00	0	0.00	0	0.00		0	0.00		0
1/6		0.00	200	0	8.90	100	890	0.00	30	0	13.70	0	0.00	0	17.20	0	39.80	22.36	890	39.80	44.32	1,764
	1/7																					
5/1		0.00	200	0	0.00	100	0	52.00	30	1,560	0.00	0	0.00	0	17.10	0	69.10	22.58	1,560	69.10	23.35	1,613
5/2		0.00	200	0	0.00	100	0	1.70	30	51	0.00	0	0.00	0	1.30	0	3.00	17.00	51	3.00	23.35	70
	5/3																					
6/1		0.00	200	0	43.30	100	4,330	13.60	30	408	8.70	0	0.00	0	38.80	0	104.40	45.38	4,738	104.40	40.06	4,182
6/2		25.30	200	5,060	15.90	100	1,590	0.00	30	0	6.40	0	0.00	0	5.00	0	52.60	126.43	6,650	52.60	40.06	2,107
5/3		0.00	200	0	0.00	100	0	0.00	30	0	1.50	0	0.00	0	25.60	0	27.10	0.00	0	27.10	98.71	2,675
5/4		0.00	200	0	5.10	100	510	37.40	30	1,122	2.00	0	0.00	0	16.30	0	60.80	26.84	1,632	60.80	98.71	6,002
1/7		0.00	200	0	0.00	100	0	2.20	30	66	1.20	0	0.00	0	30.00	0	33.40	1.98	66	33.40	13.23	442
	1/8																					
7/1		0.00	200	0	0.00	100	0	33.90	30	1,017	2.00	0	0.00	0	24.70	0	60.60	16.78	1,017	60.60	16.58	1,005
7/2		0.00	200	0	0.00	100	0	21.40	30	642	0.00	0	0.00	0	5.70	0	27.10	23.69	642	27.10	21.62	586
1/8	T.P	0.00	200	0	0.00	100	0	0.00	30	0	0.00	0	0.00	0	0.00	0	0.00		0	0.00	0.00	0
Total		131.80		26,360	276.80		27,680	242.00		7,260	122.90		0.00		249.50		1,023.00	59.92	61,300	1,023.00	59.92	61,296
Adopted		78.60			200.10			232.50			188.60		0.00		323.20		1,023.00		61,300			

Table 3.3.6 (2) Hydraulic Calculation for Design of Sewers (LOP BURI)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	·	ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-1A		1705	1705	730	730							42.50	7247	7247	0106			0106	500	130	059	0136	1338 1180	11338 10258	100 100	
1-1B		000	1705	60	790							0.00	0	7247	0106			0106	300	400	087	0061	1180 1177	4550 4310	692 713	FUSEKOSI
1-1C		000	1705	0	790							0.00	0	7247	0106			0106	500	110	064	0125	1177 1177	4310 9758	592 147	
1-2	1-3	756	2461	1180	1970							136.5	10320	17567	.256			0256	800	130	095	0477	1177 1139	9458 7778	145 275	
2-1		1326	1326	1440	1440							38.85	5152	5152	0075			0075	400	150	064	0081	1020 1059	8765 6249	100 401	
2-2A		000	1326	70	1510							0.00	0	5152	0075			0075	400	150	064	0081	1059 1139	5906 5792	435 516	
2-2B		000	1326	0	1510							0.00	0	5152	0075			0075	600	090	065	0184	1139 1139	5792 9600	435 114	P.U
1-3	1-4A	4780	4265	950	2920							136.5	6525	29244	0426			0426	800	130	095	0477	1139 940	7768 6423	276 211	
3-1		4850	4850	620	620							136.5	6621	6621	0096			0096	500	130	059	0136	1100 940	9410 7858	105 100	
1-4A		3670	51170	450	3370							71.16	2611	38476	0560			0560	1000	130	110	0864	940 1095	5128 4496	319 537	
1-4B		000	51170	0	3370							0.00	0	38476	0560			0560	1000	060	075	0587	1095 1095	4496 8800	537 107	P.U
1-4C	1-5	000	51170	400	3770							0.00	0	38476	0560			0560	1000	130	110	0864	1095 1140	8790 8230	108 209	
4-1		3340	3340	320	320							71.16	2377	2377	0035			0035	300	200	051	0043	1250 1140	11112 10970	106 100	

Table 3.3.6 (3) Hydraulic Calculation for Design of Sewers (LOP BURI)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	·	ha	ha	m³/sec	Pey/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-5		000	54510	45	3815							0.00	0	40853	0595			0595	600	090	065	0184	1140 1302	4449 4399	630 797	PUSEKOSI
1-6A		000	54510	0	3815							0.00	0	40853	0595			0595	800	070	070	0350	1302 1302	4399 8145	776 401	
1-6B	1-7	3980	58490	485	4300							44.32	1764	42617	0621			0621	1000	130	110	0864	1302 978	7945 7255	399 144	
5-1		6910	6910	1650	1650							23.35	1614	1514	0024			0024	300	200	061	0043	1043 973	9100 5384	100 402	
5-2A		300	7210	0	1650							23.35	70	1684	0025			0025	300	200	061	0043	973 973	5384 12100	402 -270	P.U
5-2B		000	7210	130	1780							0.00	0	1684	0025			0025	200	250	068	0021	973 1029	12100 12100	-257 -291	圧送管
5-2C	5-3	000	7210	440	2220							0.00	0	1684	0025			0025	300	200	061	0043	1029 1097	8360 7980	100 256	
6-1A		10440	10440	1500	1500							40.06	4183	4183	0061			0061	400	150	064	0081	1085 1120	9415 6304	100 396	
6-1B		000	10440	0	1500							0.00	0	4183	0061			0061	300	200	061	0043	1120 1120	6304 9800	407 197	P.U
6-1C		000	10440	800	2300							0.00	0	4183	0061			0061	400	150	064	0081	1120 1150	9700 8310	107 276	
6-2A		5250	15700	0	2300							40.06	2107	6290	0092			0092	500	110	064	0125	1150 1150	8310 12300	265 -184	P.U
6-2B		000	15700	130	2430							0.00	0	6290	0092			0092	200	1800	182	0057	1150 1097	12300 12300	-150 -203	圧送管
5-3		2710	25620	150	2580							98.71	2674	10648	0155			0155	600	130	078	0221	1097 1429	7580 7454	264 619	
5-4A		6080	31700	0	2580							98.71	6002	16650	0242			0242	600	130	078	0221	1429 1429	7454 12303	619 134	P.U

Table 3.3.6 (4) Hydraulic Calculation for Design of Sewers (LOP BURI)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
S-4B		000	31700	1300	3880							0.00	0	16550	0242			0242	800	130	095	0477	1429 978	12103 7914	132 100	
1-7	1-8	3340	93530	200	4500							13.23	441	59708	0869			0869	1200	130	124	1406	978 903	7955 6735	143 100	
7-1A		6060	6060	1000	1000							16.58	1005	1005	0015			0015	300	200	061	0043	935 930	8020 5780	100 369	
7-1B		000	6060	0	1000							0.00	0	1005	0015			0015	300	200	061	0043	930 930	5780 8400	369 107	P.U
7-1C		000	6060	380	1380							0.00	0	1005	0015			0015	300	200	061	0043	930 1018	8390 7540	108 231	
7-2		2710	8770	630	2010							21.62	586	1591	0023			0023	300	200	061	0043	1018 903	7530 6117	232 258	
1-8	T.PL ANT	000	102300	50	4550							0.00	0	61299	0893			0893	1200	130	124	1406	903 920	5217 5152	252 275	

3.4.6 Design of Wastewater Collection System

Tabel 3.4.6 (1) Distribution of Population and Wastewater Quantity (ANG THONG)

No.of Sewers		Commercial Area			Residential Area (Medium)			Residential Area (Low)			Public Land		Industrial Area		Vacant Area		Service Area			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1		0.00	120	0	0.00	60	0	0.00	20	0	15.20	0	0.00	0	52.10	0	67.30	0.00	0	67.30	16.72	1,125
1/2		0.00	120	0	0.00	60	0	0.00	20	0	0.00	0	0.00	0	20.90	0	20.90	0.00	0	20.90	16.72	349
	1/3																					
2/1		0.00	120	0	0.00	60	0	0.00	20	0	9.30	0	0.00	0	49.30	0	58.60	0.00	0	58.60	16.72	980
1/3		0.00	120	0	0.00	60	0	0.00	20	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0
1/4		0.00	120	0	8.00	60	480	5.00	20	100	2.10	0	0.00	0	0.00	0	15.10	38.41	580	15.10	16.72	252
	1/5																					
3/1		2.00	120	240	20.40	60	1,224	45.10	20	902	11.00	0	0.00	0	0.00	0	78.50	30.14	2,366	78.50	16.72	1,313
	1/5																					
4/1		2.10	120	252	9.50	60	570	57.40	20	1,148	5.10	0	0.00	0	0.00	0	74.10	26.59	1,970	74.10	16.72	1,239
1/5		0.00	120	0	0.00	60	0	0.00	20	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0
	1/6																					
5/1		4.40	120	528	9.20	60	552	15.60	20	312	23.60	0	0.00	0	0.00	0	52.80	26.36	1,392	52.80	32.19	1,700
5/2		6.40	120	768	2.80	60	168	9.60	20	192	2.70	0	0.00	0	0.00	0	21.50	52.47	1,128	21.50	32.19	692
5/3		0.00	120	0	18.90	60	1,134	3.00	20	60	7.10	0	0.00	0	0.00	0	29.00	41.17	1,194	29.00	57.23	1,660
1/6		19.80	120	2,376	13.90	60	834	8.80	20	176	1.00	0	0.00	0	0.00	0	43.50	77.84	3,386	43.50	57.23	2,490
1/7		0.00	120	0	11.70	60	702	39.10	20	782	5.90	0	0.00	0	0.00	0	56.70	26.17	1,484	56.70	29.98	1,700
1/8		0.00	120	0	0.00	60	0	0.00	20	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0.00	0.00	0
	T.P																					
Total		34.70		4,164	94.40		5,664	183.60		3,672	83.00		0.00		122.30		518.00	26.06	13,500	518.00	26.06	13,499
Adopted		23.00			51.80			127.30			54.40		0.00		261.50		518.00		13,500	518.00		

Table 3.4.6 (2) Hydraulic Calculation for Design of Sewers (ANG THONG)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Pc/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-1		6730	6730	1150	1150							16.72	1126	1126	0016			0016	300	200	061	0043	763 686	6300 3731	100 280	
1-2	1-3A	2090	8820	30	1180							16.72	349	1475	0021			0021	300	200	061	0043	686 737	2664 2604	387 444	
2-1		5860	5860	800	800							16.72	980	980	0014			0014	300	200	061	0043	656 737	5230 3440	100 360	
1-3A		000	14680	0	1180							0.00	0	2455	0036			0036	300	200	061	0043	737 737	2604 5975	444 107	P. U
1-3B		000	14680	1500	2680							0.00	0	2455	0036			0036	300	150	053	0037	737 760	5965 3354	108 392	
1-3C		000	14680	0	2680							0.00	0	2455	0036			0036	300	200	061	0043	760 760	3475 6215	380 105	P. U
1-3D		000	14680	690	3370							0.00	0	2455	0036			0036	300	150	053	0037	760 790	6205 5008	107 256	
1-4A		1510	16190	30	3400							16.72	252	2707	0039			0039	400	140	062	0078	790 760	3176 3134	423 433	
1-4B		000	16190	0	3400							0.00	0	2707	0039			0039	400	200	074	0093	760 760	3134 5160	403 101	P. U
1-4C	1-5A	000	16190	590	3990							0.00	0	2707	0039			0039	400	140	062	0078	760 780	6150 5184	102 218	
3-1	1-5A	7850	7850	650	650							16.72	1313	1313	0019			0019	300	200	061	0043	720 780	5870 4416	100 305	
4-1		7410	7410	980	980							16.72	1239	1239	0018			0018	300	200	061	0043	800 780	6670 4480	100 299	
1-5A		000	31450	0	3990							0.00	0	5259	0077			0077	400	140	062	0078	780 780	4416 8000	295 -064	P. U

Table 3.4.6 (3) Hydraulic Calculation for Design of Sewers (ANG THONG)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Pey/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-5B	1-6	000	31450	210	4200							0.00	0	5259	0077			0077	200	1200	149	0047	730 793	8000 8000	-040 -027	圧送管
5-1		5280	5280	530	530							32.19	1700	1700	0025			0025	300	200	061	0043	713 820	5800 4607	100 326	
5-2A		2150	7430	70	600							32.19	692	2392	0035			0035	300	150	053	0037	820 767	4597 0975	327 637	
5-2B		000	7430	0	600							0.00	0	2392	0035			0035	300	200	061	0043	767 760	0975 5800	637 147	P.U
5-2C		000	7430	260	860							0.00	0	2392	0035			0035	300	150	053	0037	760 697	5790 5338	148 130	
5-3		2900	10330	470	1330							57.23	1660	4052	0059			0059	400	140	062	0078	697 793	5238 4469	130 303	
1-6		4350	46130	620	4820							57.23	2489	11800	0172			0172	600	110	072	0204	793 761	4269 3432	301 353	
1-7A		5670	51800	0	4820							29.98	1700	13500	0197			0197	600	090	065	0184	761 761	3432 5914	353 105	P.U
1-7B		000	51800	930	5750							0.00	0	13500	0197			0197	600	110	072	0204	761 833	5904 4544	106 304	
1-8	T.PLANT	000	51800	480	6230							0.00	0	13500	0197			0197	600	110	072	0204	833 730	4634 3996	305 265	

3.5.6 Design of Wastewater Collection System

Table 3.5.6 (1) Distribution of Population and Wastewater Quantity (PA MOK)

No.of Sewers		Commercial Area			Residential Area (Medium)			Residential Area (Low)			Public Land		Industrial Area		Vacant Area		Service Area			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1		8.70	120	1,044	8.80	60	528	30.60	20	612	38.60	0	0.00	0	39.00	0	125.70	17.37	2,184	125.70	17.59	2,211
1/2		0.00	120	0	29.90	60	1,794	0.00	20	0	0.00	0	0.00	0	0.00	0	29.90	60.00	1,794	29.90	17.59	526
1/3		0.00	120	0	5.20	60	312	17.00	20	340	0.50	0	0.00	0	0.00	0	22.70	28.72	652	22.70	17.59	399
1/4		0.00	120	0	6.20	60	372	49.50	20	990	17.40	0	0.00	0	16.00	0	89.10	15.29	1,362	89.10	17.59	1,567
	1/5																					
2/1		0.00	120	0	3.00	60	180	32.00	20	640	0.00	0	0.00	0	85.60	0	120.60	6.80	820	120.60	17.59	2,121
1/5	T.P	0.00	120	0	0.00	60	0	25.20	20	504	0.60	0	0.00	0	1.20	0	27.00	18.67	504	27.00	17.59	475
S.T.	T.PLANT	8.70		1,044	53.10		3,186	154.30		3,086	57.10		0.00		141.80		415.00	17.63	7,316	415.00	17.59	7,300
3/1		0.00	120	0	0.00	60	0	13.10	20	262	24.20	0	0.00	0	79.40	0	116.70	2.25	262	116.70	22.73	2,653
3/2		2.30	120	276	35.00	60	2,100	0.00	20	0	8.00	0	0.00	0	7.00	0	52.30	45.43	2,376	52.30	22.73	1,189
	3/3																					
4/1		3.70	120	444	13.30	60	798	13.70	20	274	4.00	0	0.00	0	2.60	0	37.30	40.64	1,516	37.30	20.00	746
4/2		0.00	120	0	0.00	60	0	17.90	20	358	1.60	0	0.00	0	2.00	0	21.50	16.65	358	21.50	20.00	430
3/3		5.00	120	600	3.50	60	210	4.00	20	80	0.00	0	0.00	0	0.00	0	12.50	71.20	890	12.50	22.73	284
3/4		0.00	120	0	0.00	60	0	0.00	20	0	0.00	0	0.00	0	0.00	0	0.00		0	0.00	0.00	0
3/5		0.00	120	0	0.00	60	0	29.90	20	598	7.50	0	0.00	0	20.30	0	57.70	10.36	598	57.70	12.09	698
3/6	T.P	0.00	120	0	0.00	60	0	0.00	20	0	0.00	0	0.00	0	0.00	0	0.00		0	0.00	0.00	0
S.T.		11.00		1,320	51.80		3,108	78.60		1,572	45.30		0.00		111.30		298.00	20.13	6,000	298.00	20.13	6,000
Total		19.70		2,364	104.90		6,294	232.90		4,658	102.40		0.00		253.10		713.00	18.68	13,316			
Adopted		19.70			104.90			232.10			47.00		0.00		309.30		713.00		13,300			

Table 3.5.6 (2) Hydraulic Calculation for Design of Sewers (PA MOK-EAST/WEST)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	·	ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-1		12577	12577	765	765							17.59	2213	2213	0032			0032	300	150	053	0037	664 528	5300 3943	101 101	
1-2		2990	15567	480	1245							17.59	526	2739	0040			0040	400	140	062	0078	528 650	3843 3040	100 313	
1-3A		2270	17837	530	1775							17.59	399	3138	0046			0046	400	140	062	0078	650 650	3030 2159	314 391	
1-3B		000	17837	0	1775							0.00	0	3138	0046			0045	400	140	062	0078	650 650	2159 5045	391 102	P.U
1-4	1-5	8910	26747	1580	3355							17.59	1567	4705	0069			0069	400	140	062	0078	650 665	5036 2425	103 379	
2-1		12060	12060	1800	1800							17.59	2122	2122	0031			0031	300	150	053	0037	668 665	5350 2180	100 414	
1-5	T.PL ANT	2700	41507	100	3455							17.59	475	7302	0106			0106	500	110	064	0125	665 650	1980 1849	413 421	
3-1A		11670	11670	1550	1550							22.73	2653	2653	0039			0039	400	140	062	0078	666 610	5225 2659	100 301	
3-1B		000	11670	0	1550							0.00	0	2653	0039			0039	300	200	061	0043	610 610	2659 4700	311 107	P.U
3-2	3-3	5230	16900	800	2350							22.73	1189	3842	0056			0056	400	140	062	0078	610 586	4600 3290	107 214	
4-1		3730	3730	600	600							20.00	746	746	0011			0011	300	200	061	0043	550 570	4170 2809	100 256	
4-2		2150	5880	450	1050							20.00	430	1176	0017			0017	300	200	061	0043	570 586	2799 1779	257 375	
3-3		1250	24030	440	2790							22.73	284	5302	0077			0077	400	140	062	0078	586 600	1679 0943	375 462	

Table 3.5.6 (3) Hydraulic Calculation for Design of Sewers (PA MOK-WEST)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
3-4A		000	24030	50	2840							0.00	0	5302	0077			0077	400	140	062	0078	630 630	0933 0853	463 471	
3-4B		000	24030	0	2840							0.00	0	5302	0077			0077	400	140	062	0078	630 630	0853 4341	471 122	P.U
3-5		5770	29800	580	3420							12.09	698	6000	0087			0087	500	110	064	0125	630 620	4241 3444	122 221	
3-6	T.PLANT	000	29800	140	3560							0.00	0	6000	0087			0087	500	110	064	0125	620 660	1857 1575	330 438	

3.6.6 Design of Wastewater Collection System

Table 3.6.6 (1) Distribution of Population and Wastewater Quantity (SENA)

No.of Sewers		Commercial Area			Residential Area (Medium)			Residential Area (Low)			Public Land		Industrial Area		Vacant Area		Service Area			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1		0.00	200	0	12.30	100	1,230	26.40	30	792	13.70	0	0.00	0	0.00	0	52.40	38.59	2,022	52.40	47.24	2,475
1/2		4.60	200	920	4.80	100	480	24.90	30	747	2.10	0	0.00	0	0.00	0	36.40	58.98	2,147	36.40	47.24	1,720
1/3		1.40	200	280	4.20	100	420	2.30	30	69	0.00	0	0.00	0	0.00	0	7.90	97.34	769	7.90	47.24	373
	1/4																					
2/1		0.00	200	0	9.30	100	930	5.10	30	153	6.30	0	0.00	0	0.00	0	20.70	52.32	1,083	20.70	47.24	978
2/2		0.00	200	0	0.00	100	0	5.30	30	159	0.40	0	0.00	0	0.00	0	5.70	27.89	159	5.70	47.24	269
2/3A		5.30	200	1,060	1.30	100	130	1.00	30	30	1.10	0	0.00	0	0.00	0	8.70	0.00	1,220	8.70	47.24	411
2/3c		0.00	200	0	3.40	100	340	10.70	30	321	7.20	0	0.00	0	6.70	0	28.00	23.61	661	28.00	47.24	1,323
1/4	T.P	0.00	200	0	5.00	100	500	28.00	30	840	6.20	0	0.00	0	0.00	0	39.20	34.18	1,340	39.20	47.24	1,852
Total		11.30		2,260	40.30		4,030	103.70		3,111	37.00		0.00		6.70		199.00		9,401	199.00		9,401
Adopted		13.60			40.80			86.60			23.30		0.00		34.80		199.00		9,400			

Table 3.6.6 (2) Hydraulic Calculation for Design of Sewers (SENA)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	-	ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-1A		5240	5240	520	520							47.24	2476	2476	0036			0035	300	150	053	0037	373 350	2400 1500	190 157	
1-1B		000	5240	0	520							0.00	0	2476	0036			0036	300	200	061	0043	350 350	1500 5131	157 -196	P.U
1-1C		000	5240	80	600							0.00	0	2476	0036			0036	200	1200	149	0047	350 350	5131 5131	-183 -183	圧送管
1-2		3640	8880	200	800							47.24	1719	4195	0061			0061	400	140	062	0078	350 390	2065 1745	190 172	
1-3	1-4	790	9670	370	1170							47.24	374	4569	0067			0067	400	140	062	0078	390 340	1735 1125	173 184	
2-1A		2070	2070	100	100							47.24	978	978	0014			0014	300	650	110	0078	370 390	2353 1570	192 190	
2-1B		000	2070	38	138							0.00	0	978	0014			0014	300	800	122	0086	390 267	0024 -0280	255 252	
2-2		570	2640	100	238							47.24	270	1248	0018			0018	300	200	061	0043	267 267	-0290 -0511	253 285	
2-3A		870	3510	500	738							47.24	411	1659	0024			0024	300	200	061	0043	267 350	-0521 -1561	285 433	
2-3B		000	3510	0	738							0.00	0	1659	0024			0024	300	150	053	0037	350 350	-1561 2211	433 096	P.U
2-3C		2800	6310	480	1218							47.24	1322	2981	0043			0043	400	140	062	0078	350 340	2065 1283	190 168	
1-4	T.PLANT	3920	19900	590	1808							47.19	1849	9399	0137			0137	600	110	072	0204	340 340	0925 -0845	183 360	

3.7.6 Design of Wastewater Collection System

Table 3.7.6 (1) Distribution of Population and Wastewater Quantity (RANGSIT)

No.of Sewers		Commercial Area			Residential Area (Medium)			Residential Area (Low)			Public Land		Industrial Area		Vacant Area		Service Area			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1	1/2	167.40	120	20,088	187.10	60	11,226	40.50	20	810	31.10	0	68.80	0	68.70	0	563.60	57.00	32,124	563.60	57.00	32,125
(101-106)																						
1/3	1/10	0.00	120	0	326.30	60	19,578	25.50	20	510	0.00	0	0.00	0	0.00	0	351.80	57.10	20,088	351.80	57.10	20,088
2/1	2/3	153.40	120	18,408	0.00	60	0	0.00	20	0	18.20	0	0.00	0	19.20	0	190.80	96.48	18,408	190.80	96.50	18,412
3/1	3/3	137.00	120	16,440	130.20	60	7,812	0.00	20	0	3.60	0	0.00	0	0.00	0	270.80	89.56	24,252	270.80	89.60	24,264
4/1	4/3	0.00	120	0	0.00	60	0	176.00	20	3,520	0.00	0	0.00	0	45.30	0	221.30	15.91	3,520	221.30	15.90	3,519
(5/1-5/2)																						
6/1	6/3	0.00	120	0	162.20	60	9,732	65.60	20	1,312	0.00	0	0.00	0	0.00	0	227.80	48.48	11,044	227.80	48.50	11,048
6/4	6/6	55.00	120	6,600	209.00	60	12,540	39.10	20	782	2.80	0	0.00	0	0.00	0	305.90	65.13	19,922	305.90	65.10	19,914
6/7	6/10	0.00	120	0	132.50	60	7,950	0.00	20	0	0.00	0	0.00	0	0.00	0	132.50	60.00	7,950	132.50	60.00	7,950
6/11	6/14	0.00	120	0	0.00	60	0	135.80	20	2,716	0.00	0	51.20	0	40.30	0	227.30	11.95	2,716	227.30	12.00	2,728
(9/1-9/4)																						
6/15	6/17	0.00	120	0	0.00	60	0	165.40	20	3,308	0.00	0	0.00	0	233.60	0	399.00	8.29	3,308	399.00	8.30	3,312
(10/1-10/2)																						
7/1	7/4	0.00	120	0	122.70	60	7,362	0.00	20	0	0.00	0	0.00	0	39.50	0	162.20	45.39	7,362	162.20	45.40	7,364
8/1	8/3	0.00	120	0	0.00	60	0	165.30	20	3,306	0.00	0	0.00	0	111.70	0	277.00	11.94	3,306	277.00	11.90	3,296
Adopted		512.80		61,536	1,270.00		76,200	813.20		16,264	55.70	0	120.00	0	558.30	0	3,330.00	46.25	154,000	3,330.00	46.25	154,019

Table 3.7.6 (2) Hydraulic Calculation for Design of Sewers (RANGSIT)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-1	1-2	56360	56360	1240	1240							57.02	32137	32137	.601	0364	0364	0965	1200	120	119	1351	250 189	0305 -1345	100 194	
2-1		15900	15900	50	50							96.50	15344	15344	.287			0287	800	160	105	0529	180 220	-0066 -0146	100 148	
2-2		3180	19080	60	110							96.50	3069	18413	0345			0345	800	160	105	0529	220 139	-0156 -0252	149 128	
1-2	1-3A	000	75440	73	1313							0.00	-1	50549	0946		0364	1310	1200	120	119	1351	139 200	-3607 -3695	420 440	
3-1		24620	24620	710	710							89.60	22060	22060	.413			0413	800	160	105	0529	248 260	0614 -0633	100 237	
3-2		2460	27080	630	1340							89.60	2204	24264	0454			0454	800	160	105	0529	260 220	-0643 -1720	238 395	
3-3		000	27080	60	1400							0.00	0	24264	0454			0454	800	160	105	0529	220 200	-1730 -1826	396 296	
1-3A		000	102520	0	1400							0.00	0	74813	1400		0364	1764	1500	120	139	2449	290 200	-3695 -0650	408 104	P.U
1-3		1050	103580	220	1620							57.10	605	75418	1411		0364	1775	1500	120	139	2449	200 319	-0650 -0944	105 252	
1-4		9420	113000	290	1910							57.10	5379	80797	1512		0364	1876	1500	120	139	2449	319 205	-0954 -1332	253 177	
1-5		000	113000	71	1981							0.00	0	80797	1512		0364	1876	1000	280	152	1269	205 450	-3564 -3754	453 718	FUSEKOSI
1-6A		000	113000	0	1981							0.00	0	80797	1512		0364	1876	1500	120	139	2449	450 450	-3764 -2035	655 492	
1-6	1-7A	10990	123990	580	2561							57.10	6275	87072	1630		0364	1994	1500	120	139	2449	450 288	-2045 -2301	493 407	

Table 3.7.6 (3) Hydraulic Calculation for Design of Sewers (RANGSIT)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
4-1		6940	6940	420	420							15.90	1104	1104	0021			0021	300	220	064	0045	210 214	0770 -0255	100 237	
4-2	4-3	6400	13340	320	740							15.90	1018	2122	0040			0040	300	220	064	0045	214 204	-0265 -1971	208 278	
5-1		4990	4990	300	300							15.90	794	794	0015			0015	300	220	064	0045	240 215	1070 0332	100 149	
5-2		3800	8790	230	530							15.90	604	1398	0026			0026	300	220	064	0045	215 204	0322 -0244	150 195	
4-3		000	22130	65	805							0.00	-1	3519	0066			0066	400	180	070	0088	204 285	-2677 -2794	428 521	
4-4A		000	22130	0	805							0.00	0	3519	0066			0066	400	180	070	0088	285 285	-2794 1380	521 194	P.U
4-4		000	22130	50	855							0.00	0	3519	0066			0066	400	180	070	0088	285 288	1370 1270	195 118	
1-7A		000	146120	0	2561							0.00	0	90591	1695		0364	2059	1500	120	139	2449	288 288	-2801 0230	407 194	P.U
1-7	1-8	10150	156270	700	3261							57.10	5796	96387	1804		0364	2168	1500	120	139	2449	288 298	0220 -0682	105 205	
6-1		11780	11780	430	430							48.50	5714	5714	0107			0107	500	160	077	0151	180 180	0258 -0534	100 179	
6-2		9110	20890	570	1000							48.50	4418	10132	0190			0190	600	160	087	0246	180 179	-0534 -1689	178 283	
6-3		1890	22780	54	1054							48.50	917	11049	0207			0207	600	160	087	0246	179 180	-4327 -4430	547 558	
6-3A		000	22780	0	1054							0.00	0	11049	0207			0207	600	160	087	0246	180 180	-4430 0080	558 197	P.U
6-4		270	23050	200	1254							65.10	176	11225	0210			0210	600	160	087	0246	180 249	0070 -0290	108 213	

Table 3.7.6 (4) Hydraulic Calculation for Design of Sewers (RANGSIT)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	·	ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
6-5		21350	44410	680	1934							65.10	13905	25130	.470			0470	800	150	105	0529	249 247	-0490 -1567	211 327	
6-6		8950	53370	690	2624							65.10	5833	30963	0579			0579	1000	140	114	0897	247 236	-1867 -2933	326 421	
6-7	6-8A	4420	57790	330	2954							60.00	2652	33615	0629			0629	1000	140	114	0897	236 238	-2943 -3445	422 474	
7-1		7840	7840	350	350							45.40	3560	3560	0067			0067	400	180	070	0088	200 180	0565 -0145	100 151	
7-2		8130	15970	90	440							45.40	3691	7251	0136			0136	500	160	077	0151	180 179	-0245 -0409	150 166	
7-3		000	15970	54	494							0.00	0	7251	0136			0136	300	500	097	0068	179 225	-3952 -4222	541 615	FUSEKOSI
7-3A		000	15970	0	494							0.00	0	7251	0136			0136	500	160	077	0151	225 226	-4222 -1650	594 337	
7-4		250	16220	240	734							45.40	113	7364	0138			0138	500	160	077	0151	226 238	-1650 -2094	338 393	
6-8A		000	74010	0	2954							0.00	0	40979	0767			0767	1000	140	114	0897	238 238	-2094 0255	339 194	P.U
6-8		8240	82250	420	3374							60.00	4944	45923	0859			0859	1000	140	114	0897	238 204	0245 -0403	135 136	
6-9		590	82840	190	3564							60.00	354	46277	0866			0866	1000	140	114	0897	204 213	-0413 -0700	137 175	
6-10		000	82840	1620	5184							0.00	0	46277	0866			0866	1000	140	114	0897	213 270	-0710 -3179	176 480	
6-11		530	83370	200	5384							12.00	63	46340	0867			0867	1000	140	114	0897	270 263	-3189 -3499	481 505	
6-12A		000	83370	0	5384							0.00	0	46340	0867			0867	1000	140	114	0897	263 263	-3999 0530	555 102	P.U
6-12	6-13A	5940	89310	1480	6864							12.00	713	47053	0881			0881	1000	140	114	0897	263 200	0520 -1731	103 265	

Table 3.7.6 (5) Hydraulic Calculation for Design of Sewers (RANGSIT)

P 4

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	·	ha	ha	m³/sec	Pey/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
8-1		11650	11650	640	640							11.90	1388	1388	0026			0026	300	220	064	0045	200 200	0670 -0300	100 257	
8-2		10330	21990	740	1380							11.90	1229	2617	0049			0049	400	180	070	0088	200 200	-1000 -2521	257 409	
8-2A		000	21990	0	1380							0.00	0	2617	0049			0049	400	180	070	0088	200 200	-2521 0560	409 101	P.U
8-3	6 -13A	5710	27700	380	1760							11.90	680	3297	0062			0062	400	180	070	0088	200 200	0550 -0223	102 179	
9-1		6970	6970	320	320							12.00	837	837	0016	0172	0172	0188	600	160	087	0246	200 200	0350 -0243	100 159	
9-2		6210	13180	290	610							12.00	745	1582	0030		0172	0202	600	160	087	0246	200 192	-0253 -0788	160 206	
9-3		000	13180	40	650							0.00	0	1582	0030		0172	0202	400	350	098	0123	192 200	-3208 -3348	459 491	FUSEKOSI
9-3A		000	13180	0	650							0.00	0	1582	0030		0172	0202	600	160	087	0246	200 200	-3348 -1040	470 239	
9-4		320	13500	200	850							12.00	38	1620	0030		0172	0202	600	160	087	0246	200 200	-1050 -1410	240 276	
6 -13A		000	130510	0	6864							0.00	-1	51969	0973		0172	1145	1200	120	119	1351	200 200	-1731 0500	244 021	P.U
6-13		000	130510	57	6921							0.00	0	51969	0973		0172	1145	800	250	134	0674	200 245	-4500 -4648	563 623	FUSEKOSI
6 -14A		000	130510	0	6921							0.00	0	51969	0973		0172	1145	1200	120	119	1351	245 245	-4648 0100	580 196	
6-14	6-15	000	153870	50	6971							0.00	0	53908	1009		0172	1181	1200	120	119	1351	245 310	0090 0030	107 178	

Table 3.7.6 (6) Hydraulic Calculation for Design of Sewers (RANGSIT)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Pe/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
10-1		13810	13810	750	750							8.30	1147	1147	0021			0021	300	220	064	0045	290 290	1570 -0280	190 285	
10-2		9550	23360	800	1550							8.30	792	1939	0036			0036	300	220	064	0045	290 310	-0290 -2270	286 504	
10 -2A	6-14	000	23360	0	1550							0.00	0	1939	0036			0036	300	220	064	0045	310 245	-2270 1100	594 102	P.U
6-15		2760	156630	200	7171							12.00	332	54240	1015		0172	1187	1200	120	119	1351	310 327	0020 -0240	179 222	
6-16		000	156630	43	7214							0.00	0	54240	1015		0172	1187	800	280	139	0700	327 327	-4049 -4169	645 657	FUSEKOSI
6 -17A		000	156630	0	7214							0.00	0	54240	1015		0172	1187	1200	120	119	1351	327 327	-4169 -0600	614 258	
6-17		9000	165630	700	7914							8.30	747	54987	1029		0172	1201	1200	120	119	1351	327 294	-0610 -1530	259 318	
6-18		7540	173170	350	8264							8.30	625	55612	1041		0172	1213	1200	120	119	1351	294 298	-1540 -2000	319 369	
1-8		1650	331100	1690	9954							57.10	947	152946	2862		0536	3398	1600 x1600	100	158	3558	298 201	-2400 -4234	348 434	
1-9		1900	333000	160	10114							57.10	1085	154031	2883		0535	3419	1600 x1600	100	158	3558	201 236	-4244 -4414	435 487	
1-10	T.PL ANT	000	333000	520	10634							0.00	0	154031	2883		0535	3419	1600 x1600	100	158	3558	236 210	-4424 -4984	488 518	

3.8.6 Design of Wastewater Collection System

Table 3.8.6 (1) Distribution of Population and Wastewater Quantity (BANG BUA THONG)

No.of Sewers		Commercial Area			Residential Area (Medium)			Residential Area (Low)			Public Land		Industrial Area		Vacant Area		Service Area			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1	1/3	17.20	200	3,440	106.10	100	10,610	15.00	30	450	5.40	0	0.00	0	0.00	0	143.70	100.90	14,500	143.70	100.90	14,499
(101-105)																						
1/4	1/6	48.30	200	9,660	4.70	100	470	3.10	30	93	4.60	0	0.00	0	0.00	0	60.70	168.42	10,223	60.70	168.40	10,222
(106)																						
1/7	1/10	22.00	200	4,400	25.60	100	2,560	16.40	30	492	0.00	0	0.00	0	0.00	0	64.00	116.44	7,452	64.00	116.40	7,450
(107-108)																						
1/11	1/12	0.00	200	0	14.40	100	1,440	11.90	30	357	0.00	0	0.00	0	0.00	0	26.30	68.33	1,797	26.30	68.30	1,796
2/1	2/2	7.90	200	1,580	0.00	100	0	20.90	30	627	4.60	0	0.00	0	0.00	0	33.40	66.08	2,207	33.40	66.10	2,208
2/3	2/5	0.00	200	0	73.20	100	7,320	19.80	30	594	0.00	0	0.00	0	0.00	0	93.00	85.10	7,914	93.00	85.10	7,914
(201-202)																						
2/6		0.00	200	0	0.00	100	0	2.10	30	63	0.00	0	0.00	0	0.00	0	2.10	30.00	63	2.10	30.00	63
3/1	3/5	0.00	200	0	0.00	100	0	163.80	30	4,914	0.00	0	0.00	0	26.20	0	190.00	25.86	4,914	190.00	25.90	4,921
3/6	3/7	0.00	200	0	95.80	100	9,580	0.00	30	0	0.00	0	0.00	0	0.00	0	95.80	100.00	9,580	95.80	100.00	9,580
N.T.		95.40		19,080	319.80		31,980	253.00		7,590	14.60	0	0.00	0	26.20	0	709.00		58,650	709.00		58,653
4/1	4/6	0.00	200	0	0.00	100	0	157.00	30	4,710	0.00	0	0.00	0	88.00	0	245.00	19.22	4,710	245.00	19.20	4,704
5/1	5/3	0.00	200	0	0.00	100	0	52.20	30	1,566	0.00	0	0.00	0	23.60	0	75.80	20.66	1,566	75.80	20.70	1,569
6/1	6/5	0.00	200	0	0.00	100	0	121.00	30	3,630	0.00	0	0.00	0	0.70	0	121.70	29.83	3,630	121.70	29.80	3,627
7/1		0.00	200	0	62.70	100	6,270	75.30	30	2,259	0.00	0	0.00	0	1.20	0	139.20	61.27	8,529	139.20	61.30	8,533
7/2		0.00	200	0	0.00	100	0	7.30	30	219	0.00	0	0.00	0	0.00	0	7.30	30.00	219	7.30	30.00	219
8/1		0.00	200	0	10.50	100	1,050	41.50	30	1,245	0.00	0	0.00	0	0.00	0	52.00	44.13	2,295	52.00	44.13	2,295
S.T.		0.00		0	73.20		7,320	454.30		13,629	0.00	0	0.00	0	113.50	0	641.00	32.68	20,949	641.00	32.70	20,946
Adopted		95.40		19,080	393.00		39,300	707.30		21,219	14.60	0	0.00	0	139.70	0	1,350.00		79,599	1,350.00		79,600

Table 3.8.6 (2) Hydraulic Calculation for Design of Sewers (BANG BUA THONG-NORTH)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	·	ha	ha	m³/sec	Pey/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-1		2840	2840	530	530							100.9	2866	2866	0.054			0.054	400	1.30	0.70	0.088	1.65 2.54	0.215 -0.866	1.00 2.97	
1-2A		8500	11340	0	530							100.9	8577	11443	0.214			0.214	600	1.50	0.87	0.246	2.54 2.54	-2.542 0.800	4.53 1.09	P.U
1-2		1360	12700	510	1040							100.9	1372	12815	0.240			0.240	600	1.50	0.87	0.246	2.54 1.99	0.790 -0.156	1.10 1.50	
1-3		1670	14370	38	1078							100.9	1685	14500	0.271			0.271	400	4.00	1.05	0.132	1.99 1.94	-3.469 -3.621	5.02 5.13	FUSEKOSI
1-3A		000	14370	0	1078							0.00	0	14500	0.271			0.271	600	1.50	0.87	0.246	1.94 1.94	-3.621 -0.450	4.91 1.74	
1-4		1930	16300	400	1478							168.4	3250	17750	0.332			0.332	800	1.50	1.05	0.529	1.94 2.19	-0.650 -1.340	1.72 2.56	
1-5		000	16300	15	1493							0.00	0	17750	0.332			0.332	800	1.50	1.05	0.529	2.19 2.19	-1.350 -1.374	2.67 2.70	
1-6	1-7	4140	20440	710	2203							168.4	6972	24722	0.463			0.463	800	1.50	1.05	0.529	2.19 2.09	-1.384 -2.613	2.71 3.84	
2-1		3340	3340	380	380							66.10	2208	2208	0.041			0.041	300	2.20	0.64	0.045	1.74 1.92	0.410 -0.517	1.00 2.11	
2-2		000	3340	15	395							0.00	0	2208	0.041			0.041	300	2.20	0.64	0.045	1.92 1.92	-0.527 -0.550	2.12 2.15	
2-3		6410	9750	710	1105							85.10	5455	7663	0.143			0.143	500	1.60	0.77	0.151	1.92 2.30	-0.760 -2.065	2.14 3.82	
2-4		2890	12640	170	1275							85.10	2460	10123	0.189			0.189	600	1.50	0.87	0.246	2.30 2.76	-2.165 -2.475	3.82 4.59	
2-5		000	12640	17	1292							0.00	0	10123	0.189			0.189	600	1.50	0.87	0.246	2.76 2.76	-2.485 -2.512	4.60 4.62	
2-6		210	12850	160	1452							30.00	63	10186	0.191			0.191	600	1.50	0.87	0.246	2.76 2.09	-2.522 -2.308	4.63 4.25	
1-7		000	33290	60	2263							116.4	-1	34907	0.553			0.553	1000	1.40	1.14	0.897	2.09 1.78	-3.208 -3.292	4.22 3.99	

Table 3.8.6 (3) Hydraulic Calculation for Design of Sewers (BANG BUA THONG-NORTH)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Peg/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
1-8A		3360	36650	0	2263							116.4	3911	38818	0726			0726	1000	140	114	0897	178 178	-3292 -0320	399 102	P. U
1-8		2170	38820	650	2913							116.4	2526	41344	0774			0774	1000	140	114	0897	178 201	-0330 -1331	103 226	
1-9		870	39690	250	3163							116.4	1012	42356	0793			0793	1000	140	114	0897	201 154	-1341 -1723	227 218	
1-10		000	39690	30	3193							0.00	0	42356	0793			0793	1000	140	114	0897	154 151	-2757 -2799	322 333	
1-11	1-12	2630	42320	250	3443							68.30	1797	44153	0826			0826	1000	140	114	0897	151 234	-2809 -3188	334 445	
3-1		7170	7170	1100	1100							25.90	1858	1858	0035			0035	300	220	064	0045	272 246	1390 -1288	190 342	
3-2		000	7170	50	1150							0.00	0	1858	0035			0035	300	220	064	0045	246 246	-2454 -2584	459 471	
3-3A		000	7170	0	1150							0.00	0	1858	0035			0035	300	220	064	0045	246 246	-2584 1100	471 103	P. U
3-3		5550	12720	930	2080							25.90	1437	3295	0062			0062	400	130	070	0088	246 220	1900 -0905	103 267	
3-4		000	12720	50	2130							0.00	0	3295	0062			0062	400	130	070	0088	220 250	-2029 -2129	379 419	
3-5A		000	12720	0	2130							0.00	0	3295	0062			0062	400	130	070	0088	250 250	-2129 1000	419 197	P. U
3-5		6280	19000	45	2175							25.90	1626	4921	0092			0092	500	150	077	0151	250 250	0900 0484	106 147	
3-6		000	19000	240	2415							0.00	0	4921	0092			0092	500	150	077	0151	250 242	0474 0040	148 134	
3-7		9580	26580	470	2885							100.0	9580	14501	0271			0271	800	150	105	0529	242 234	-0260 -1073	131 255	
1-12	T. PL ANT	000	70900	50	3493							0.00	0	58654	1098			1098	1200	120	119	1351	234 200	-3388 -3448	443 415	

Table 3.8.6 (4) Hydraulic Calculation for Design of Sewers (BANG BUA THONG-SOUTH)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
4-1		5870	5870	1080	1080							19.20	1128	1128	0021			0021	300	220	064	0045	200 200	0670 -1987	100 356	
4-2		2710	8580	760	1840							19.20	520	1648	0031			0031	300	220	064	0045	200 151	-1997 -3865	357 505	
4-3A		000	8580	0	1840							0.00	0	1648	0031			0031	400	180	070	0088	151 151	-3865 0050	494 103	P.U
4-3	4-4A	9130	17710	1290	3130							19.20	1753	3401	0064			0064	400	180	070	0088	151 250	0040 -2593	104 466	
5-1A		1990	1990	0	0							20.70	412	412	0008			0008	300	220	064	0045	276 276	0823 0823	151 151	
5-1		000	1990	40	40							0.00	0	412	0008			0008	300	280	072	0051	276 203	0812 0700	152 100	
5-2		2500	4490	760	800							20.70	518	930	0017			0017	300	220	064	0045	203 249	0690 -1184	101 334	
5-3A		000	4490	0	800							0.00	0	930	0017			0017	300	220	064	0045	249 249	-1184 1150	334 101	P.U
5-3		3080	7570	750	1550							20.70	637	1567	0029			0029	300	220	064	0045	249 250	1140 -0692	102 286	
4-4A		000	25280	0	3130							0.00	0	4958	0093			0093	500	160	077	0151	250 250	-2593 0900	455 106	P.U
4-4		530	25810	640	3770							19.20	102	5070	0095			0095	500	160	077	0151	250 243	0890 -0284	107 217	
4-5	4-6	1670	27480	640	4410							19.20	320	5390	0101			0101	500	160	077	0151	243 237	-0294 -1468	218 330	
6-1		4610	4610	930	930							29.80	1374	1374	0026			0026	300	220	064	0045	252 250	1190 -1085	100 325	
6-2	6-3	4610	9220	440	1370							29.80	1374	2748	0051			0051	400	180	070	0088	250 246	-1185 -2077	325 410	

Table 3.8.6 (5) Hydraulic Calculation for Design of Sewers (BANG BUA THONG-SOUTH)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
7-1		13920	13920	350	350							61.30	8533	8533	0160			0160	600	160	087	0246	180 189	0150 -0488	100 173	
7-2		730	14650	340	690							30.00	219	8752	0164			0164	600	160	087	0246	189 216	-0488 -1118	174 293	
6-3		000	23870	15	1385							0.00	0	11500	0215			0215	600	160	087	0246	216 246	-2277 -2301	409 411	
6-4A		000	23870	0	1385							0.00	0	11500	0215			0215	600	160	087	0246	246 246	-2301 0800	411 101	P. U
6-4	6-5	2950	26820	850	2235							29.80	879	12379	0232			0232	600	160	087	0246	246 237	0790 -0785	102 251	
8-1		5200	5200	370	370							44.13	2295	2295	0043			0043	300	220	064	0045	223 237	0900 0000	100 204	
6-5		000	32020	15	2250							0.00	0	14674	0275			0275	800	160	105	0529	237 237	-0985 -1009	249 251	
4-6	T.PL ANT	4600	54100	480	4890							19.20	883	20947	0392			0392	800	160	105	0529	237 200	-1768 -2596	327 373	

PART 3

PRELIMINARY ENGINEERING DESIGN OF SEWERAGE SYSTEMS FOR RANGSIT AREA AND BANG BUA THONG MUNICIPALITY

2.6.1 Population Distribution and Hydraulic Calculation

Table 2.6.1.1 Population Distribution

RangSit (F/S)

NO. of Sewers		Commercal-Area			Residential-Area			Residential-Area			PublicLand		IndustrialArea		VacantArea		ServiceArea			Adopted		
Current Sewer	Down-stream	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)	Area (ha)	P.Dens. (p./ha)	Design P. (person)
1/1	1/2	17.9	120	2,148	35.7	60	2,142	0.0	20	0	0.0	0	68.8	0	66.8	0	189.2	22.67	4,290	189.2	57.00	10,784
101	104	149.5	120	17,940	151.4	60	9,084	34.1	20	682	9.0	0	0.0	0	0.7	0	344.7	80.38	27,706	344.7	57.00	19,648
105	106	0.0	120	0	0.0	60	0	6.4	20	128	22.1	0	0.0	0	1.2	0	29.7	4.31	128	29.7	57.00	1,693
1/3	1/10	0.0	120	0	0.0	60	0	0.0	20	0	0.0	0	0.0	0	0.0	0	0.0	0.00	0	0.0	0.00	0
2/1	2/2	0.0	120	0	0.0	60	0	0.0	20	0	2.8	0	0.0	0	0.0	0	2.8	0.00	0	2.8	76.50	214
3/1	3/3	137.0	120	16,440	130.2	60	7,812	0.0	20	0	3.6	0	0.0	0	0.0	0	270.8	89.56	24,252	270.8	89.60	24,254
4/1 (5/1—5/2)	4/3	0.0	120	0	0.0	60	0	111.5	20	2,230	0.0	0	0.0	0	44.6	0	156.1	14.29	2,230	156.1	15.90	2,482
6/1	6/3	0.0	120	0	0.0	60	0	0.0	20	0	0.0	0	0.0	0	0.0	0	0.0	0.00	0	0.0	0.00	0
6/4	6/6	0.0	120	0	0.0	60	0	0.0	20	0	0.0	0	0.0	0	0.0	0	0.0	0.00	0	0.0	0.00	0
6/7	6/10	0.0	120	0	132.5	60	7,950	0.0	20	0	0.0	0	0.0	0	0.0	0	132.5	60.00	7,950	132.5	60.00	7,950
6/11 (9/1—9/4)	6/15	0.0	120	0	0.0	60	0	0.0	20	0	0.0	0	0.0	0	0.0	0	0.0	0.00	0	0.0	0.00	0
6/16 (10/1—10/4)	6/18	0.0	120	0	0.0	60	0	0.0	20	0	0.0	0	0.0	0	0.0	0	0.0	0.00	0	0.0	0.00	0
7/1	7/4	0.0	120	0	122.7	60	7,362	0.0	20	0	0.0	0	0.0	0	39.5	0	162.2	45.39	7,362	162.2	45.40	7,364
8/1	8/3	0.0	120	0	0.0	60	0	0.0	20	0	0.0	0	0.0	0	0.0	0	0.0	0.00	0	0.0	0.00	0
Adopted		304.4		36,528	572.5		34,350	152.0		3,040	37.5	0	68.8	0	152.8	0	1,288.0	57.39	73,918	1288.0	57.76	74,399

Table 2.6.1.2 (1) Hydraulic Calculation for Design of Sewers (Rang Sit)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	-	ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
101A		11160	11160	0	0							80.40	8973	8973	0.168	0.003	0.003	0.171	500	1.60	0.77	0.151	232 232	0.200 0.200	1.58 1.58	
101		000	11160	150	150							0.00	0	8973	0.168		0.003	0.171	500	1.60	0.87	0.246	232 2.46	0.100 -0.170	1.57 1.98	
102		3990	15150	1110	1260							80.40	3208	12181	0.228	0.005	0.008	0.236	600	1.60	0.87	0.246	2.46 2.63	-0.180 -2.216	1.99 4.20	
102A		000	15150	0	1260							0.00	0	12181	0.228		0.008	0.236	600	1.60	0.87	0.246	2.63 2.63	-2.762 0.901	4.74 1.98	P.U
103		000	15150	400	1660							0.00	0	12181	0.228		0.008	0.236	600	1.60	0.87	0.246	2.63 2.60	0.891 0.161	1.99 1.79	
104		18790	33940	60	1720							80.40	15107	27288	0.511		0.008	0.519	800	1.60	1.05	0.529	2.60 2.60	-0.039 -0.135	1.77 1.87	
1-1	1-2	21890	55830	1240	2960							22.70	4969	32257	0.504	0.353	0.361	0.965	1200	1.20	1.19	1.351	2.60 1.89	-0.535 -2.185	1.84 2.78	
2-1		280	280	0	0							96.50	271	271	0.005	0.282	0.282	0.287	800	1.60	1.05	0.529	2.20 2.20	-1.345 -1.345	2.58 2.58	
2-2		3180	3460	60	60							96.50	3068	3339	0.062		0.282	0.344	800	1.60	1.05	0.529	2.20 1.89	-1.355 -1.451	2.69 2.48	
1-2	1-3A	000	59290	73	3033							0.00	0	35596	0.666		0.643	1.309	1200	1.20	1.19	1.351	1.89 2.00	-3.607 -3.695	4.20 4.40	
301		6370	6370	1120	1120							89.60	5708	5708	0.107			0.107	500	1.60	0.77	0.151	3.17 3.07	1.528 -0.434	1.00 2.96	
302		11700	18070	800	1920							89.60	10483	16191	1.303			0.303	800	1.60	1.05	0.529	3.07 2.98	-0.734 -2.104	2.94 4.22	
303	305	000	18070	40	1960							89.60	0	16191	0.303			0.303	800	1.60	1.05	0.529	2.98 2.98	-2.114 -2.178	4.23 4.29	

Table 2.6.1.2 (2) Hydraulic Calculation for Design of Sewers (Rang Sit)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
304		3070	3070	650	680							89.60	2751	2751	0051			0051	400	150	070	0088	307 298	1635 0251	130 229	
305		1350	22500	460	2420							89.60	1218	20160	0377			0377	800	150	105	0529	298 248	-2188 -2975	430 459	
305A		000	22500	0	2420							0.00	0	20160	0377			0377	800	150	105	0529	248 248	-2975 0500	459 111	P. U
3-1		2120	24620	710	3130							89.60	1900	22060	0413			0413	800	150	105	0529	248 250	0490 -0757	112 249	
3-2		2450	27080	630	3760							89.60	2204	24264	0454			0454	800	150	105	0529	250 220	-0757 -1844	250 318	
3-3		000	27080	60	3820							0.00	0	24264	0454			0454	800	150	105	0529	220 200	-1854 -1950	319 308	
1-3A		000	86370	0	3820							0.00	0	59860	1120		0643	1763	1500	120	139	2449	200 200	-3695 -0550	408 104	P. U
1-3		000	86370	220	4040							57.10	0	59860	1120	0011	0654	1774	1500	120	139	2449	200 319	-0660 -0944	105 252	
1-4		000	86370	290	4330							57.10	0	59860	1120	0101	0755	1875	1500	120	139	2449	319 205	-0954 -1332	253 177	
1-5		000	86370	71	4401							0.00	0	59860	1120		0755	1875	1000	280	152	1269	205 450	-3564 -3764	453 718	FUSEKOSI
1-6A		000	86370	0	4401							0.00	0	59860	1120		0755	1875	1500	120	139	2449	450 450	-3764 -2035	665 492	
1-6	1-7A	000	86370	580	4981							57.10	0	59860	1120	0118	0873	1993	1500	120	139	2449	450 288	-2045 -2801	493 407	
4-1		000	000	0	0							0.00	0	0	0000	0021	0021	0021	300	220	064	0045	214 214	-0255 -0255	207 207	
4-2	4-3	4760	4760	320	320							15.90	757	757	0014	0005	0026	0040	300	220	064	0045	214 204	-0265 -1071	208 278	

Table 2.6.1.2 (3) Hydraulic Calculation for Design of Sewers (Rang Sit)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm				Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
5-1		4990	4990	300	300							15.90	794	794	0015			0015	300	220	064	0045	240 215	1070 0332	100 149	
5-2		3800	8790	230	530							15.90	604	1398	0026			0026	300	220	064	0045	215 204	0322 -0244	150 195	
4-3		000	13550	65	595							0.00	0	2155	0040		0026	0066	400	130	070	0088	204 285	-2677 -2794	428 521	
4-4A		000	13550	0	595							0.00	0	2155	0040		0026	0066	400	130	070	0088	285 285	-2794 1380	521 104	P.U
4-4		000	13550	50	645							0.00	0	2155	0040		0026	0066	400	130	070	0088	285 288	1370 1270	105 118	
1-7A		000	99920	0	4981							0.00	-1	62014	1161		0399	2060	1500	120	139	2449	288 288	-2801 0230	407 104	P.U
1-7	1-8	000	99920	700	5681							57.10	0	62014	1161	0108	1007	2168	1500	120	139	2449	288 298	0220 -0682	105 205	
6-6		000	000	0	0							65.10	0	0	0000	0580	0580	0580	1000	140	114	0897	247 236	-2933 -2933	432 421	
6-7	6-8A	4420	4420	330	330							60.00	2652	2652	0050		0580	0630	1000	140	114	0897	236 238	-2943 -3445	422 474	
101		4970	4970	225	225							45.40	2257	2257	0042			0042	300	220	064	0045	180 200	0470 -0084	100 175	
7-1	7-2	2870	7840	350	575							45.40	1303	3560	0067			0067	400	130	070	0088	200 180	-0184 -0894	175 226	
702		6160	6160	350	350							45.40	2797	2797	0052			0052	400	130	070	0088	175 179	0315 -0404	100 176	
703		1970	8130	120	470							45.40	895	3692	0069			0069	400	130	070	0088	179 180	-0414 -0650	177 292	

Table 2.6.1.2 (4) Hydraulic Calculation for Design of Sewers (Rang Sit)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha	-	ha	ha	m³/sec	Pey/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
7-2		000	15970	90	665							0.00	-1	7251	0136			0136	500	160	077	0151	180 179	-0994 -1158	225 241	
7-3		000	15970	54	719							0.00	0	7251	0136			0136	300	500	097	0068	179 226	-3952 -4222	541 615	FUSEXOSI
7-3A		000	15970	0	719							0.00	0	7251	0136			0136	500	160	077	0151	226 226	-4222 -1550	594 337	
7-4		250	16220	240	959							45.40	113	7364	0138			0138	500	160	077	0151	226 238	-1560 -2394	338 393	
6-8A		000	20640	0	959							0.00	0	10016	0187		0580	0767	1000	140	114	0897	238 238	-2394 0255	339 104	P. U
6-8		8240	28880	420	1379							60.00	4944	14960	0280		0580	0860	1000	140	114	0897	238 204	0245 -0403	135 136	
6-9		000	28880	190	1569							60.00	0	14960	0280	0007	0587	0867	1000	140	114	0897	204 213	-0413 -0700	137 175	
6-10		000	28880	1620	3189							0.00	0	14960	0280		0587	0867	1000	140	114	0897	213 270	-0710 -3179	176 480	
6-11		000	28880	200	3389							12.00	0	14960	0280	0001	0588	0868	1000	140	114	0897	270 253	-3189 -3499	481 595	
6-12A		000	28880	0	3389							0.00	0	14960	0280		0588	0868	1000	140	114	0897	253 253	-3999 0530	555 102	P. U
6-12	6-13A	000	28880	1480	4869							12.00	0	14960	0280	0013	0601	0881	1000	140	114	0897	253 200	0520 -1731	103 265	
8-3	6-13A	000	000	0	0							11.90	0	0	0000	0062	0052	0062	400	180	070	0088	200 200	-0223 -0223	179 179	
9-4		000	000	0	0							12.00	0	0	0000	0203	0203	0203	300	220	084	0045	200 200	-1510 -1510	318 318	
6-13A		000	28880	0	4869							0.00	0	14960	0280		0866	1146	1200	120	119	1351	200 200	-1731 0500	244 021	P. U

Table 2.6.1.2 (5) Hydraulic Calculation for Design of Sewers (Rang Sit)

No. of Sewers	Downstream Sewers No.	Drainage Area		Length		Concentrated Time	Run-off Storm					Wastewater Flow				Other W.W		Grand Total Design Flow	Designing of Sewers							Remarks
		Area	Total	Length	Total		Rainfall	Run-off Coeffi.	Arranged Area		Rainfall	Pop. Density	Population		Design Flow	Sewer	Total		Diameter	Slope	Velocity	Flow	Elevation	Invert Level	Earth Cover	
									Area	Total			Sewer	Total												
		ha	ha	m	m	min	m³/sec·ha		ha	ha	m³/sec	Per/ha	Person		m³/sec	m³/sec	m³/sec	m³/sec	mm	‰	m/sec	m³/sec	M	M	m	
S-13		000	28880	57	4926							0.00	0	14960	0280		0866	1146	800	260	134	0674	200 245	-4500 -4548	563 623	FUSEKOSI
S-14A		000	28880	0	4926							0.00	0	14960	0280		0866	1146	1200	120	119	1351	245 245	-4648 0100	580 106	
S-14	S-15	000	28880	50	4976							0.00	0	14960	0280		0866	1146	1200	120	119	1351	245 310	0930 0030	107 178	
10-2A		000	000	0	0							0.00	0	0	0000	0036	0036	0036	300	220	054	0045	310 310	1400 1400	137 137	
S-15		000	28880	200	5176							12.00	0	14960	0280	0006	0908	1188	1200	120	119	1351	310 327	0920 -0240	179 232	
S-16		000	28880	43	5219							0.00	0	14960	0280		0908	1188	800	280	139	0700	327 327	-3429 -3549	583 595	FUSEKOSI
S-17A		000	28880	0	5219							0.00	0	14960	0280		0908	1188	1200	120	119	1351	327 327	-3549 -0500	552 258	
S-17		000	28880	700	5919							8.30	0	14960	0280	0014	0922	1202	1200	120	119	1351	327 294	-0610 -1542	259 319	
S-18		000	28880	350	6269							8.30	0	14960	0280	0012	0934	1214	1200	120	119	1351	294 298	-1552 -2012	320 370	
1-8		000	128800	1690	7959							57.10	0	76974	1441	0018	1959	3400	1600 x1600	100	156	3598	298 201	-2412 -4246	349 436	
1-9		000	128800	160	8119							57.10	0	76974	1441	0020	1979	3420	1600 x1600	100	156	3598	201 236	-4256 -4426	437 489	
1-10	T.PLANT	000	128800	520	8639							0.00	0	76974	1441		1979	3420	1600 x1600	100	156	3598	236 210	-4436 -4996	490 520	