

Sustainability of Wastewater Treatment & Management

Presenter Introduction



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Introduction

Introduction

Introduction

NATIONAL ENVIRONMENTAL QUALITY (EMISSION) GUIDELINES

CHAPTER I General Provisions

အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ

အခန်း (၁)

အထွေထွေပြဋ္ဌာန်းချက်များ

Introduction

Definitions အဓိပ္ပာယ်ဖော်ပြချက်များ

2.

(d) **Effluent** means wastewater, treated or untreated, that is discharged to surface waters from a treatment plant, sewer, or industrial outfall.

၂။

(ဃ) စွန့်ထုတ်အရည် (Effluent) ဆိုသည်မှာ သန့်စင်စက်ရုံ၊ မိလ္လာပိုက်နှင့် စက်ရုံမှ သန့်စင်ပြီး သို့မဟုတ် သန့်စင်မှုမပြုလုပ်ဘဲ မြေပေါ်ရေသို့ စွန့်ထုတ်လိုက်သော စွန့်ပစ်ရေကို ဆိုသည်။

Introduction

- Over the past few years, the rapid growth of Myanmar's population and economy had led to an increase in municipal wastewater and industrial wastewater discharge volume.
- The ineffective wastewater management had caused significant environmental pollution in the major cities, especially Yangon City.
-
- Even though some of the wastewater treatment plant infrastructure had been constructed, the performance and quality produced from the wastewater treatment plant (WWTP) are yet to achieve the discharge standard stipulated in National Environmental Quality (Emission) Guideline.

Introduction

- One of the main reasons is the lack of competent persons in the wastewater treatment management supply chain such as system designers, operation teams as well as the performance monitoring team in WWTP.
- Nevertheless, many other factors also may affect the overall performance of WWTP such as poor legislation and regulation enforcement by local authorities, and lack of public awareness among the industrial and community.

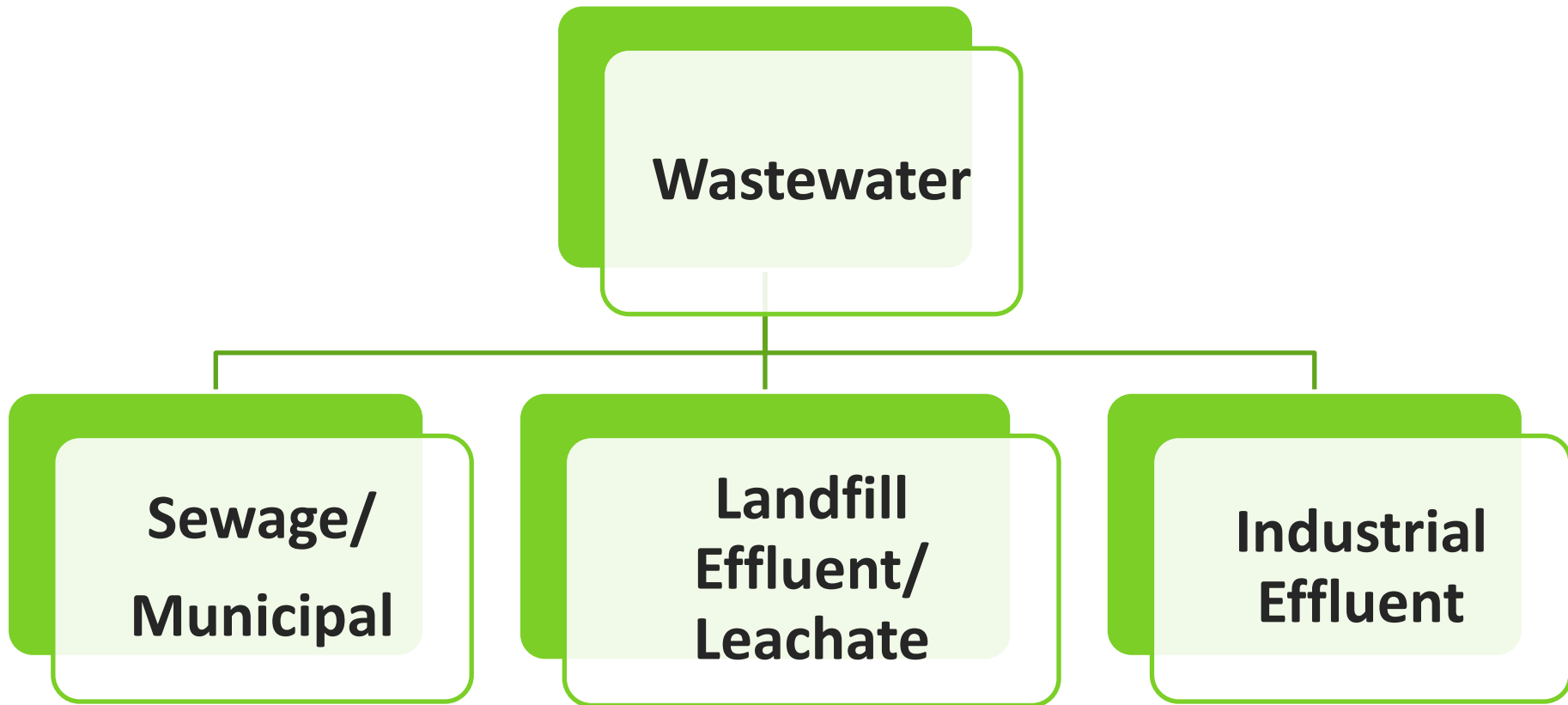
Introduction

- The right approach for **the sustainability of wastewater treatment & management will be shared with** those environmental practitioners to ensure that environmental pollution can be minimized and provide a cleaner and safer environment for the next generation.

Wastewater Sources

Wastewater Sources

Wastewater Sources

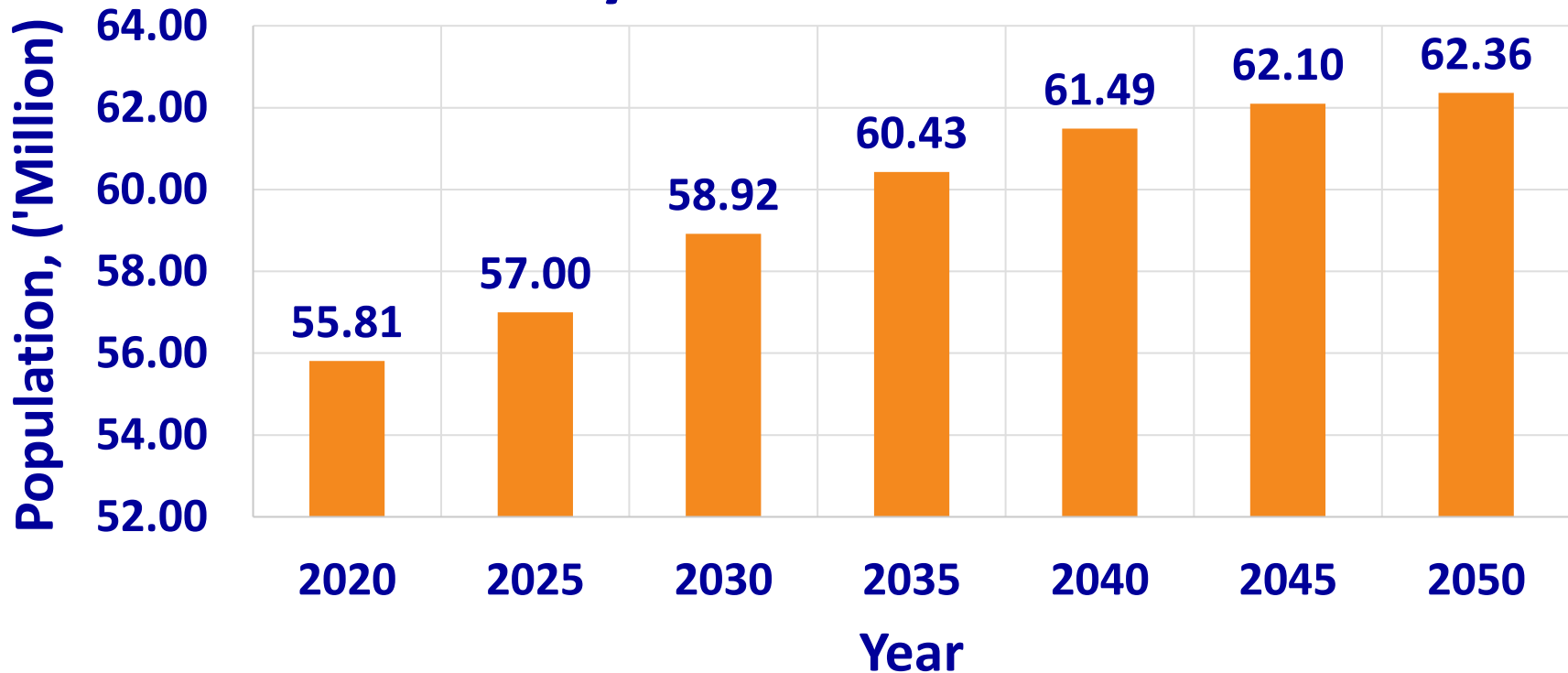


Wastewater Sources

Sewage/Municipal

Wastewater Sources

Population Projection of Myanmar For year 2020-2050



Sources: United Nations Department of Economic and Social Affairs: Population Division for Myanmar, 2022

Wastewater Sources

Population Projection of Yangon City For Year 2020-2040

Year	Population Projection ('Million)
2020	6,003,820
2025	6,825,971
2030	7,760,706
2035	8,823,442
2040	10,031,707

Sources: JICA Study Team based on the Data Collection Survey for the Project for Updating the Strategic Urban Development Plan of the Greater Yangon by JICA in 2017

Wastewater Sources

Population Equivalent, PE

Population Equivalent = 242.5 L

➤ Sewage Volume generated per person per day
= 242.5 L/persons/day

Sources: The Republic of The Union of Myanmar: Data Collection Survey for Sewerage System Development in Yangon City, Final Report, Japan International Cooperation Agency (JICA), 2019.

Wastewater Sources

Sewage Generation of Yangon City For Year 2017-2040

Year	Population Projection	Sewage Generation m ³ /day
2020	6,003,820	1,455,926
2025	6,825,971	1,655,298
2030	7,760,706	1,881,971
2035	8,823,442	2,139,685
2040	10,031,707	2,432,689

Sources: JICA Study Team based on the Data Collection Survey for the Project for Updating the Strategic Urban Development Plan of the Greater Yangon by JICA in 2017

Wastewater Sources

**Landfill
Effluent/Leachate**

Wastewater Sources

Landfill Effluent/Leachate

- **Definition:** Liquid effluent generated from rainwater percolation through solid waste disposed of in a landfill, the moisture present in the waste, and the degradation products of residues.
- The leachate quantity is mainly determined by precipitation, evapotranspiration, surface runoff, groundwater infiltration, and the degree of compaction within a landfill.
- Leachate comprises of four major types of pollutants:
 1. Dissolved organic matter (organic carbon, fatty acids)
 2. Inorganic compounds (chloride, ammonium, phosphates, nitrate)
 3. Heavy metals (copper, zinc, lead, mercury)
 4. Xenobiotic organic compounds (XOCs) (benzene, phenols, phthalates)

Wastewater Sources

Industrial Effluent

Wastewater Sources

No	State/Region	Zone ID	Quantity
1	Yangon	1-47	47
2	Ayeyarwady	48 - 52	5
3	Bago	53-56	4
4	Kachin	57-59	3
5	Kayah	60	1
6	Kayin	61-62	2
7	Magway	63-65	3

Sources: Myanmar Management Information Unit: Industrial & Special Economic Zone, 2019

Wastewater Sources

No	State/Region	Zone ID	Quantity
8	Mandalay	66-72	7
9	Mon	73-75	3
10	Nay Pyi Taw	76	1
11	Rakhine	77-78	2
12	Sagaing	79-82	4
13	Shan	83-86	4
14	Tanintharyi	88-89	2

Sources: Myanmar Management Information Unit: Industrial & Special Economic Zone, 2019

Content

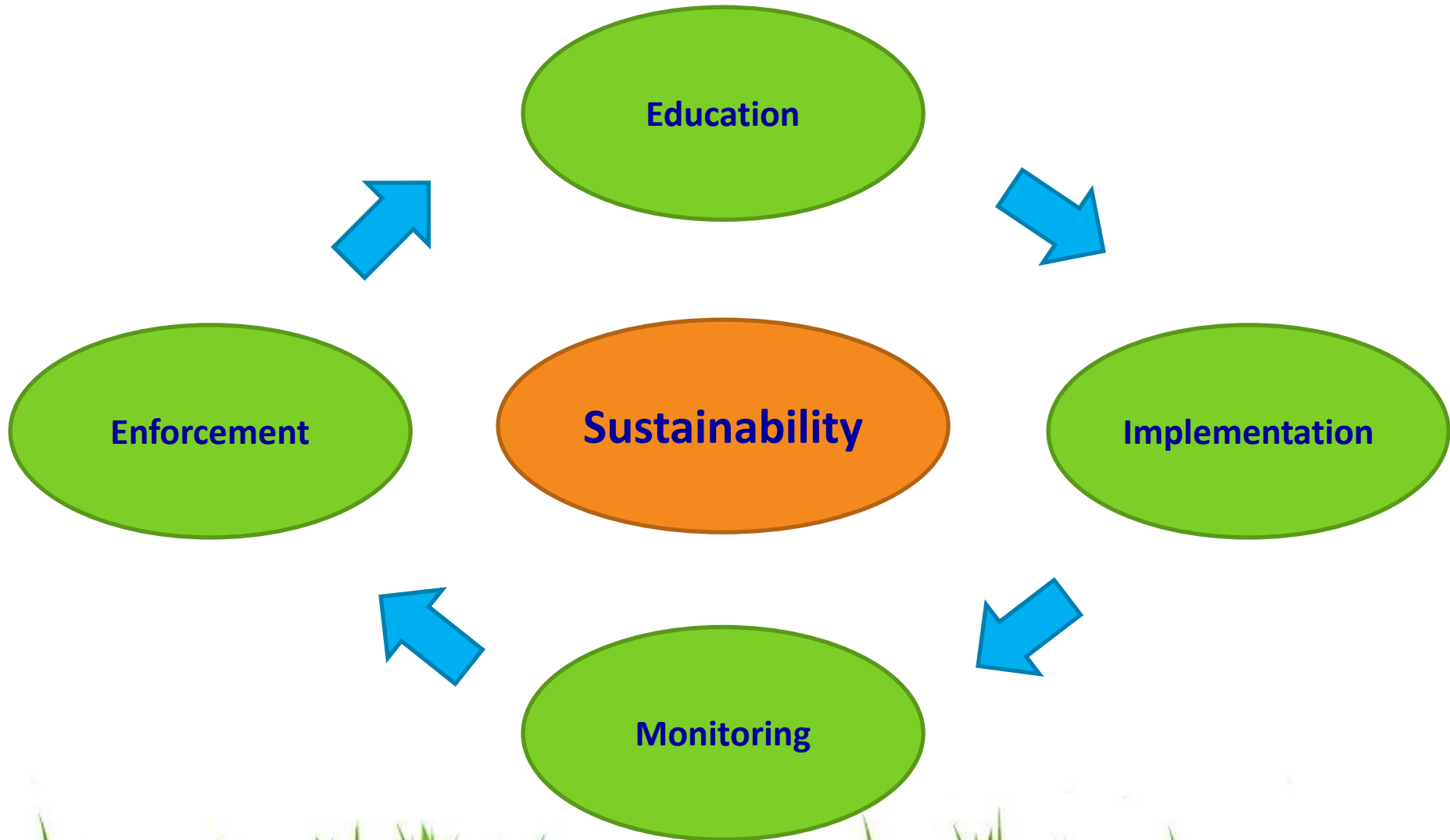


Eutrophication in the drainage near Their Phyu township, Yangon

Sources: Wastewater Management and Its Consequences; Interview With Si Thu Tun – A Wastewater Expert. Myanmar Water Portal. 2020.

Sustainability of Wastewater Treatment & Management

Sustainability



Sustainability



Education

Sustainability

Education

- Formal education
- Informal Education
- Professional Training

Sustainability

- Formal education
 - College/University (Environmental, pollution control related courses)



Sustainability

➤ Informal Education

- Seminar, conferences, social media (LinkedIn)

MCRB Contributes to Successful First International Conference by Myanmar Environment Assessment Association

📅 January 09, 2020



Sustainability



i-Chem Solution Group of Companies



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How well do you know about your [#Protozoa](#) in biological treatment?

[#Amoeba](#) are predominant under a young sludge age, could dominate ...see more



Protozoa Amoeba - Activated Sludge

Sustainability

➤ Professional Training

- Environmental Protection courses: Sewage Water Treatment, Industrial Wastewater Treatment, etc.
- Theory and fundamental lecturing, hand-on practical training, on-site training

Sustainability

Wastewater Treatment Training



Sustainability

Hand-On Practical Training



Sustainability

Implementation

Sustainability

Implementation

- Environmental Regulation
- Wastewater Treatment Plant
Design & Construction

Sustainability

Implementation

- Understanding and ensuring conformity with legislation, regulations, standards, and codes

အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ

NATIONAL ENVIRONMENTAL QUALITY
(EMISSION) GUIDELINES

Wastewater Sources

Sewage/Municipal

Sustainability

၂.၄.၂ စွန့်ပစ်ရေ သန့်စင်မှု လုပ်ငန်း (Wastewater Treatment Facilities)

လူနေရပ်ကွက်များ၊ စီးပွားရေးလုပ်ငန်းနှင့် စက်မှုလုပ်ငန်းများမှ ထွက်ရှိလာမည့် စွန့်ပစ်ရေဆိုးများကို သန့်စင်သည့် ဗဟိုစွန့်ပစ်ရေဆိုးသန့်စင်သည့် လုပ်ငန်းများတွင် ဤလမ်းညွှန်ချက်များကို လိုက်နာရမည်။ လမ်းညွှန်ချက်တန်ဖိုးများကို မြေပေါ်ရေအတွင်းသို့ မစွန့်ပစ်မီ မိလ္လာရေများနှင့် ညစ်ညမ်းစီးဆင်းရေ (Contaminated Storm Water) များ ပြုပြင်သန့်စင်ခြင်းလုပ်ငန်းများတွင် လိုက်နာကျင့်သုံးရမည်။ ဤလုပ်ငန်းကဏ္ဍအတွက် စွန့်ထုတ်အရည် အဆင့်သတ်မှတ်ချက်များမှာ အောက်ဖော်ပြပါအတိုင်း ဖြစ်သည်-

This guideline applies to centralized wastewater treatment facilities receiving wastewater from residential, commercial and industrial users. Guideline values are applicable to treated sewage and contaminated storm water before being discharged to surface waters.

Sustainability

စွန့်ထုတ်အရည်အဆင့်သတ်မှတ်ချက်များ: (Effluent Levels)

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	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

Sustainability

Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U. ^a	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	°C	<3 ^b
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

Sustainability

**Landfill
Effluent/Leachate**

Sustainability

2.4 Waste Management

2.4.1 Solid Waste Management Facilities⁵⁸

This guideline applies to projects dedicated to the management of municipal solid waste and industrial waste including waste receipt, unloading, processing, and storage; landfill disposal; physico-chemical and biological treatment; and incineration projects. Industry-specific waste management activities (e.g. medical waste) are covered in the relevant industry guidelines.

၂.၄ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု (Waste Management)

၂.၄.၁ အစိုင်အခဲစွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှုလုပ်ငန်း (Solid Waste Management Facilities)^{၅၈}

စွန့်ပစ်ပစ္စည်းများအား လက်ခံ/ရွှေ့ပြောင်း/ပြုပြင်/ထုပ်ပိုး/သိုလှောင်ခြင်း၊ မြေဖိုစွန့်ပစ်ခြင်း၊ ရူပ-ဓာတုနှင့် ဇီဝနည်းစဉ်များဖြင့် ပြုပြင်သန့်စင်ခြင်းနှင့် မီးရှို့ဖျက်ဆီးခြင်းစသည့် မြူနီစပါယ် စွန့်ပစ်အစိုင်အခဲနှင့် စက်မှုလုပ်ငန်း စွန့်ပစ်ပစ္စည်းများ စီမံခန့်ခွဲမှု လုပ်ငန်းများတွင် ဤလမ်းညွှန်ချက်ကို လိုက်နာရမည်။ သက်ဆိုင်ရာလုပ်ငန်းသဘာဝအလိုက် စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု လုပ်ဆောင်ချက်များ (ဥပမာ - ဆေးကုသမှုနှင့်ဆိုင်သော စွန့်ပစ်ပစ္စည်း) သည် သက်ဆိုင်ရာ လုပ်ငန်းလမ်းညွှန်ချက်များ (Relevant Industry Guidelines) တွင် အကျုံးဝင်သည်။ ဤလုပ်ငန်းကဏ္ဍအတွက် စွန့်ထုတ်အရည်နှင့် ထုတ်လွှတ်အခိုးအငွေ့ အဆင့်သတ်မှတ်ချက်များမှာ အောက်ဖော်ပြပါအတိုင်း ဖြစ်သည်-

⁵⁸ Environmental, health, and safety guidelines for waste management facilities. 2007. International Finance Corporation, World Bank Group.

Sustainability

Effluent Levels (for landfills)

စွန့်ထုတ်အရည်အဆင့်သတ်မှတ်ချက်များ

Parameter	Unit	Guideline Value			
		Hazardous Waste Landfills		Municipal Solid Waste Landfills	
		Daily Max.	Monthly Average	Daily Max.	Monthly Average
5-day Biochemical oxygen demand	mg/L	220	56	140	37
Ammonia	mg/L	10	4.9	10	4.9
Aniline	mg/L	0.024	0.015	–	–
Arsenic	mg/L	1.1	0.54	–	–
α -Terpineol	mg/L	0.042	0.019	0.033	0.016
Benzoic acid	mg/L	0.119	0.073	0.12	0.071
Chromium (total)	mg/L	1.1	0.46	–	–
Naphthalene	mg/L	0.059	0.022	–	–
p-Cresol	mg/L	0.024	0.015	0.025	0.014
pH	S.U. ^a	6-9	6-9	6-9	6-9
Phenol	mg/L	0.048	0.029	0.026	0.015
Pyridine	mg/L	0.072	0.025	–	–
Total Suspended Solids	mg/L	88	27	88	27
Zinc	mg/L	0.535	0.296	0.2	0.11

^aStandard unit

Sustainability

Industrial Effluent

Sustainability

၂.၃ ကုန်ထုတ်လုပ်မှု

၂.၃.၁ အစားအစာနှင့် အဖျော်ယမကာ ထုတ်လုပ်ခြင်း

2.3 Manufacturing

2.3.1 Food and Beverages Manufacturing

Sustainability

၂.၃.၁.၄ အစားအစာနှင့် အဖျော်ယမကာ ထုတ်လုပ်ခြင်းလုပ်ငန်း^{၃၁}

လူတို့ စားသုံးရန်အတွက် သားငါး၊ ဟင်းသီးဟင်းရွက်၊ သစ်သီးနှင့် အခြားကုန်ကြမ်းပစ္စည်းများကို ပြုပြင်မွမ်းမံ၍ တန်ဖိုးမြင့် စားသောက်ကုန်နှင့် ကစော်ဖောက်မထားသော အဖျော်ယမကာ ထုတ်လုပ်သည့်လုပ်ငန်းများတွင် ဤလမ်းညွှန်ချက်များကို လိုက်နာရမည်။ ဤလုပ်ငန်းကဏ္ဍအတွက် စွန့်ထုတ်အရည်နှင့် ထုတ်လွှတ်အခိုးအငွေ့ အဆင့်သတ်မှတ်ချက်များမှာ အောက်ဖော်ပြပါအတိုင်း ဖြစ်သည်-

2.3.1.4 Food and Beverage Processing³¹

This guideline covers the processing of meat, vegetable, fruit, and other raw materials in value-added food and non-fermented beverage products for human consumption

³¹ Environmental, health, and safety guidelines for food and beverage processing. 2007. International Finance Corporation, World Bank Group.

Sustainability

စွန့်ထုတ်အရည်အဆင့်သတ်မှတ်ချက်များ: (Effluent Levels)

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	

Sustainability

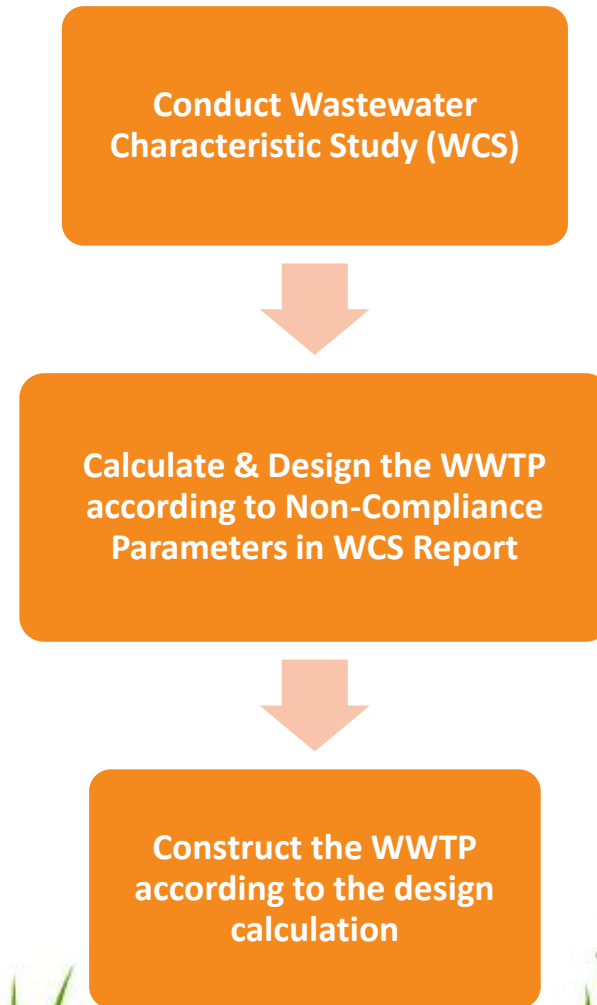
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U. ^a	6-9
Temperature increase	°C	<3 ^b
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

^a Standard unit

^b At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Sustainability

- Design and construct an appropriate Wastewater Treatment Plant (WWTP).



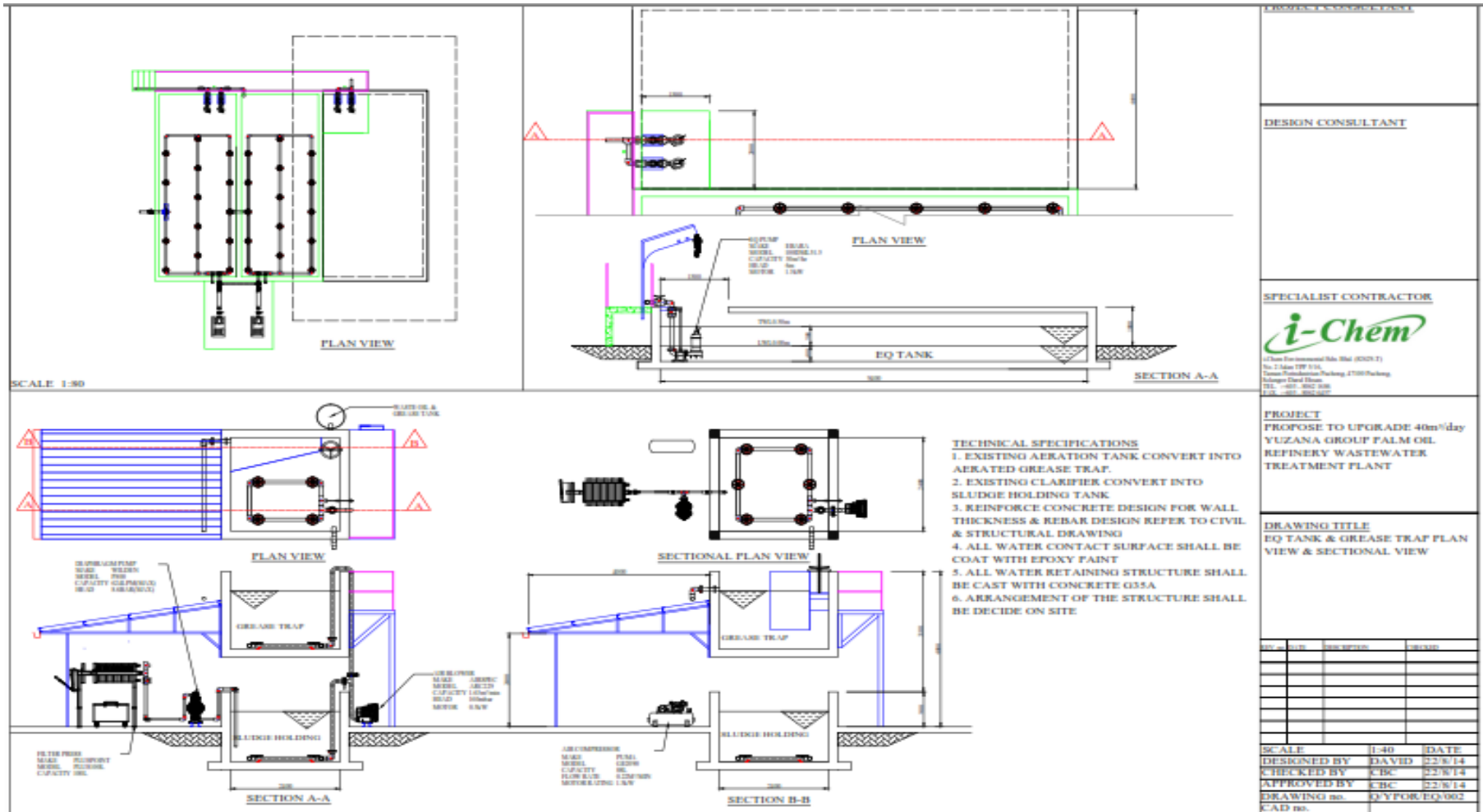
Sustainability

WWTP Design Calculation

AERATION TANK					
Flowrate per Day	=	24.00 m ³ /d	No of Cycle per Day	=	4 cycle/d
BOD5	=	600 mg/L	SBR Cycle	=	12 h/cycle
No of SBR	=	2 units	Aeration Period	=	8 h
No of Cycle/SBR	=	2 cycles	F/M SBR	=	0.050 /d
MLVSS	=	3000 mg/L	Filling Period	=	6 h
F/M Ratio	=	0.15	Flowrate per Hour	=	1.00 m ³ /h
Settled MLSS Conc	=	0.8 %	Incoming BOD5/cycle	=	3.6 kg/cycle
Aeration Height	=	7.25 m	MLVSS Required	=	72.0 kg
			Aeration Volume	=	24.0 m ³
			Decant Volume	=	6.0 m ³
			Decant Level (from ground)	=	5.4 m
			MLSS Level (from ground)	=	2.7 m
			% Decant over Aeration Vol	=	25.0 %
AIR BLOWER					
Oxygen : BOD5	=	2.5	OTE @ 7.25mH	=	29.0 %
OTE per meter height	=	4.0 %	Air Blower	=	16.2 m ³ /h
Diffuser Air Speed	=	5.0 m ³ /h	Aeration Area	=	3.40 m ²
Diffuser Diameter	=	330 mm	No of Diffusers per SBR	=	3 unit
Diffuser Eff Diameter	=	300 mm	Each Diffuser Area	=	0.071 m ²
			Diffuser Coverage	=	6.2 %
			Air Blower Delivery Head	=	8.0 m

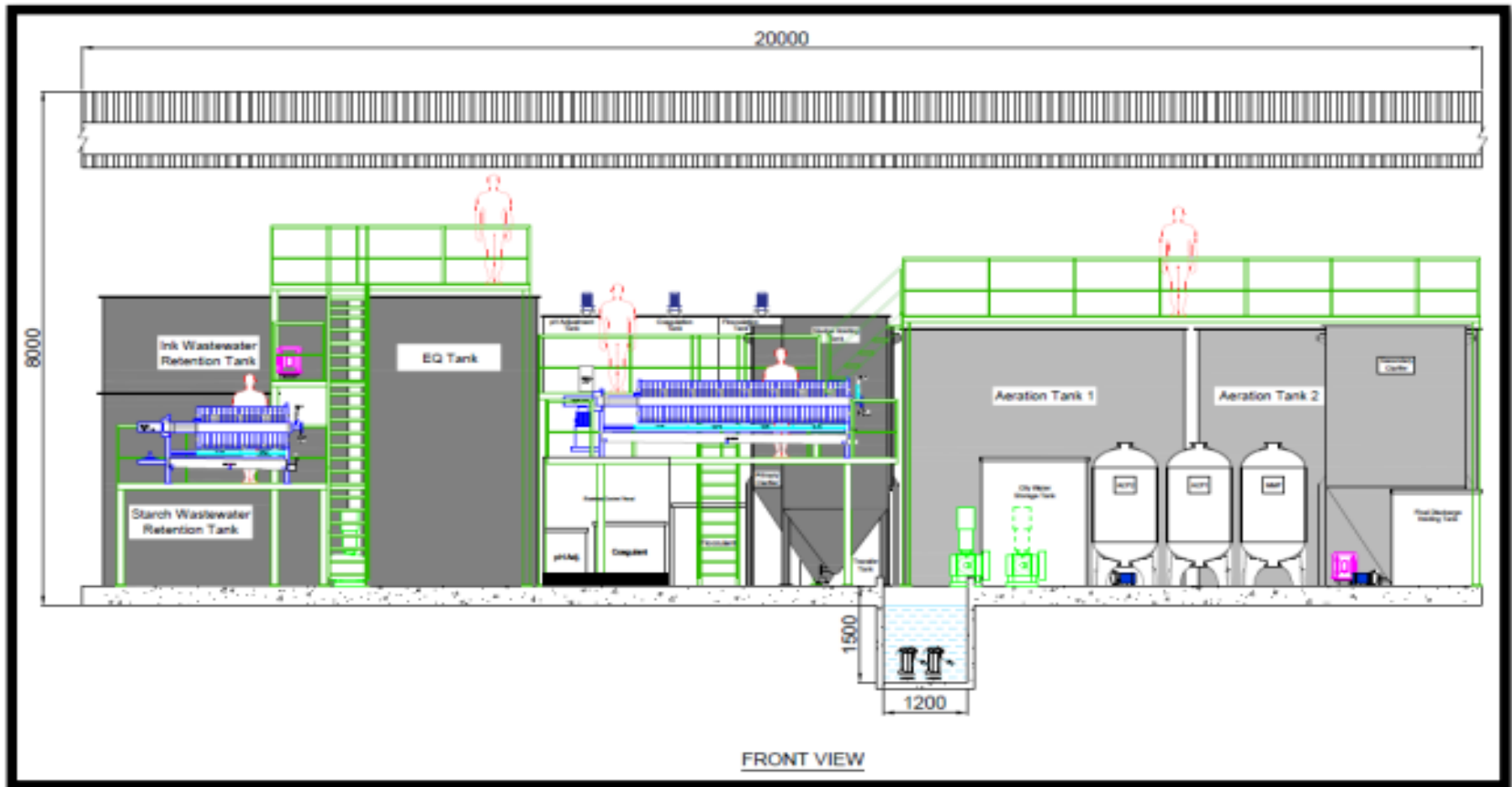
Sustainability

WWTP Design Drawing



Sustainability

WWTP Design Drawing



Sustainability

Construct a WWTP



Sustainability

Monitoring

Sustainability

Monitoring

- Internal Monitoring
- External Monitoring

Sustainability

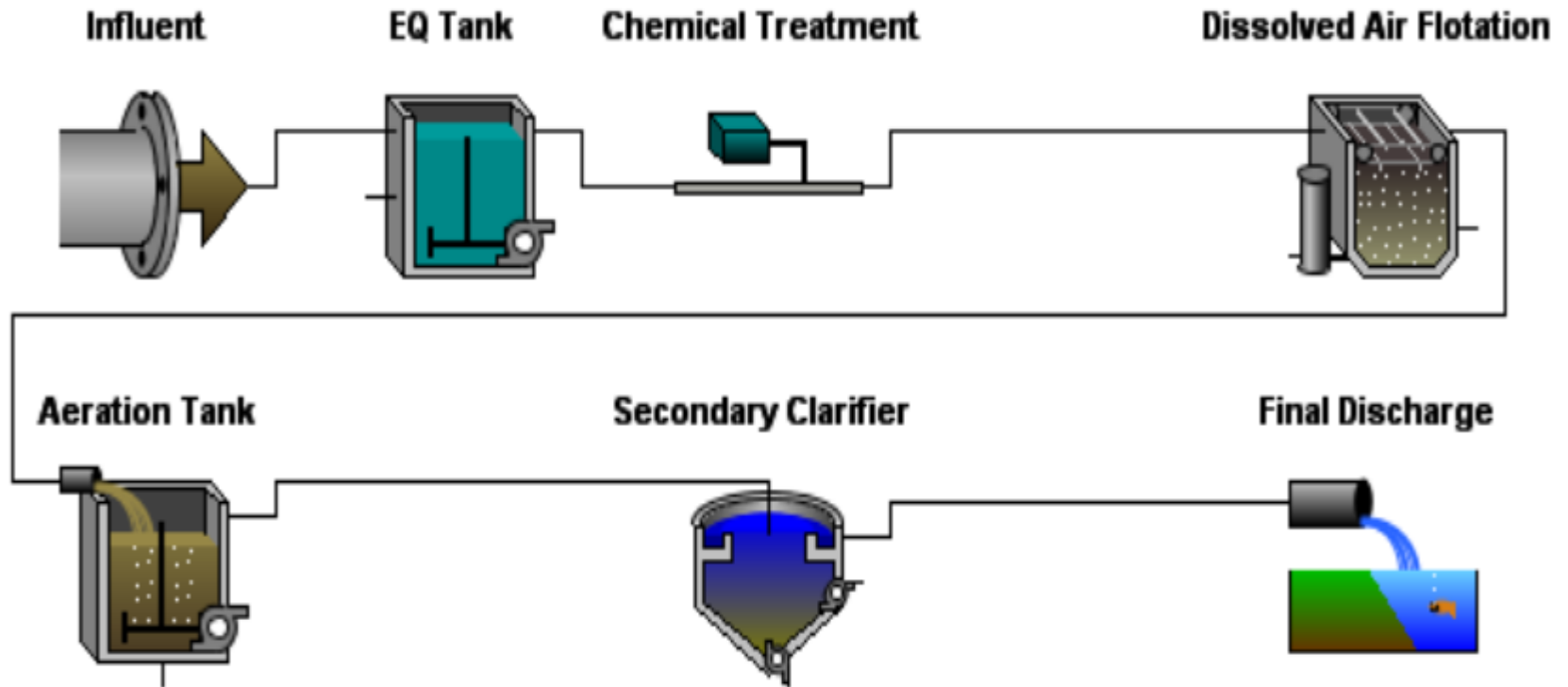
Monitoring

➤ Internal Monitoring

- Design a Performance Monitoring Program according to the WWTP process design
- Set up an appropriate internal laboratory
- Carryout analysis testing according to the frequency required

Sustainability

Eg: Food & Beverage WWTP



Sustainability

Performance Monitoring Laboratory & Instrument



Sustainability

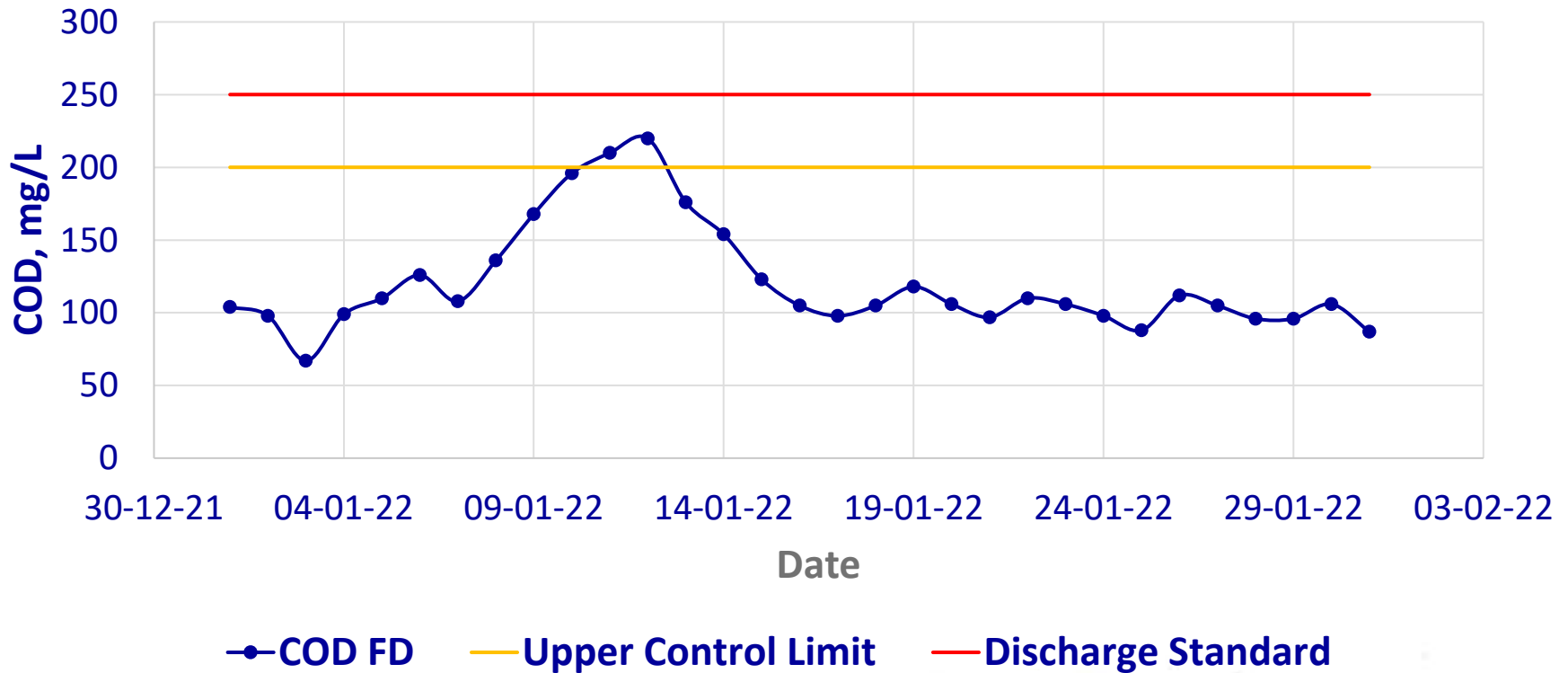
Performance Monitoring Sheet

System	Parameters	Unit	Date							
			4/10	7/10	11/10	14/10	19/10	22/10	25/10	28/10
Influent	Flow Rate	m ³ /day	36.80	38.70	39.60	37.80	42.40	38.90	29.50	37.60
	PH	-	6.8	6.9	6.8	7.0	6.9	6.5	7.1	6.8
	COD	mg/l	1866	-	1744	-	1920	-	1892	-
	BOD	mg/l	486	-	466	-	520	-	494	-
	TSS	mg/l	422	-	386	-	428	-	412	-
	Temperature	°C	26.2	27.5	25.7	24.7	25.9	25.4	27.9	25.9
Aeration Tank	PH	-	6.2	6.8	6.6	6.7	6.9	6.7	6.5	6.8
	DO	mg/l	3.8	3.8	3.7	3.8	3.7	3.6	3.8	3.7
	SV ₃₀	ml/l	470	480	460	480	520	600	580	580
	SVI	-	96.00	-	99.52	-	107.79	-	121.04	-
	MLSS	mg/l	4896	-	4622	-	4824	-	4792	-
	MLVSS	mg/l	4024	-	3868	-	3863	-	3835	-
	F/M Ratio	-	0.11	-	0.12	-	0.14	-	0.10	-
	COD	mg/l	86.0	-	90.0	-	102.0	-	110.0	-
	OUR	mg/l.hr	43.86	-	37.95	-	36.87	-	35.72	-
	SOUR	mg/g.hr	10.90	-	9.81	-	9.54	-	9.31	-
	Nitrogen	mg/l	35.6	-	36.8	-	40.3	-	39.5	-
	Phosphorus	mg/l	10.8	-	9.8	-	10.7	-	10.7	-
	BOD	-	100	-	100	-	100	-	100	-
	:N	-	:7.3	-	:7.9	-	:7.7	-	:8.0	-
:P	-	:2.2	-	:2.1	-	:2.1	-	:2.2	-	
Final Discharge	Flow Rate	m ³ /day	35.60	36.90	39.00	36.70	42.10	38.20	27.90	39.60
	PH	-	6.5	6.6	6.6	6.8	6.6	6.5	6.5	6.4
	COD	mg/l	72	69	76	89	89	78	89	62
	BOD	mg/l	14	-	18	-	25	-	28	-
	Oil & Grease	mg/l	2.4	-	2.2	-	2.6	-	2.4	-
	TSS	mg/l	18	-	22	-	28	-	36	-

Sustainability

Performance Monitoring – Control Chart

COD Final Discharge for January 2022



Sustainability

➤ External Monitoring

- Wastewater sampling and testing are carried out by the external laboratory with the **ISO/IEC 17025 Accredited Status**.
- ISO – International Organization for Standardization
- IEC – International Electrotechnical Commission

Sustainability



- ✓ General requirements for the competence of testing and calibration laboratories
- ✓ The management system has been approved
- ✓ The methods used for calibration are validated
- ✓ The calibration results have been independently compared to the results of other accredited labs
- ✓ The claimed uncertainties have been verified.
- ✓ Procedures for the entire calibration process are in place, making sure all instruments get a proper, correct calibration and constant quality will be delivered

Sustainability

ISO 9001

Management requirements are related to the ability to provide quality products and services that meet customer requirements as well as applicable statutory and regulatory requirements consistently. It also aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements.

ISO/IEC 17025

- Management requirements are related to the operation and effectiveness of the quality management system within the laboratory.
- Technical requirements address the competence of staff, testing methodology, equipment and quality, and reporting of test and calibration results.

Sustainability

Enforcement

Sustainability

Enforcement

- Execute the enforcement
- Provide guidance for industrial to comply with environmental regulation

Sustainability

Enforcement

- Execute the enforcement according to the Myanmar environmental regulation, **National Environmental Quality (Emission) Guideline.**

Sustainability

3 NOVEMBER 2013

Factories to set up wastewater treatment facilities in Yangon, Myanmar

WATER

TECHNOLOGY

Yangon City Development Committee (YCDC) of Myanmar has ordered around 80 factories in the city to set up wastewater treatment facilities by the end of the year.

The agency has warned that it will seize business licenses for all factories that fail to have proper water treatment facilities in place by 2014.

YCDC's pollution control and cleaning department head Than Lwin Oo said that 207 out of 3,264 factories within the city's industrial zones release wastewater into waterways.

Sustainability

Among the 207 factories, 109 ensure proper treatment while 78 are not following YCDC standards. Untreated wastewater creates bad odours and water pollution for residents near the industrial zone.

The agency instructed the 78 firms to initiate the process of water treatment earlier in September. However, only 49 of them have responded to say that they would complete the installation of treatment equipment by November.

A recent survey by YCDC has revealed that among those that did not respond to the order, 19 factories are due to initiate work, while some have stopped operations and some are already complying with the set standards.

Sustainability

- Provide guidance for industrial to comply with environmental regulation
 - Explain the Myanmar environmental regulation, **National Environmental Quality (Emission) Guideline**
 - Listen to the industrial voice and provide guidance in environmental regulation compliance
 - Recommend a qualified environmental consultant in WWTP design & construction

Conclusion

Conclusion

Conclusion

- ✓ With cooperation and support from stakeholders (education center, industrial owner, environmental practitioner, and government), the sustainability of wastewater treatment and management can be achieved.



Conclusion

Clean Water in Myanmar





Thank You