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Current Status and Implementation Approach for Industrial Zones Wastewater Management In Yangon Region

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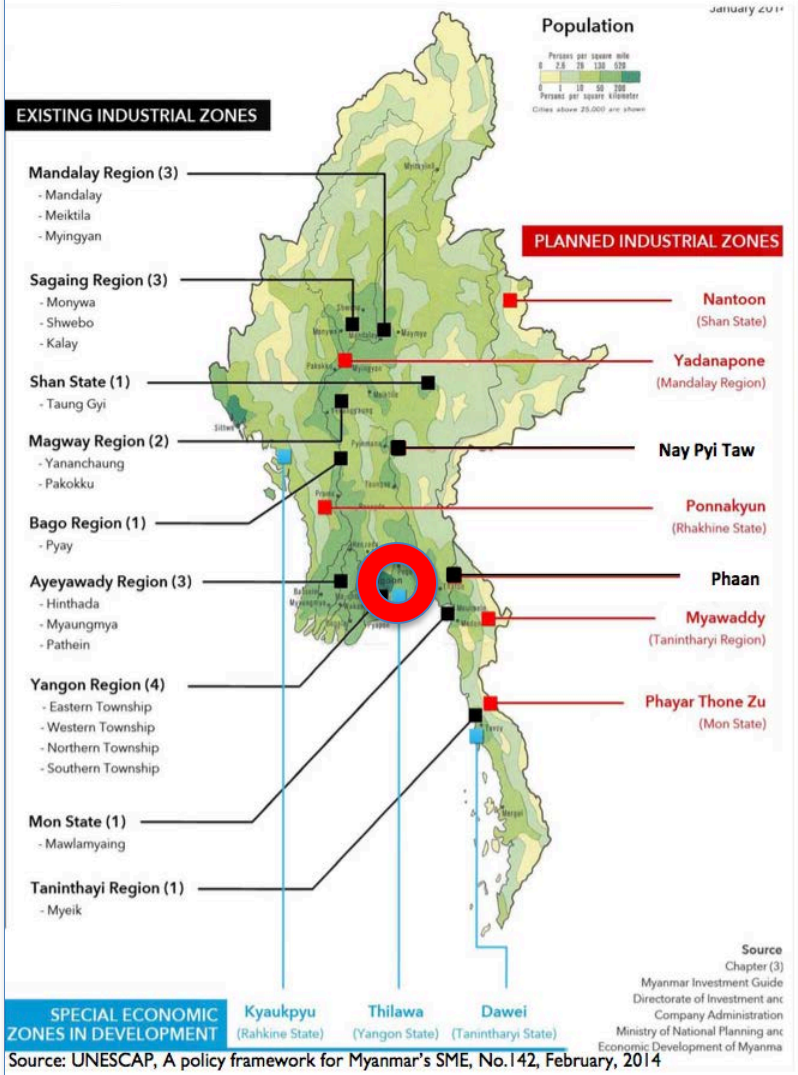
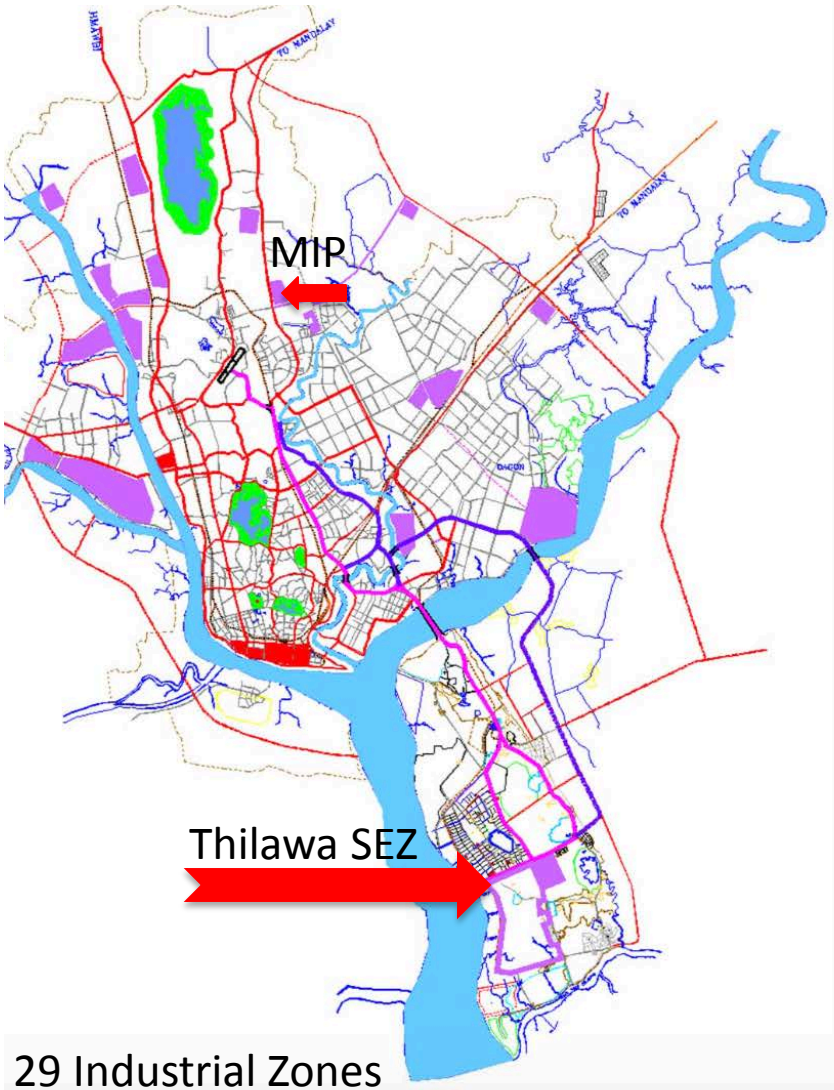
Location of Industrial Zones in Myanmar



Source: UNESCAP, A policy framework for Myanmar's SME, No.142, February, 2014

Location of Industrial Zones in Yangon City



29 Industrial Zones

Why we need Industrial Wastewater Treatment Plant?

- Industrial wastewater usually includes hazardous substances or high concentration organic matters which directly discharge to public water bodies without treatment may cause damage to human health or pollution as surrounding environmental deterioration.

- Institutions –
- (1) Environmental Conservation Department(Ministry of Natural Resources and Environmental Conservation-MONREC)
- (2) Yangon City Development Committee-YCDC
- (3) Department of Industrial Supervision and Inspection (Ministry of Industry)

- Regulations for Water Pollution Control and Enforcement

- National Environmental Quality (Emission) Guidelines (2015)

Regulations related Water Environmental Management

- ✧ National Environmental Policy (1994)
- ✧ Water Management and Myanmar Agenda 21, 1997
- ✧ 2008 Constitutions and Environmental Conservation
- ✧ Water Management and National Sustainable Development Strategy 2009
- ◆ Environmental Conservation Law (2012)
- ◆ Environmental Conservation Rules (2014)
- ◆ Environmental Impact Assessment Procedure (2015)
- ◆ National Environmental Quality (Emission) Guidelines (2015)

Wastewater Parameters and Guideline Values of National Environmental Quality

Parameter	Unit	Guideline Value
5 Days BOD	mg/l	50
Ammonias	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
COD	mg/l	250
Chlorine (Total Residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (Total)	mg/l	1.0
Fluoride	mg/l	20
Heavy Metals (Total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1

Parameter	Unit	Guideline Value
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	SU	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature	° C	<3°C
Total Coliform bacteria	100ml	400
Total Phosphorus	mg/l	2.0
TSS	mg/l	50
Zinc	mg/l	2.0

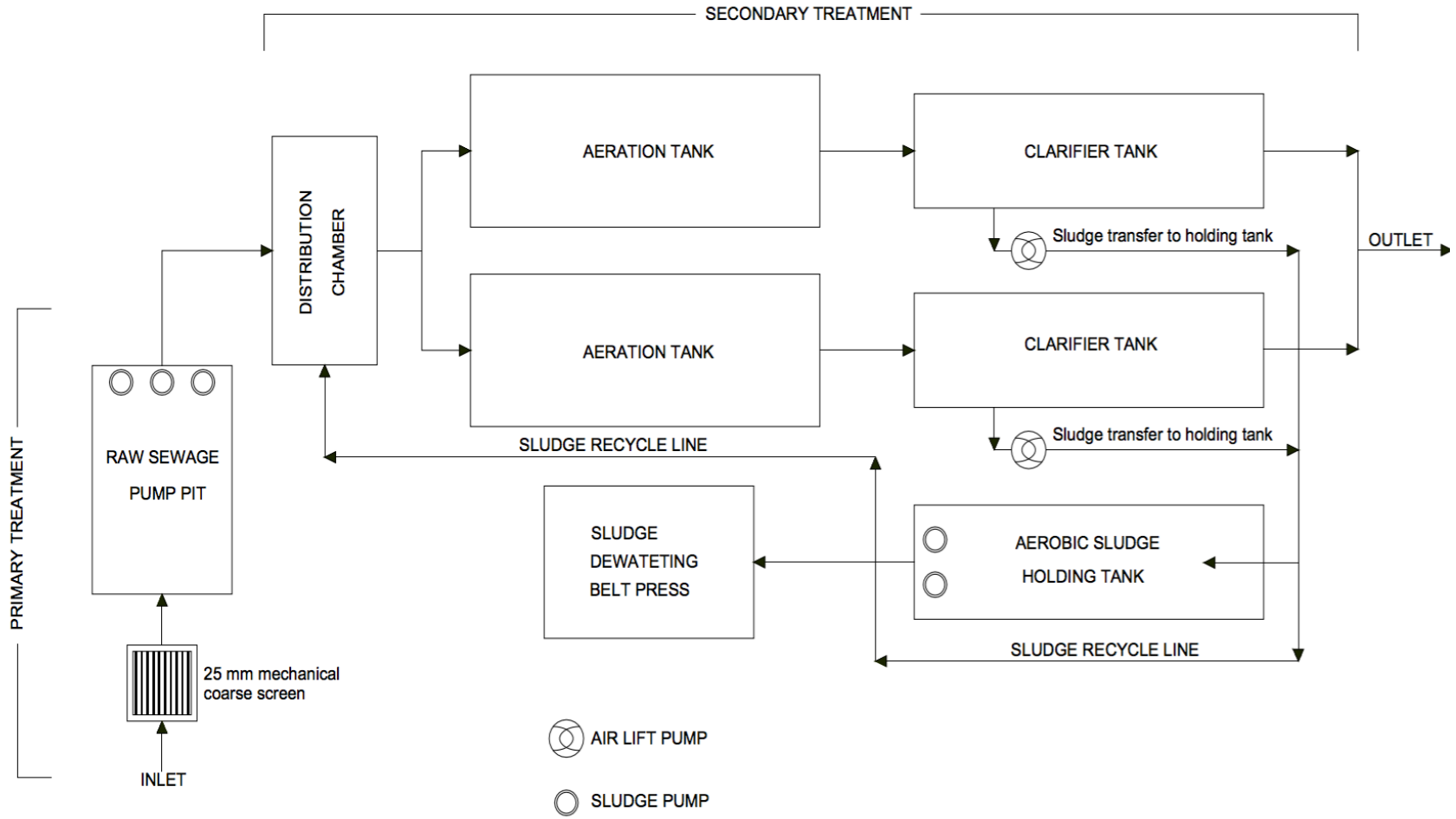
Current Systems

MIP

Mingaladon Industrial Park

Mingaladon Industrial Park Wastewater Treatment

PROCESS AND MASS FLOW DIAGRAM FOR EXTENDED AERATION ACTIVATED SLUDGE PROCESS



WASTE WATER TREATMENT PLANT

Wastewater INLET

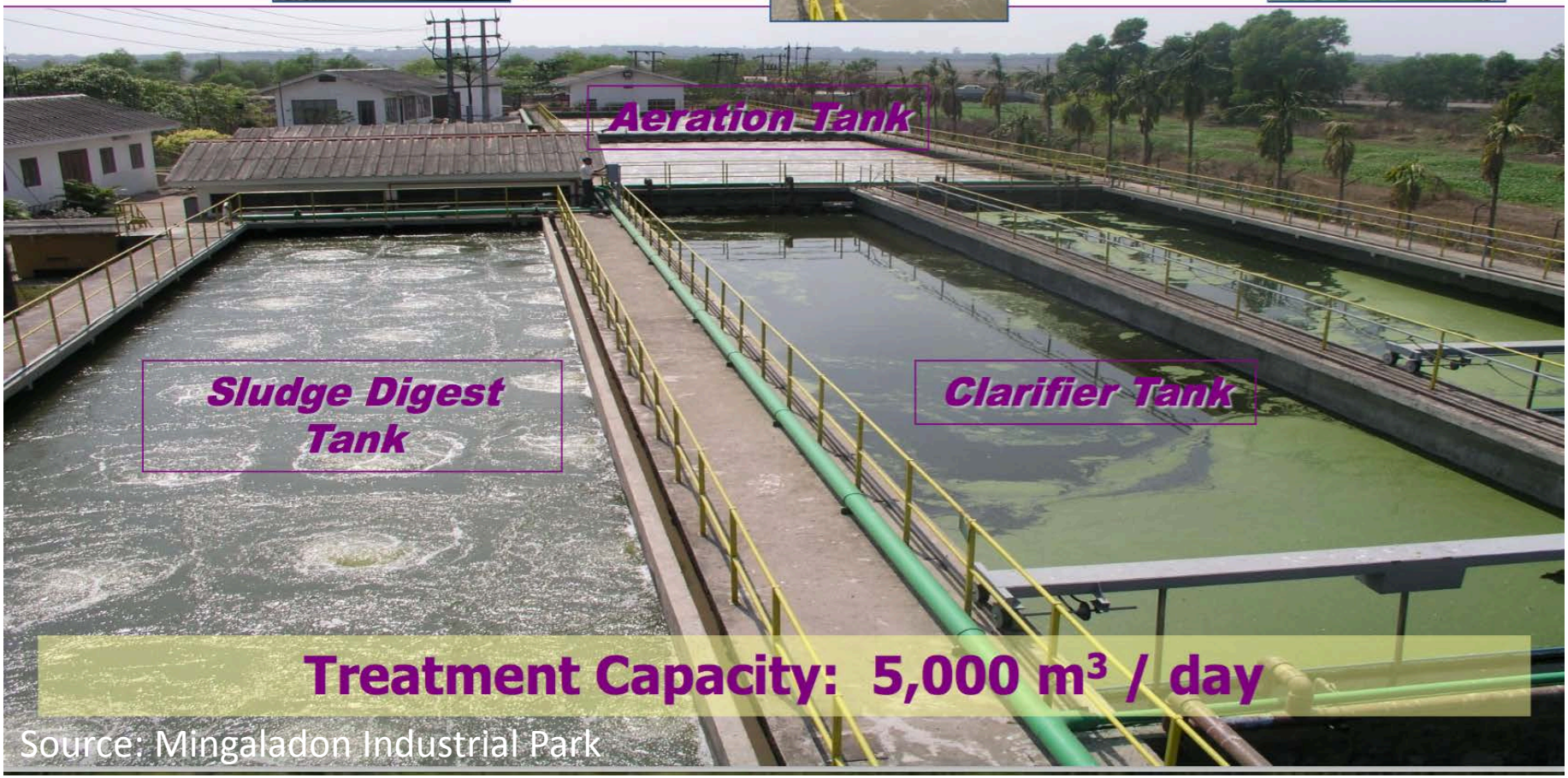
Screen Saver

PUMPS to Aeration Tank

Aeration Tank

Clarifier Tank

DISPOSAL to Regulation Pond



Treatment Capacity: 5,000 m^3 / day

Source: Mingaladon Industrial Park

Wastewater Quality Criteria to WWTP (Mingaladon Industrial Park)

Parameter	Unit	Guideline Value
5 Days BOD	mg/l	240
COD	mg/l	500
Free Ammonia	mg/l	0.5
Arsenic	mg/l	0.05
Cadmium	mg/l	0.01
Chloride	mg/l	600
Chromium (hexavalent)	mg/l	0.1
Chlorine	mg/l	1.0
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.02
Phosphate	mg/l	1.0
Fluorine	mg/l	1.5
Nitrate	mg/l	10
Nitrite	mg/l	1.0
Iron	mg/l	5.0

Parameter	Unit	Guideline Value
pH	SU	6-9
Temperature	° C	35°C
Mercury	mg/l	0.005
Nickel	mg/l	0.1
Oil and grease	mg/l	30
Phenols	mg/l	0.002
Selenium	mg/l	0.01
Sulphur	mg/l	0.01
Sulphate	mg/l	400
Detergent	mg/l	0.5
Mineral Oil (H/C)	mg/l	10.0
TDS	mg/l	1000
TSS	mg/l	200
Zinc	mg/l	5.0
Lead	mg/l	0.1

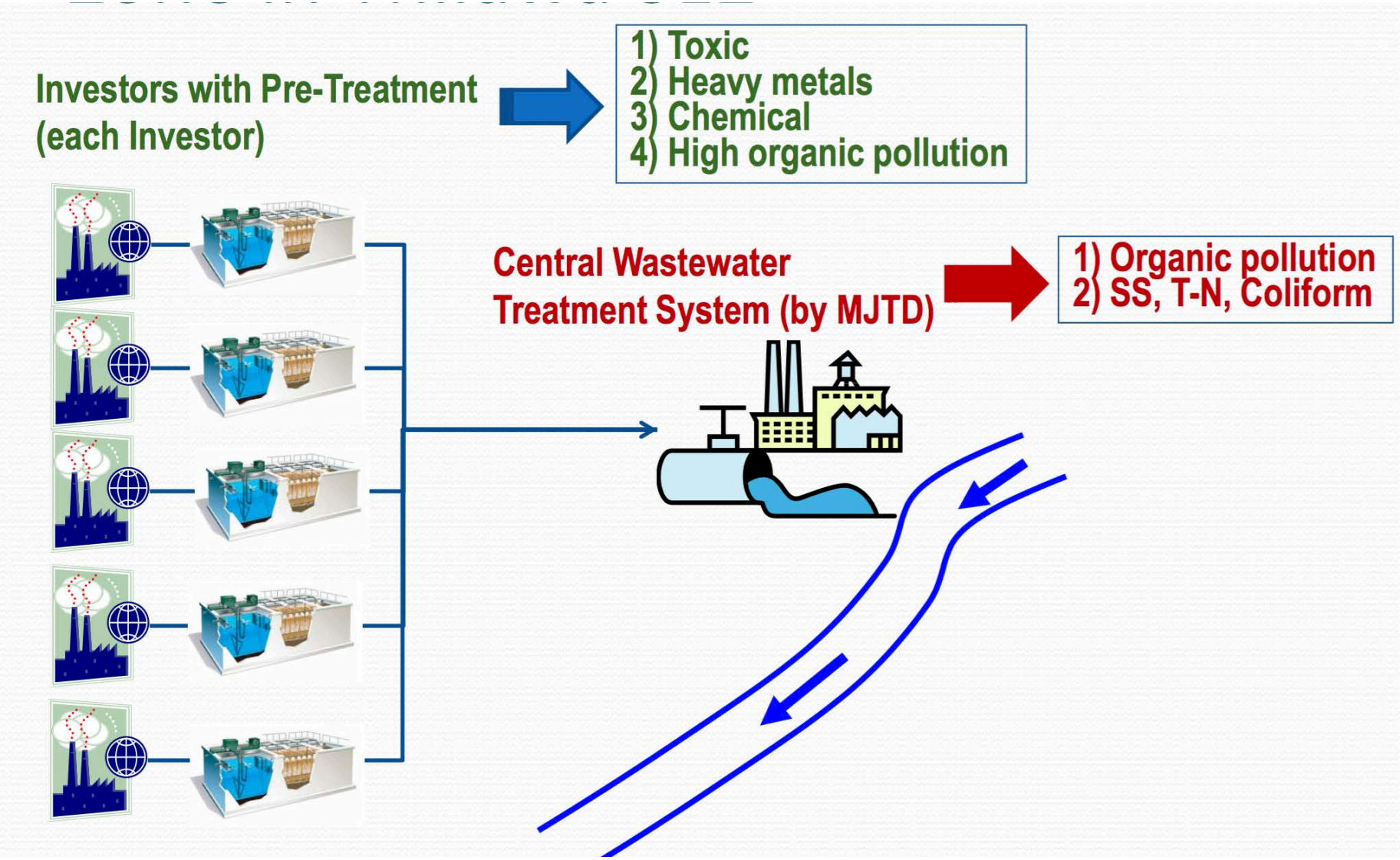
Source: Mingaladon Industrial Park

Thilawa Special Economic Zone
Jointly Developed by Myanmar and Japan

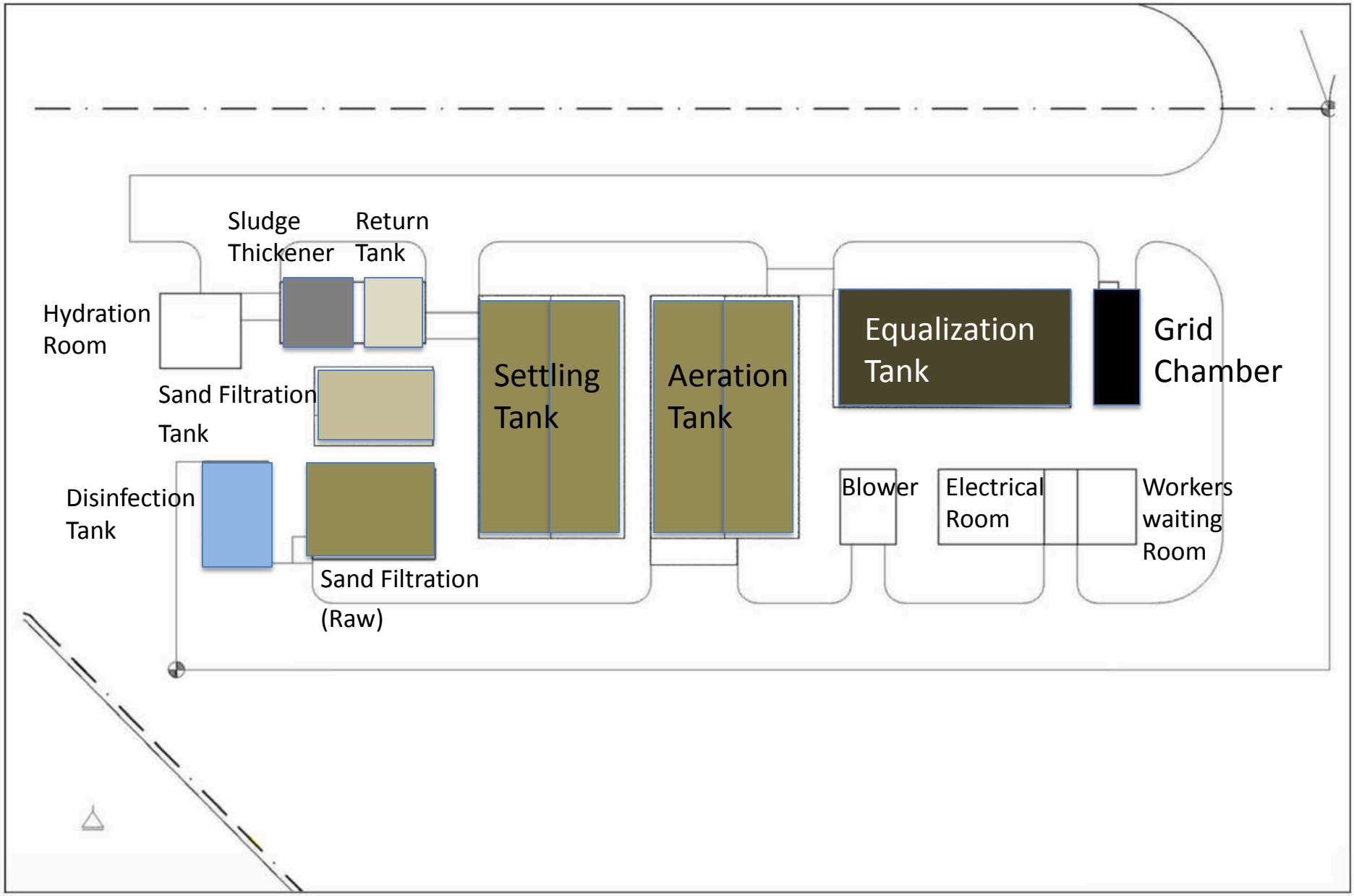
Developer: Myanmar Japan Thilawa Development Ltd., (MJTD)

Thilawa SEZ Wastewater Treatment Plant (4800 m^3/day)

Wastewater Treatment in Thilawa SEZ



Thilawa SEZ Wastewater Treatment Plant Layout Plan



Grid Chamber

Equalization Tank

Aeration Tank

Settling Tank

Rapid Filtration

Disinfection Tank

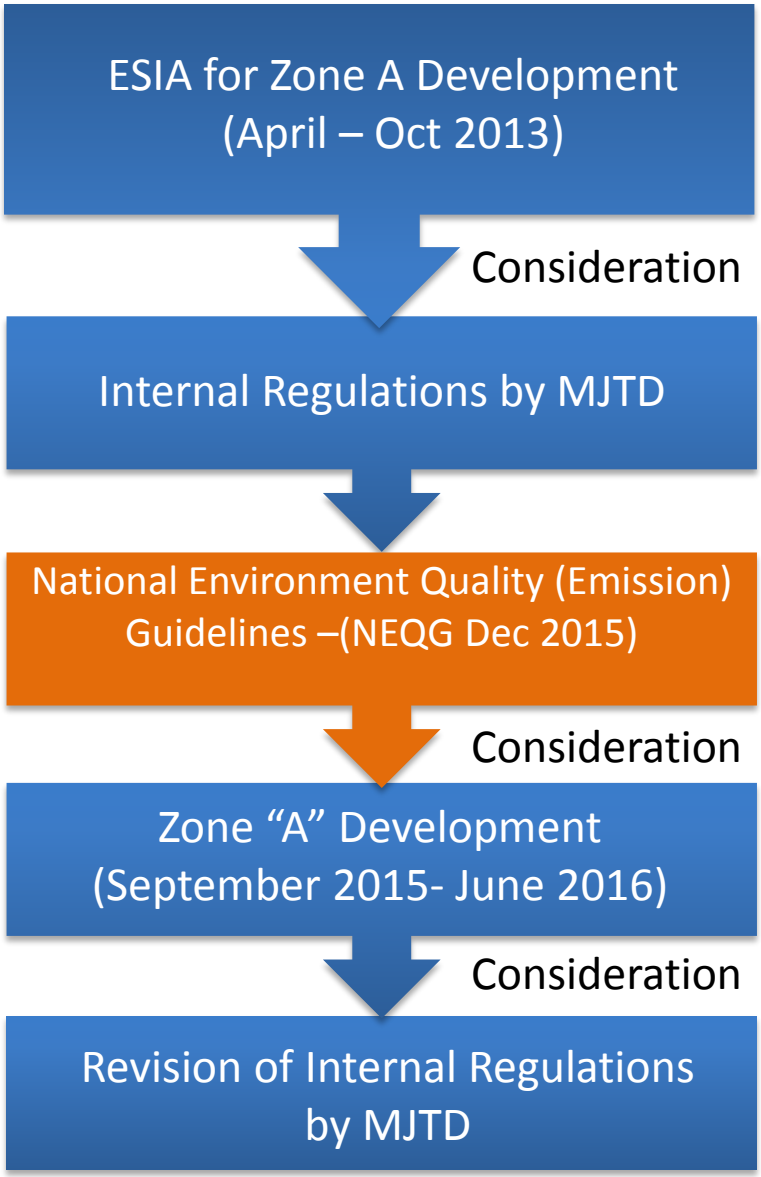
Return Tank

Sludge Thickener

Dehydration Room

Blower Room

Applied Wastewater Standard in Thilawa SEZ



- Based on standard by Ministry of Industry 1995
- Adding to some parameters (T-N, Color, etc)
- Many Stakeholders were involved
- Based on NEQG (adding to T-P, heavy metals etc.,)
- Combined with MOI and NEQG

(apply stricter value, some parameters BOD, COD, oil & grease will be relived but compliance with NEQG

Thilawa SEZ Internal Rules and Regulations:
(Standard of Wastewater Quality after Pre-wastewater treatment by the Locator)

No	Parameter	Wastewater Standard	Unit
1	BOD (5 days at 20°C)	max 200	ppm
2	Suspended Solids (SS)	max 200	ppm
3	Total Dissolved Solids	max 2000	ppm
4	pH Value	6.5-8.5	
5	COD min Permanganate value (Under Review)	max 150	ppm
6	COD cr Dicromate Value	max 300	ppm
7	Sulphide (as HS)	max 1	ppm
8	Cyanide (as HCN)	max 0.2	ppm
9	Oil and grease	max 5	ppm
10	Total coliform bacteria	max 400	MPN/100ml
11	Tar	None	-
12	Formaldehyde	max 1	ppm
13	Phenols and cresols	max 1	ppm
14	Free Chlorine	max 1	ppm

No	Parameter	Wastewater Standard	Unit
15	Zinc	max 5	ppm
16	Chromium	max 0.5	ppm
17	Arsenic	max 0.25	ppm
18	Copper	max 1.0	ppm
19	Mercury	max 0.005	ppm
20	Cadmium	max 0.03	ppm
21	Barium	max 1.0	ppm
22	Selenium	max 0.02	ppm
23	Lead	max 0.2	ppm
24	Nickel	max 0.2	ppm
25	Insecticides	None	-
26	Radioactive Materials	None	-
27	Temperature	max 35	° C
28	Color and Odor QCVN40: 2011/BTNMT QCVN13: 2008/BTNMT	150	(Co-Pt)
29	T-N	40	ppm

Key Points of Water Pollution Control

◆ Hazardous & Chemical Substances Management (High Risk Management)

- ❖ Checking Production Process
- ❖ Submission of raw material list with MSDS (Material Safety Data Sheet)
- ❖ Submission of plan for amount of chemical consumption and its monitoring
- ❖ Bi-annually self inspection and reporting results of inspection

◆ Guidance to install Proper Wastewater Treatment System

- ❖ Checking proper wastewater treatment system by referring to international standard
- ❖ Issuing notification of target parameters to be monitored to investors

◆ Water Quality Monitoring

- ❖ Treated wastewater by investor (every month) (to measure 7 Basic Parameters such as pH, BOD, COD, SS, Total-N, Total Coliform, Oil and Grease)
- ❖ Treated wastewater by MJTD wastewater treatment plant (daily, weekly, monthly, biannually)
- ❖ Surface water quality monitoring by MJTD (bi-annually)

Main Responsibilities of Environmental Section (OSSC)

◆ Before Construction

- ❖ Reviewing and Approval of Environmental Conservation and Prevention Plan (ECPP)
- ❖ Screening of necessary Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE)
- ❖ Reviewing and Appraisal of EIA and IEE

◆ During Construction

- ❖ Inspection to Construction site
- ❖ Checking Environmental Monitoring Reports
- ❖ Reviewing and Appraisal of EIA and IEE

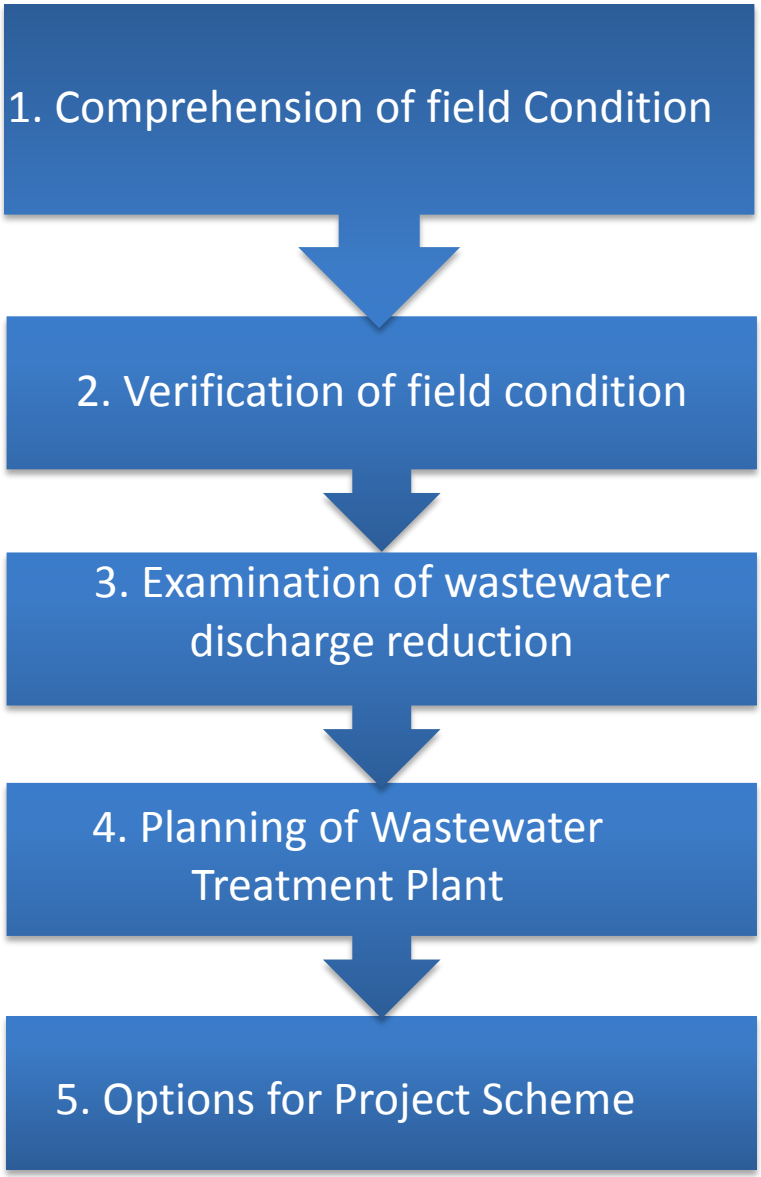
◆ During Operation

- ❖ Inspection to investors
- ❖ Checking Environmental Monitoring Reports

Analysis and Implementation Approach

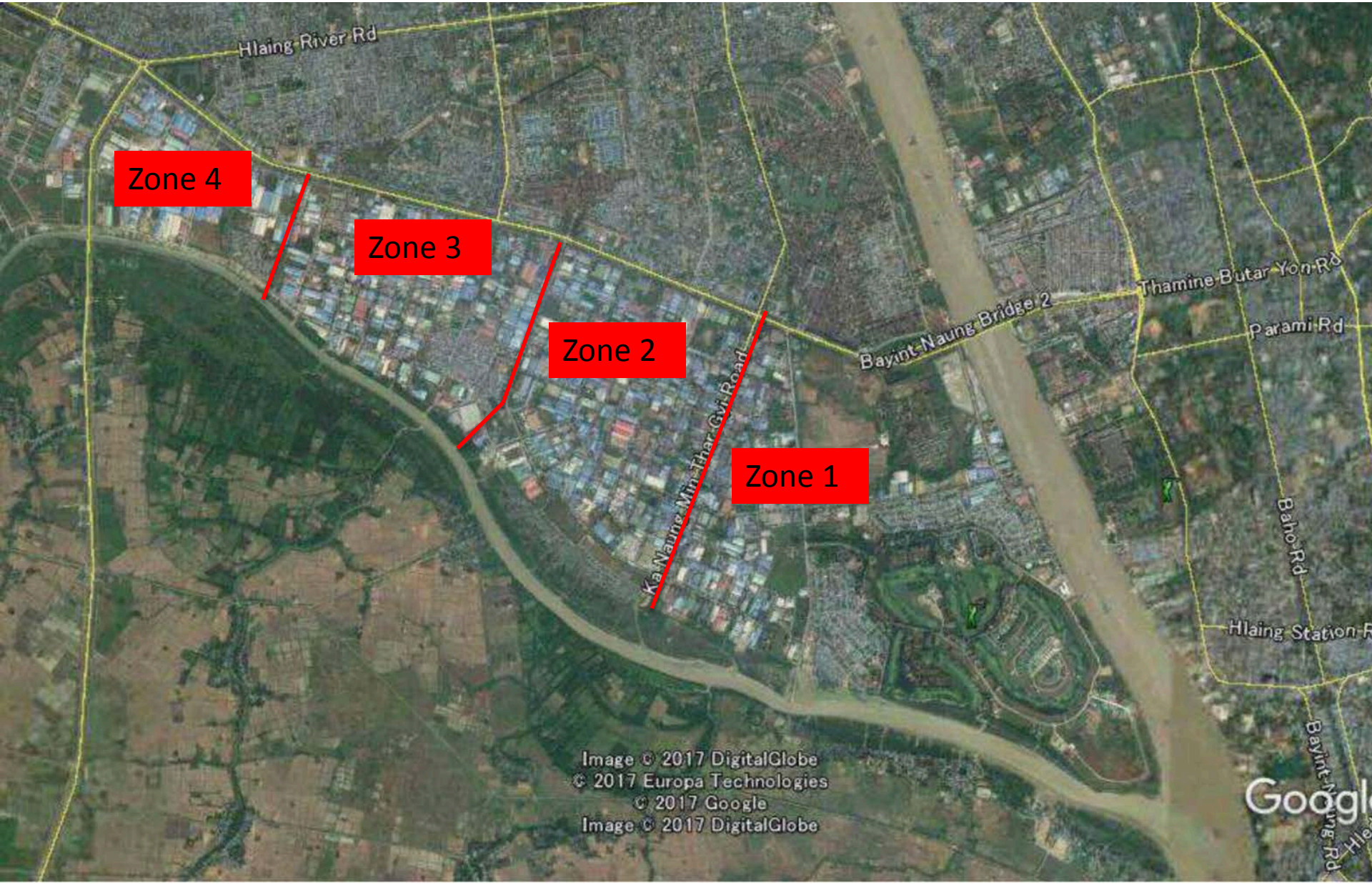
Studied by: JICA, Kobelco Eco Solutions Co., Ltd., Supreme Water Doctor Co., Ltd.

Planning of Industrial Wastewater Treatment Plant



- Factory water balance, wastewater quality survey, required discharge standard
- Confirmation of wastewater treatment volume, discharge, volume without treatment, treatment parameters
- Studies of wastewater volume at sources, concentration reduction, or reuse of wastewater in next process without treatment
- Determination of w/w volume, water quality (inlet/out let), treatment process, layout plan
- Government Owned
- Build – Own – Operate
- Build – Own – Transfer

Study Area: Hlaing Thar Yar



Number of Factories and Occupied Area (Hlaing Tharyar Industrial Zones)

	Planning compartments	Occupied compartments	Occupancy rate	Occupied area (Acre)
Zone 1	190	157	83%	280
Zone 2	250	202	81%	376
Zone 3	110	82	75%	277
Zone 4	180	161	89%	243
Total	730	602	82%	1,176

Source: data from YCDC

Wastewater is discharged to Pan Hlaing river through Open Trench, Open Creek



Source: Kobelco Eco Solutions Co., Ltd.
Supreme Water Doctor Co., Ltd.

Options of Case Study

Case 1: Zone (1)

- Option 1: Without rain water
- Option 2: With rain water

Case 2: Zone (1,2,3 and 4)

- Option 1: Without rain water
- Option 2: With rain water

Note: Study for installation of pre-wastewater treatment is not included. Because most of the factories may not be necessary to install pre-wastewater treatment by themselves except for factories discharging hazardous and chemical substance and concentration of BOD & COD levels from the factories can be treated by the central WWTP.

Setting target wastewater to be treated

Wastewater characteristic

Mainly have 7 kinds of wastewater line in this area with difference characteristic

- Type 1: Domestic wastewater
- Type 2: Garment Industrial wastewater
- Type 3: Dyeing industrial wastewater
- Type 4: Ice industrial wastewater
- Type 5: Chemical industrial wastewater
- Type 6: Paper factory industrial wastewater (with and without paper mill)
- Type 7: Food industrial wastewater

Zone 1 Wastewater Estimated Flow Rate

No	Kind of industry	Design flowrate	Calculated flowrate	COD	s-COD	BOD	SS	TN	TP
		m3/d	m3/d	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
	Zone 1	**8,300**	**6,581**	**1,899**	**1,031**	**836**	**881**	**65.6**	**7.1**
1	Domestic		1083	405	182	225	667	64.1	12.0
2	Garment		1616	1,300	1,040	260	61	150	5.0
3	Dyeing			2,500	2,000	1,000	200	130	10.0
4	Ice storage		145	2,000	900	1,500	500	100	31.0
5	Chemical								
	Painting		871	3,000	540	600	2,000	50	2.0
	Fertilizer			355	160	178	463	200	2.0
6	Paper								
	Paper mill		697	5,500	3,614	3,000	3,000	9.0	2.0
	Without paper mill		621	500	300	300	450	1.0	0.1
7	Food		1548	1,880	1,034	1,176	510	35.6	11.8

Design Flow Rate = Calculated Flow Rate/0.8 (0.8 occupancy rate)

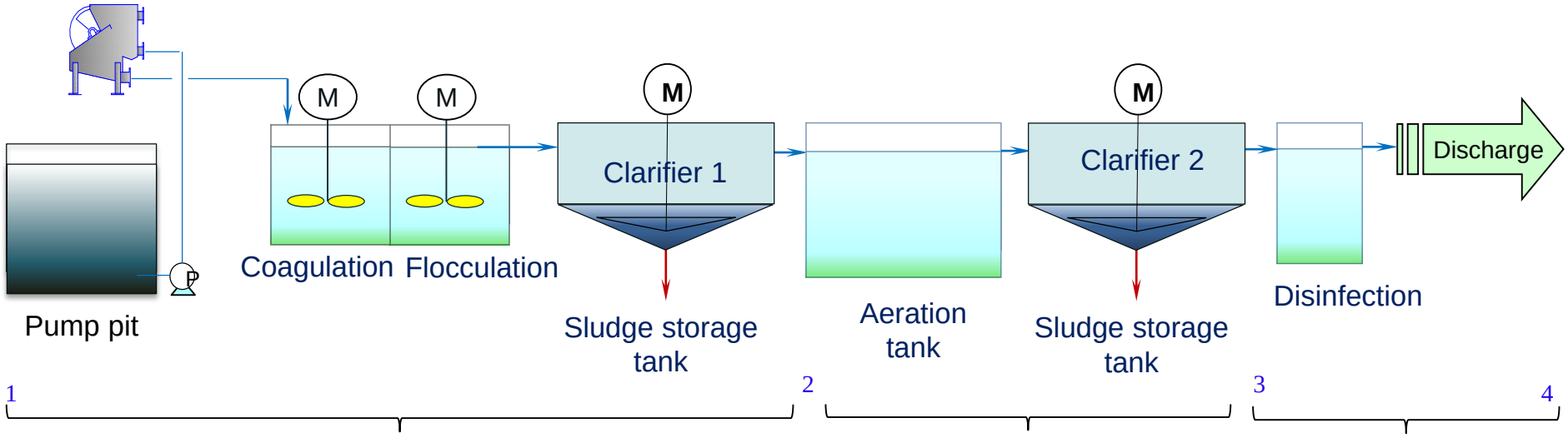
Zone 1+2+3+ 4 Wastewater Estimated Flow Rate

No	kind of industry	Design flowrate	Calculated flowrate	COD	s-COD	BOD	SS	TN	TP
		m3/d	m3/d	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
	Zone 1 +2+3+4	**43,300**	**34,614**	**1,973**	**1,209**	**931**	**719**	**83.1**	**9.6**
1	Domestic		5,468	405	182	225	667	64.1	12.0
2	Garment		8,062	1,300	1,040	260	61	150	5.0
3	Dyeing		4,325	2,500	2,000	1,000	200	130	10.0
4	Ice storage		2,670	2,000	900	1,500	500	100	31.0
5	Chemical								
	Painting		2,038	3,000	540	600	2,000	50	2.0
	Fertilizer		415	355	160	178	463	200	2.0
6	Paper								
	Paper mill		3,362	5,500	3,614	3,000	3,000	9.0	2.0
	Without paper mill		621	500	300	300	450	1.0	0.1
7	Food		7,650	1,880	1,034	1,176	510	35.6	11.8

Design Flow Rate = Calculated Flow Rate/0.8 (0.8 occupancy rate)

Setting wastewater treatment process

Flow sheet – without rain water case study



PRIMARY TREATMENT TO REMOVE SS, COD, BOD

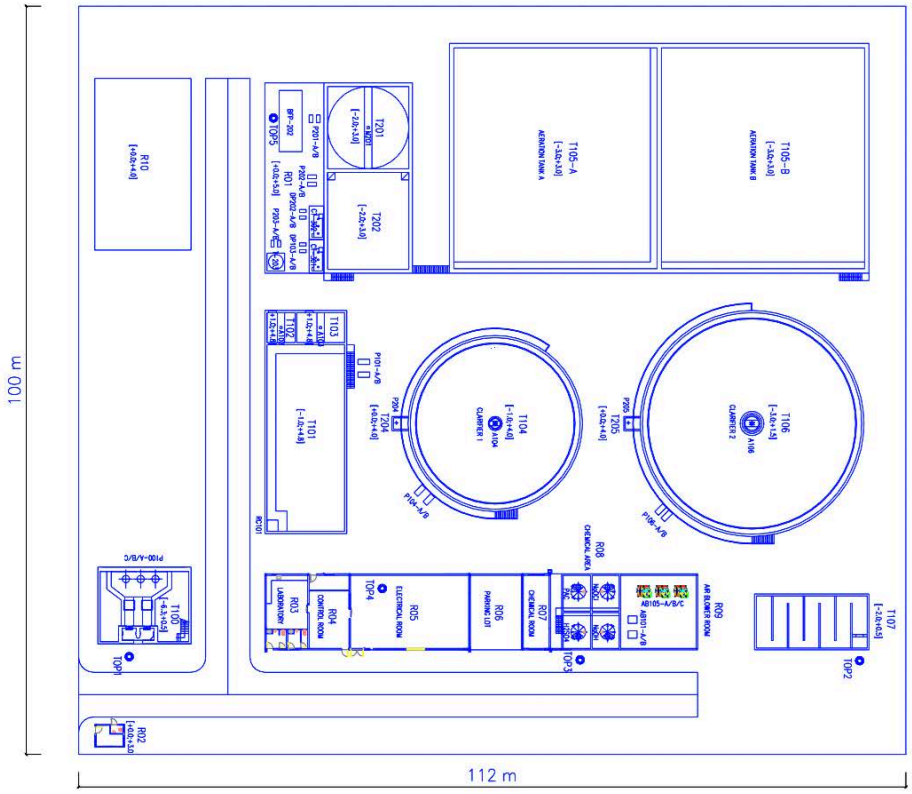
COD, BOD, NH3, TP, TN REMOVAL

REMOVE BACTERIAL

Parameter	Unit	Inlet			Outlet
		1			**4**
COD	mg/l	1780 - 1800			< 250
BOD	mg/l	700 - 800			< 50
SS	mg/l	600 - 720			< 50
NH3-N	mg/l	80 - 95			< 10
TP	mg/l	6.5 - 9			< 2
Coliform	MPN/100 ml				< 400

Outlet Conform to Effluent levels for Wastewater Treatment Facilities in National Environmental Quality (emission) guidelines 22 Apr. 2015

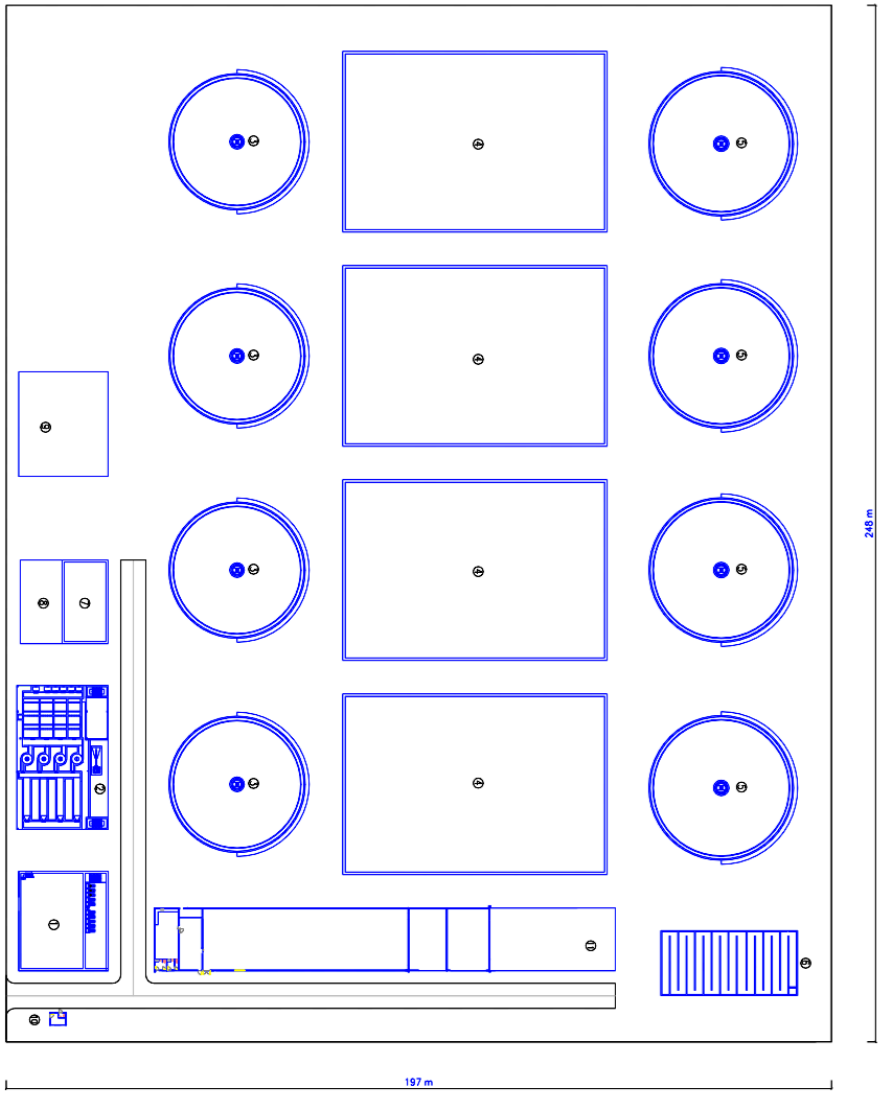
Layout Plan for Zone 1 Wastewater Treatment Pant



Capacity: 8,300 m3/d

Area 112 x 100 = 11,200 m2

Layout Plan for Zone 1+2+3+4 Wastewater Treatment Pant

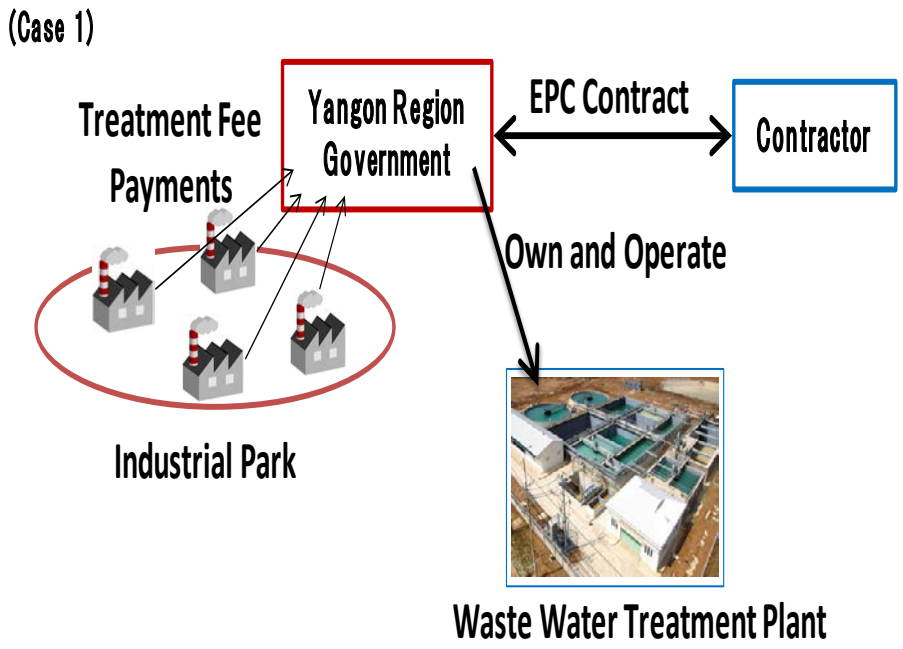


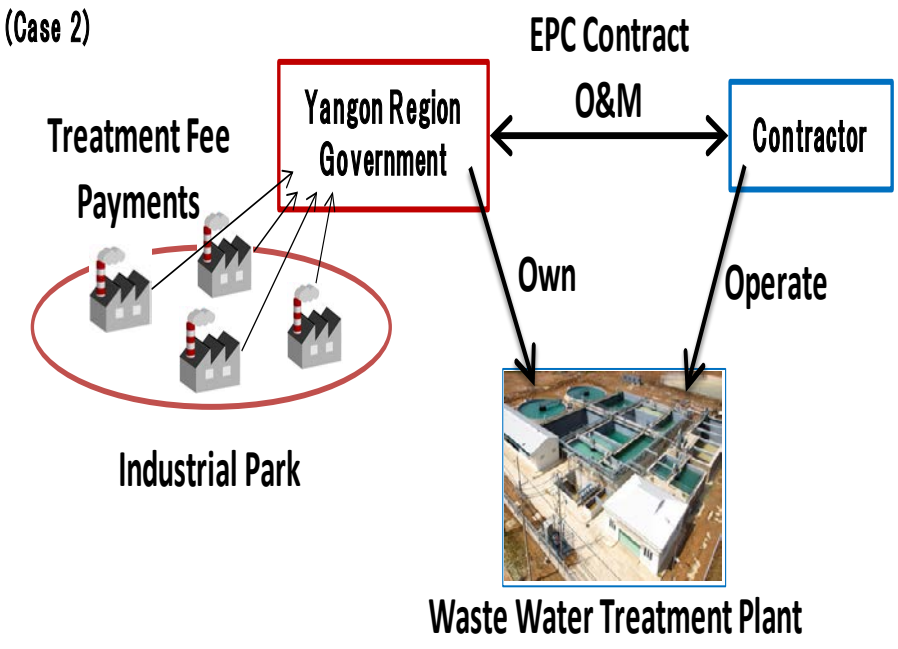
Capacity: 43,300 m3/d

Area 250 x 200 = 50,000 m2

Project Implementation Options

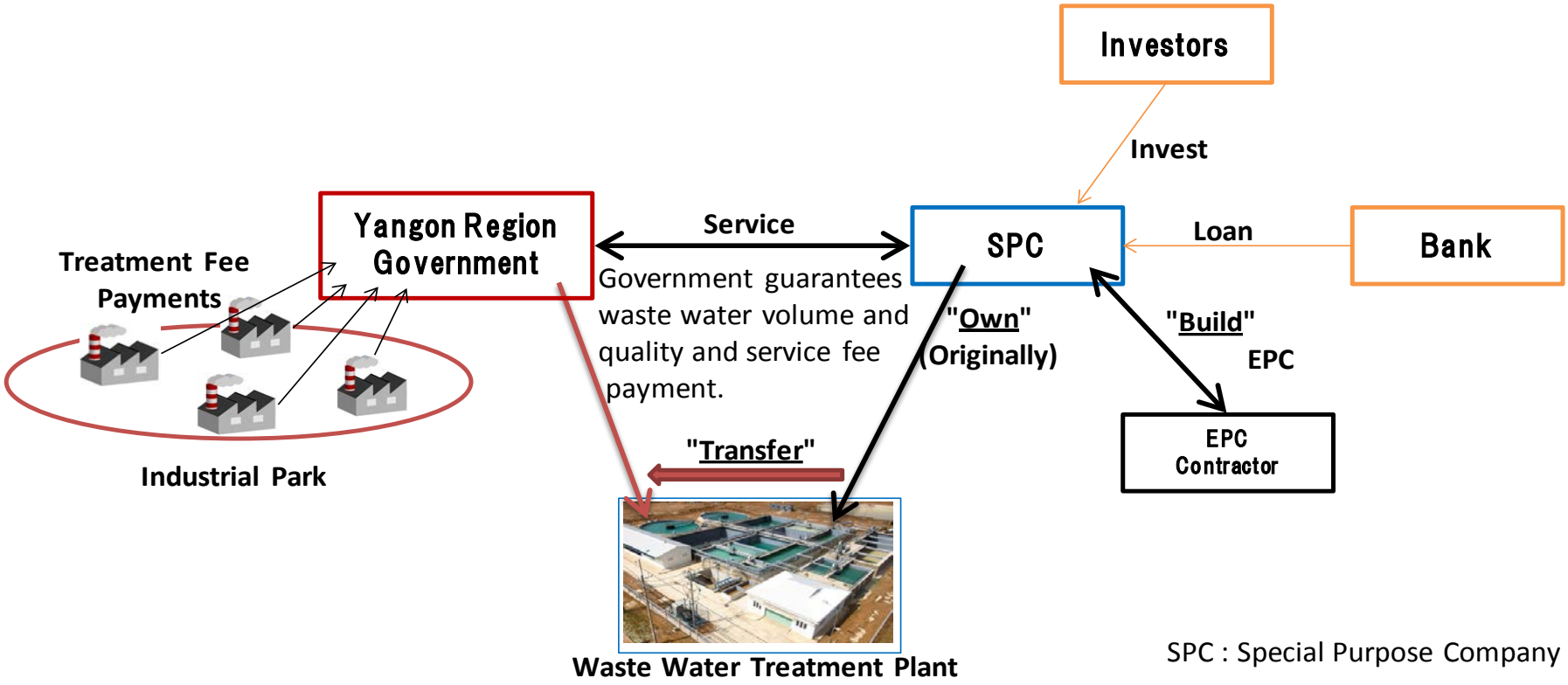
Project Scheme : Government Owned





Project Implementation Options

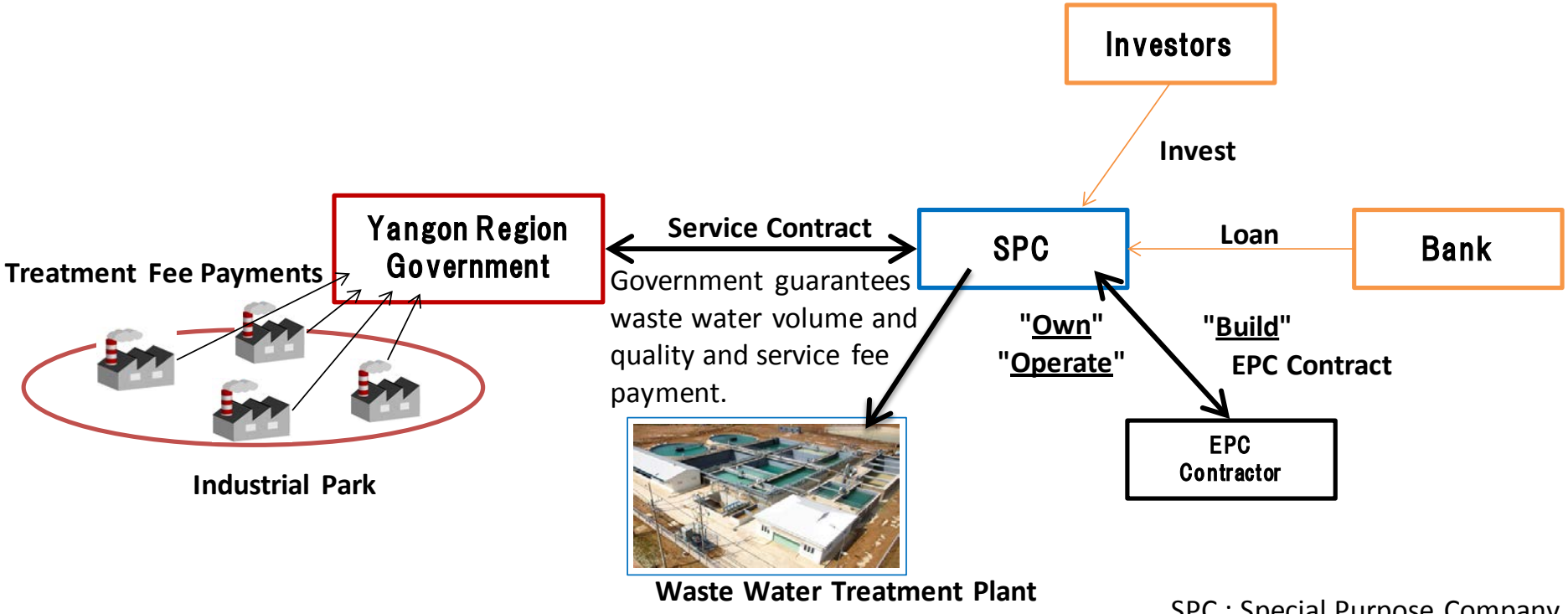
Project Scheme : Build – Operate – Transfer



SPC : Special Purpose Company

Project Implementation Options

Project Scheme : Build – Own- Operate



SPC : Special Purpose Company

Conclusion

- Issues – due to the limited facilities and budget, lack of technologies, increasing population and industries
- International Best Practice and experiences to formulate the regulations for wastewater management
- Preventive Measures is needed for health and environmental deterioration
- Control Measures – Monitoring /Coordination/ Regulations and Environmental Quality Standard/ Capacity Building / Persuasion/ Incentives (reward behavior that reduce pollution
- Implementation Options ???
- Development of Eco Industrial Zones
- Thilawa SEZ will meet Sustainable Development Goals (SDGs)

Thank You!

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Comparison

	Government Owned	Private Company Owned	
		BOO (Build-Own-Operate)	BOT (Build-Operate-Transfer)
Arrangement of Funds - CAPEX - OPEX	Government (Yangon Region Government)	SPC	
Payment by Government	- For Construction of Plant to EPC Contractor (Payment at the time of constrction) - For Operation and Maintenance (O&M) to Cotractor if it is outsourced.	- For Waste Water Treatment Service to SPC (Payment over the period of Waste Water Treatment Service)	
Source of Fund for Payment by Government	Own fund for construction of Plant (= Tax revenue or Loan) * Fund for construction of Plant and O&M will be collected from factories in the industrial zone (Tenants) over the period of plant operation.	Fee collected from factories in the industrial zone (Tenants) * It is recommended to set the Government's fee charged to Tenants higher than the fee paid to SPC in order to cover expenses of Government.	
Ownership of Waste Water Treatment Plant	Yangon Region Government	SPC	- Originally, SPC owns plant. - After reasonable return of investment has been obtained by Investors, ownership is transferred to Yangon Region Government.
Summary of role of Government	- Arrangement of fund - Operation and Maintenance of Plant - Colletion of fees from Tenants - Arrangement of land - Arrangement of resettlement (if required)	- Payment of waste water treatment service fee - Guarantee of waste water volume and quality - Collection of fee from Tenants - Arrangement of land - Arrangement of resettlement (if required)	