

Conservation of Surface Water Quality in Myanmar

Dr. Nway Nway Khaing

Associate Professor

Department of Civil Engineering

MES Webinar

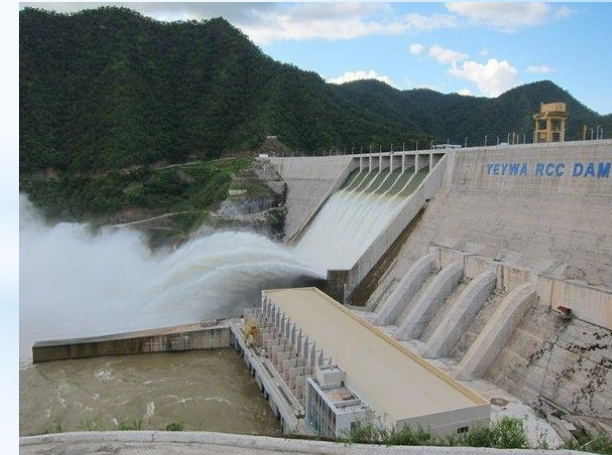
23.7.2022 (Saturday)



Fresh Water Scarcity Conservation Abundance

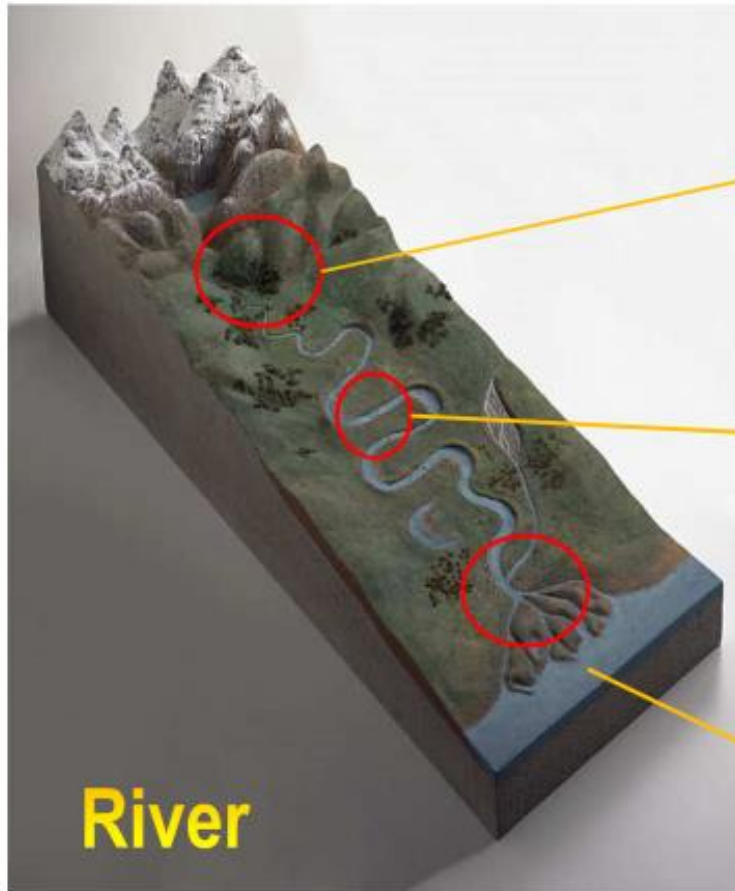
*Outlines

- *Causes of river water quality deterioration
- *Conservation : laws, policy, guide lines
- *Effects of
 - *Urbanization
 - *Industrial zones
 - *Land use and land cover changes
 - *Damming
- *Discussion
- *Conclusion
- *References



* Developments

Natural River



Developments



Agricultural Wastewater

Industrial Wastewater

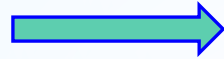
Domestic Wastewater



Impacts on WQ

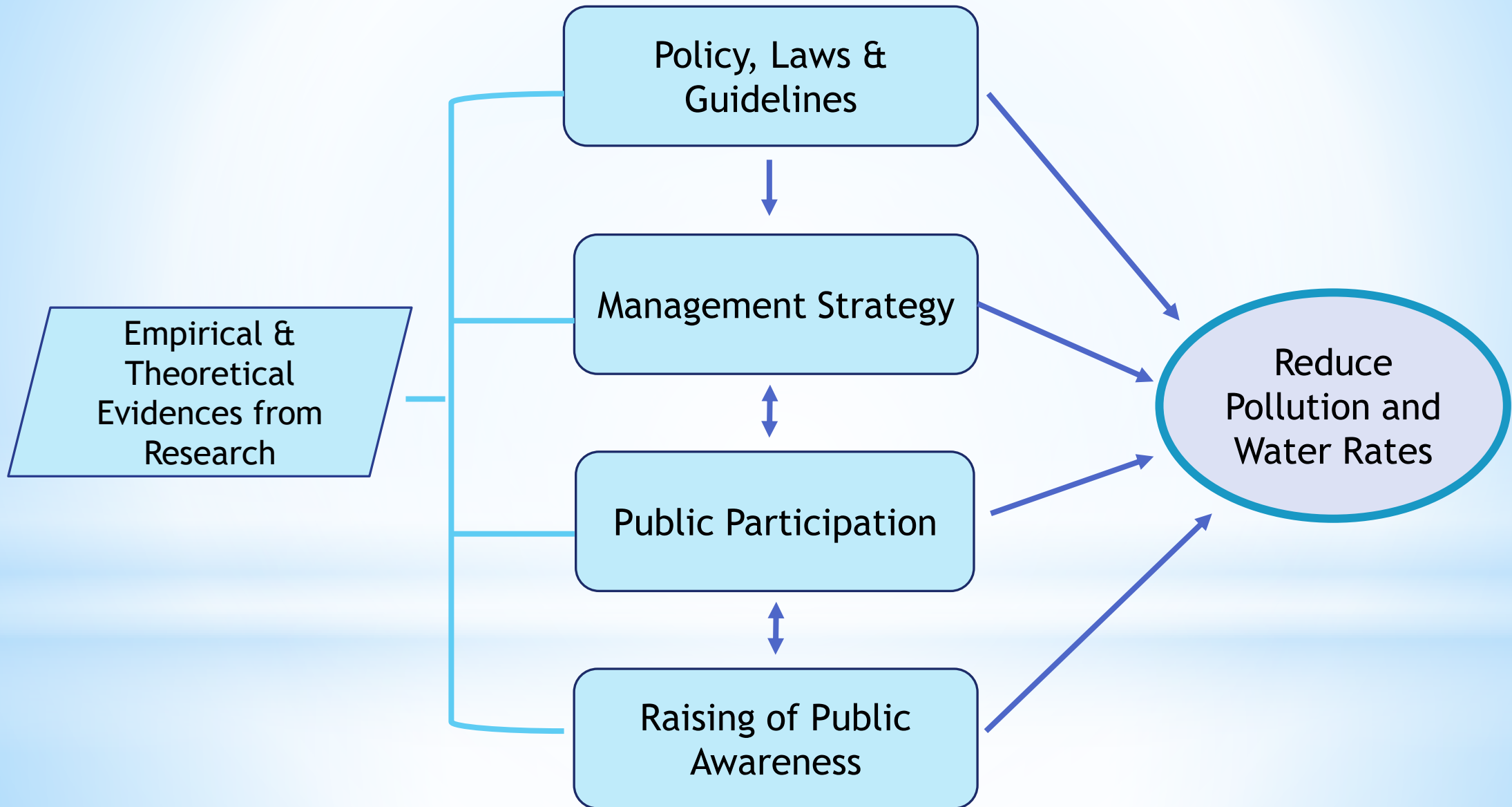
*Conservation

- *Policy, Laws, Guidelines
- *Management Strategy
- *Educate
- *Public Awareness
- *Public Participation



Reduce pollution and water rates

* Water Conservation



LAWS, POLICY AND GUIDELINES FOR WASTEWATER MANAGEMENT

Private Industrial Enterprise Law (Law No. 22, 1990)

Chapter V establishes the obligations and powers of state and district regulators to recommend registration of private industrial enterprises, taking into account that they "do not cause harm to the health of neighboring populations" and that they "do not cause environmental destruction and cause pollution".

Water and Air pollution control plan (Directive No. 3 of 1995, Ministry of Industry No. 1)

This Directive requires factories to take unified preliminary measures to prevent pollution and environmental destruction.

Chapter III of this Directive is for the management of water pollution, and requires factories to report the results of monitoring wastewater, set deadlines for wastewater treatment, and complete installation of treatment equipment.

* The Conservation of Water Resources and Rivers Law (2006)

* 8. No person shall:

- * (a) carry out any act or channel shifting with the aim to ruin the water resources and rivers and creeks.
- * (b) cause the wastage of water resources wilfully.

Whoever violates any of the prohibitions contained in sections 8, may, on conviction, be punished with imprisonment for a term not exceeding 3 years or with fine not exceeding kyats 50,000 or with both.

* 24. No one shall:

- * (a) violate the conditions relating to navigation of vessels in rivers and creeks prescribed by the Directorate for conservation of water resources, rivers and creeks.
- * (b) violate the conditions prescribed by the Directorate so as not to cause water pollution and change of watercourse in rivers and creeks.

* Whoever violates any of the prohibitions contained in sections 24 may, on conviction, be punished with imprisonment for a term not exceeding 1 year or with fine not exceeding kyats 10,000 or with both.

Environmental Conservation Law in 2012

Law	Related articles
Environmental Conservation Law (Act No. 9 of 2012)	Chapter VII (Environmental Protection) stipulates that business operators as pollution sources are required to install equipment at the site and monitor, control, reduce or eliminate pollution.
	Chapter VII also provides that persons or organizations engaged in business in industrial zone seeks donations in the form of prescribed money or in cash for environmental protection.
	Other provisions on industrial pollution control include emissions standards in Chapter VI, pre-licensing applications by plants, etc. in Chapter X, and provisions on environmental emergencies (environmental emergency) in Chapter V.

Laws and Regulations of Local Governments and Cities

Law	Related article
Law of Yangon City Development Committee (2013)	Article 62 of the Act provides that no person shall release wastewater from any manufacturing facility, plant or company into sewage and rivers without treatment in accordance with the bases established by the Committee.

* Myanmar National Water Policy (2014)

- * Contamination and pollution of water bodies (rivers also) and sediment deposition are on the rise in Myanmar due to various reasons and causes and NWRC should pinpoint and control in cooperation with government authorities. **Effluent discharge without proper treatment is one of the causes of pollution** and must be controlled by NWRC in conjunction with authorities.
- * **"Water Quality Standards"** should be set by relevant Ministries under the direction of the NWRC for the purpose of both “domestic and industrial” and economical use and their discharges” to prevent surface, ground and marine waters.
- * Growing pollution of water sources, especially through **industrial effluents**, gold mining and other mineral mining, fish and shrimp farming, etc., various economic activities, is **affecting the availability of safe water** besides causing environmental and health hazards. In many parts of the country, large stretches of **rivers are both heavily polluted** and devoid of flows to support aquatic ecology, cultural needs and aesthetics.
- * Access to water for sanitation and hygienic an even more serious problem. **Inadequate sanitation and lack of sewage treatment are polluting the water sources.**

Environmental Impact Assessment Procedure (2015)

The MOECAAF shall be authorized to monitor and inspect the requirements of Environmental Management Plan (EMP) or other requirements of Environmental Compliance Certificate (ECC).

* National Environmental Quality (Emission) Guidelines (2015)

Guideline values are maximum concentrations or specified ranges of parameters that should not be exceeded in air emissions and liquid discharges.

Wastewater, Storm Water Runoff, Effluent and Sanitary Discharges (general application)

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

* National Environmental Quality (Emission) Guidelines (Continued)

Wastewater, Storm Water Runoff, Effluent and Sanitary Discharges (general application) (Continued)

Parameter	Unit	Guideline Value
Copper	mg/l	0.5
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

^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

* National Environmental Quality (Emission) Guidelines (Continued)

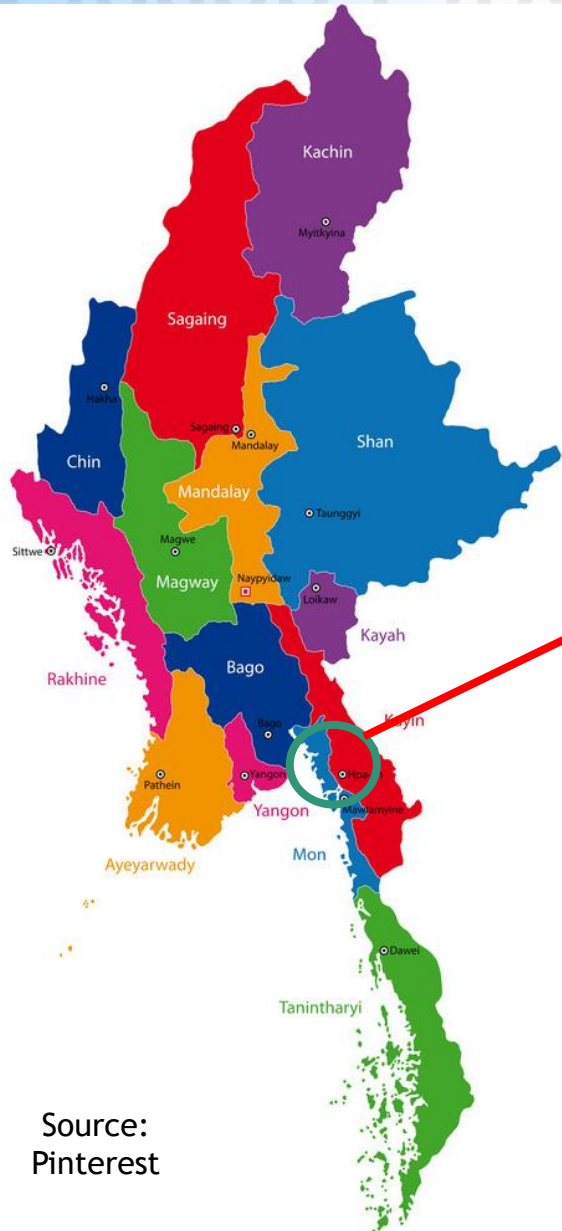
Effluent Level for Some Manufacturing Industries

- Meat Processing
- Poultry Processing
- Fish Processing
- Food and Beverage Processing
- Dairy Processing
- Vegetable Oil Processing
- Sugar Processing
- Breweries and Distilleries

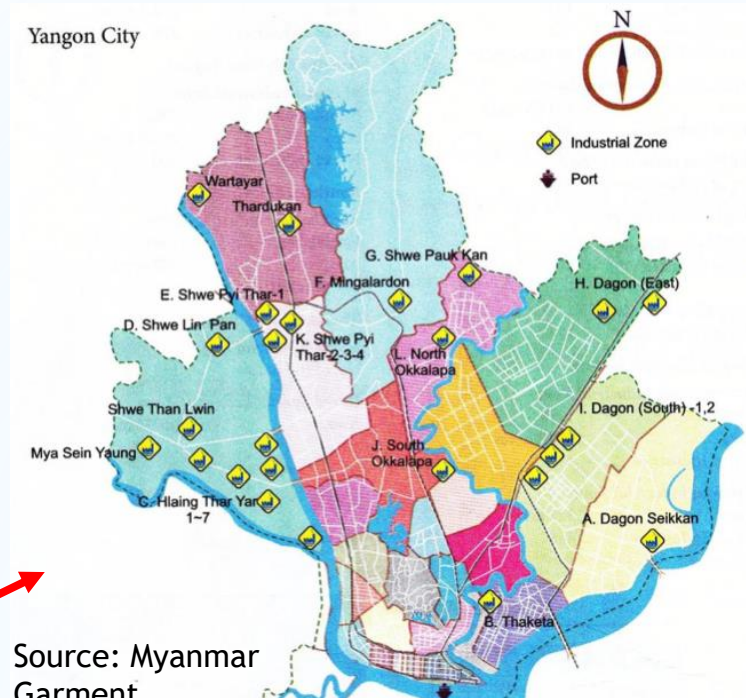
Parameters	Biochemical Oxygen Demand (5 days)	Chemical Oxygen Demand	Oil and Grease	pH	Temperatur e	Total Coliform	Total Nitrogen	Total Phosphorou s	Total Suspended Solid
Unit	mg/l	mg/l	mg/l		°C	100ml	mg/l	mg/l	mg/l
Guideline Values	50	250	10	6-9	<36	400	10	2	50

*Effects of Urbanization

*Yangon City



Source:
Pinterest



Source: Myanmar
Garment
Manufacturers
Association

Yangon

Population - About 7.83 million (2019)
(about 15% of total)

Land Area - About 598.75 sq-km

Townships - 33 nos.

Industrial/Economic Zones - 47 nos.
(Almost 53% of total)

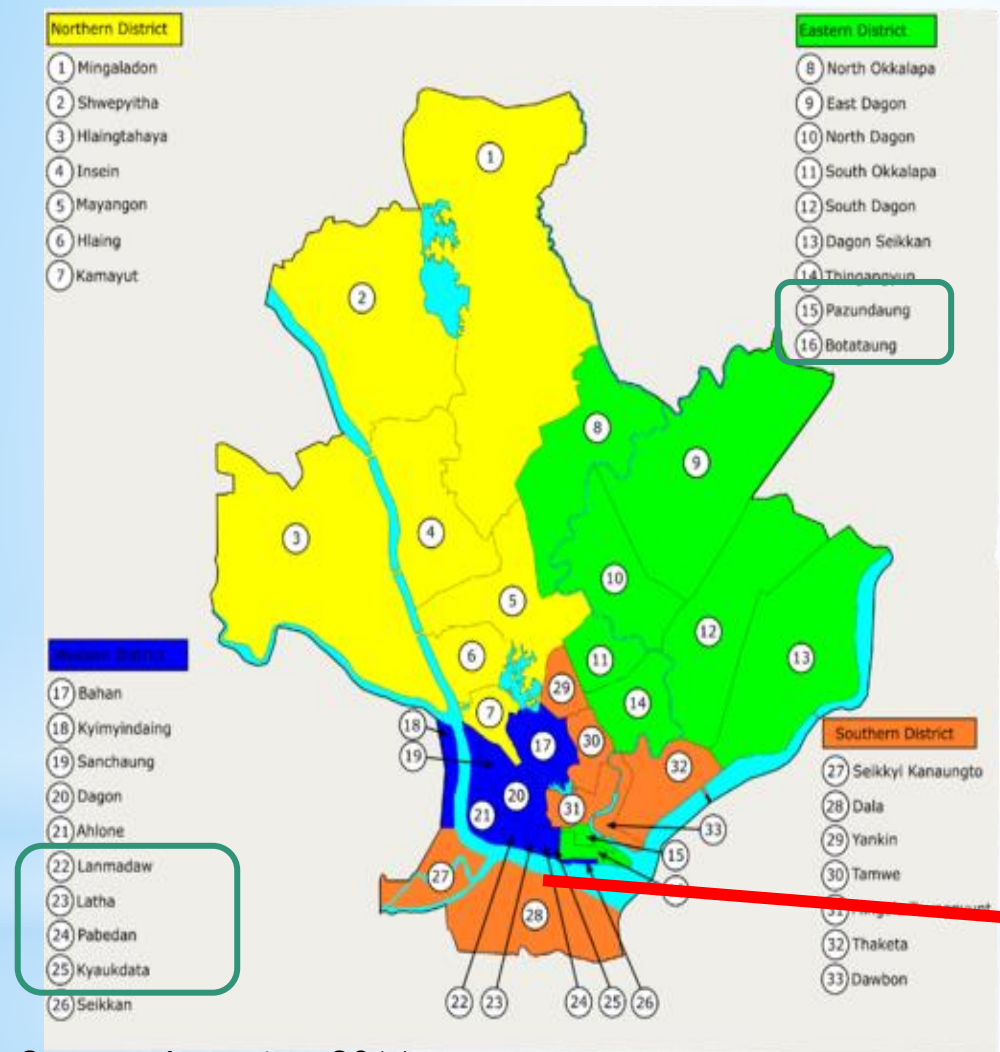


Source: vietnamparadisetravel 2019

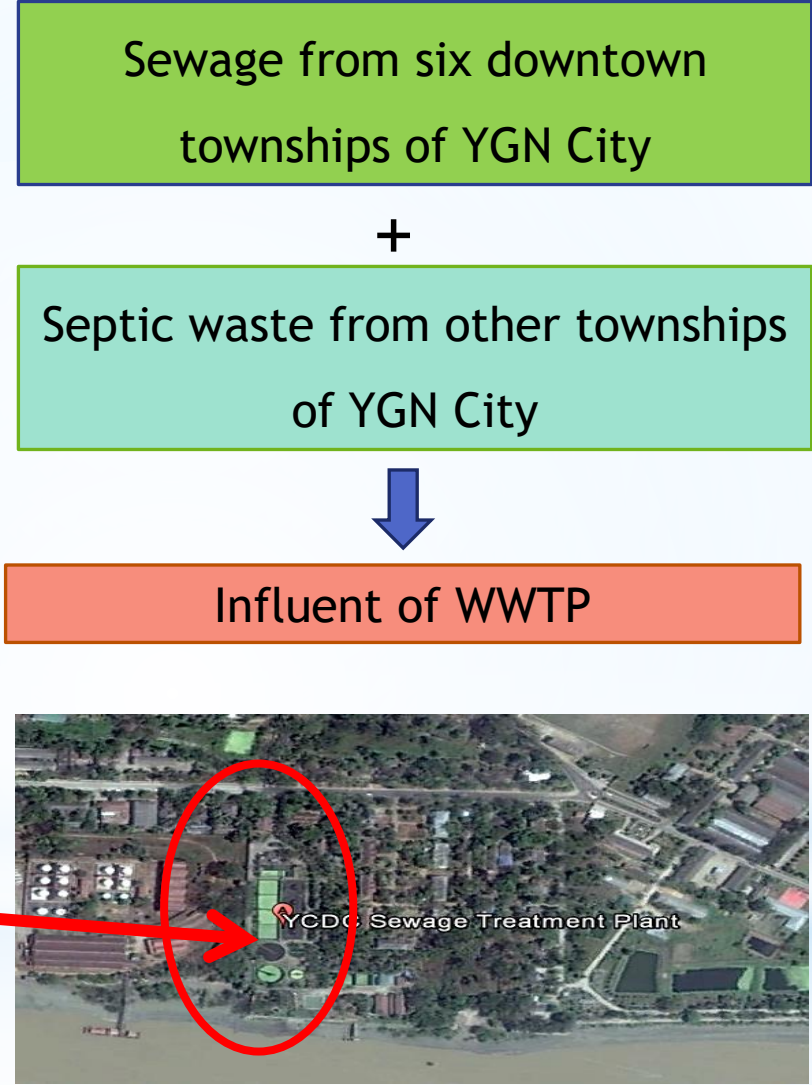


Source: xinhuanet 2020

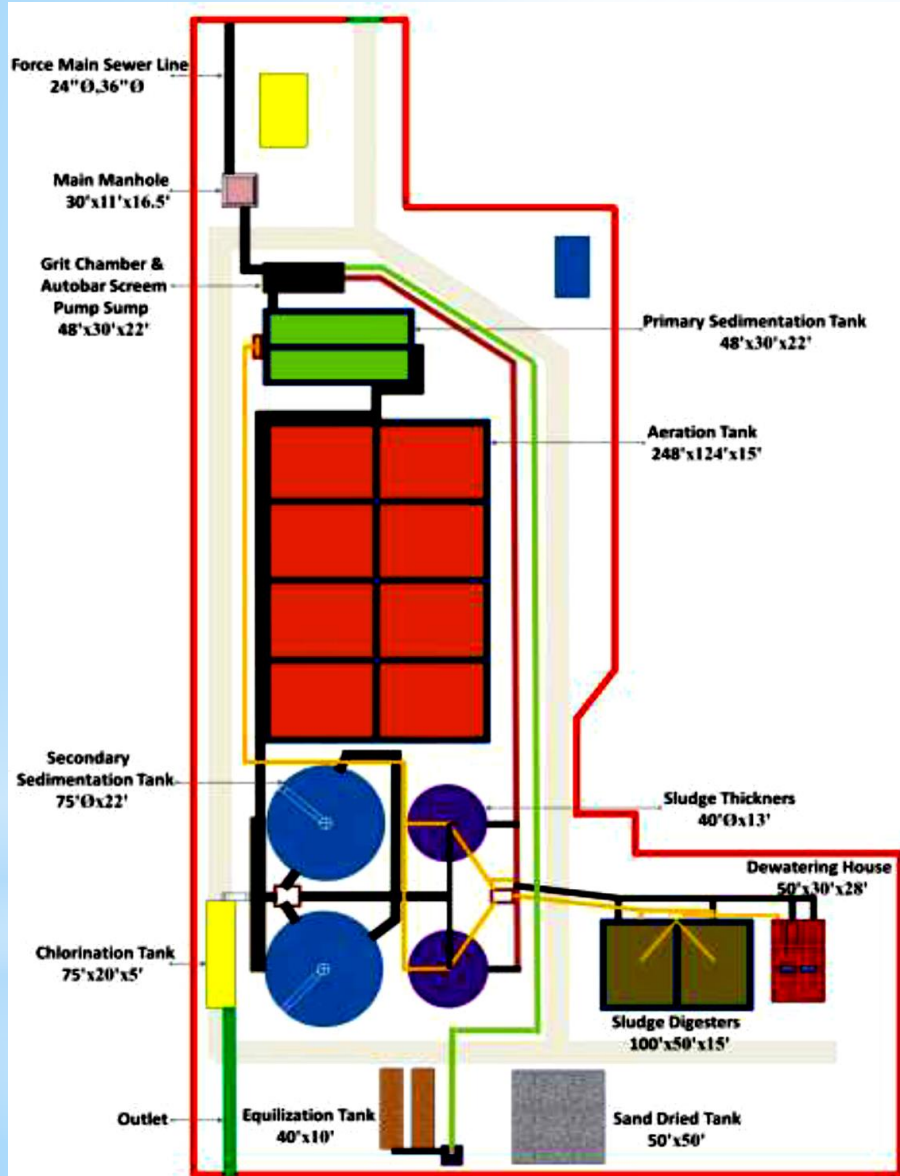
Existing Municipal Wastewater Management System



Source: Jeremias, 2014



* Layout Plan of Wastewater Treatment Plant (Thanhlatsoon)



Design Criteria:

- Area of Plant - 5.56 acres
- Design population - 300,000
- Daily wastewater discharge- - 14775 m³/day
- BOD influent - 600mg / l
- BOD effluent - 20 mg / l
- Suspended solid influent- 700 mg / l
- Suspended solid effluent- 40 mg / l



- Final disposal outlet is Yangon River that is formed by the confluence of the Pegu and Myitthaka Rivers. As it is a marine estuary, it gets tidal effect (two times per 24 hours).

* Existing Municipal Wastewater Management System

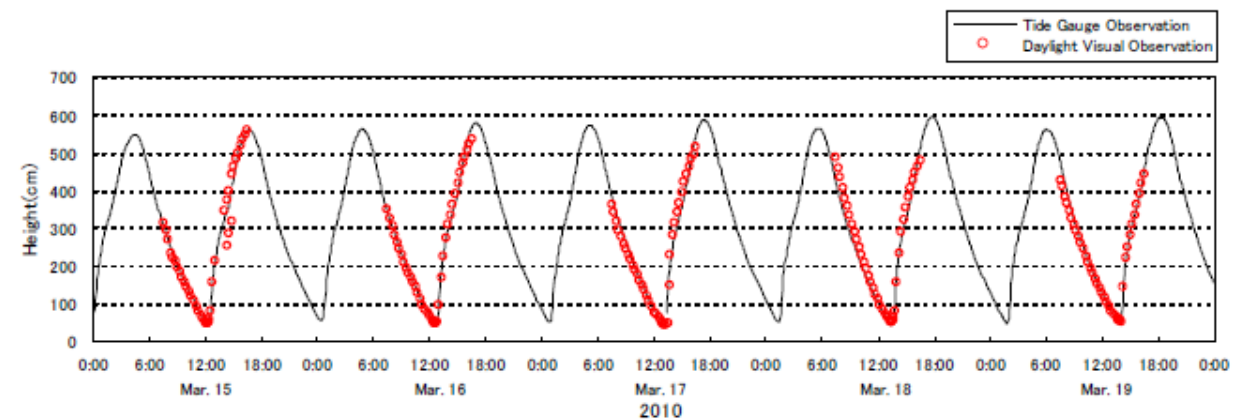
Concentration of Sewage from Six Downtown Townships of Yangon City

Sr.	Pollution Parameters	Sewage (YGN) [2016-2017]	Range of Sewage (Qasim, 1985)	Remarks
1	Biochemical Oxygen Demand (BOD) (mg/l)	141	110-400	OK
2	Chemical Oxygen Demand (COD) (mg/l)	613	200-780	OK
3	Total Solids (TS) (mg/l)	1614	375-1800	OK
4	Total Suspended Solids (TSS) (mg/l)	1072	120-360	Significantly Higher
5	Total Dissolved Solids (TDS) (mg/l)	542	250-800	OK
6	Nitrate Nitrogen (NO ₃) (mg/l)	1.3	0 - Small	OK
7	Ammonia Nitrogen (NH ₃ -N) (mg/l)	69	12-50	Slightly Higher
8	Phosphate (PO ₄) (mg/l)	10	-	-
9	Phosphorous (P) (mg/l)	3.4	4-15	Slightly Lower
10	pH	7.7	6.7-7.5	Slightly Higher

* Existing Municipal Wastewater Management System

Comparison between NEQG Values and Effluent of YCDC WWTP

Sr.	Parameters	Average Concentration in Treated Effluent	NEQG (2015)	Remarks
1	BOD	54 mg/l	50 mg/l	Not OK
2	COD	299 mg/l	250 mg/l	Not OK
3	TSS	278 mg/l	50 mg/l	Not OK
4	TDS	633 mg/l	-	
5	TS	911 mg/l	-	
6	NH3	13 mg/l	10 mg/l	Not OK
7	NO3	10 mg/l	-	
8	pH	6.7-8.4	6-9	
9	PO4	15 mg/l	-	
10	P	4 mg/l	3 mg/l	Not OK
11	Temperature	29.8°C	< 3 (Ambient water temperature)	



Source: JICA Project Team

Figure 12.2.4 Wave Distortion (Example of Monkey Point)

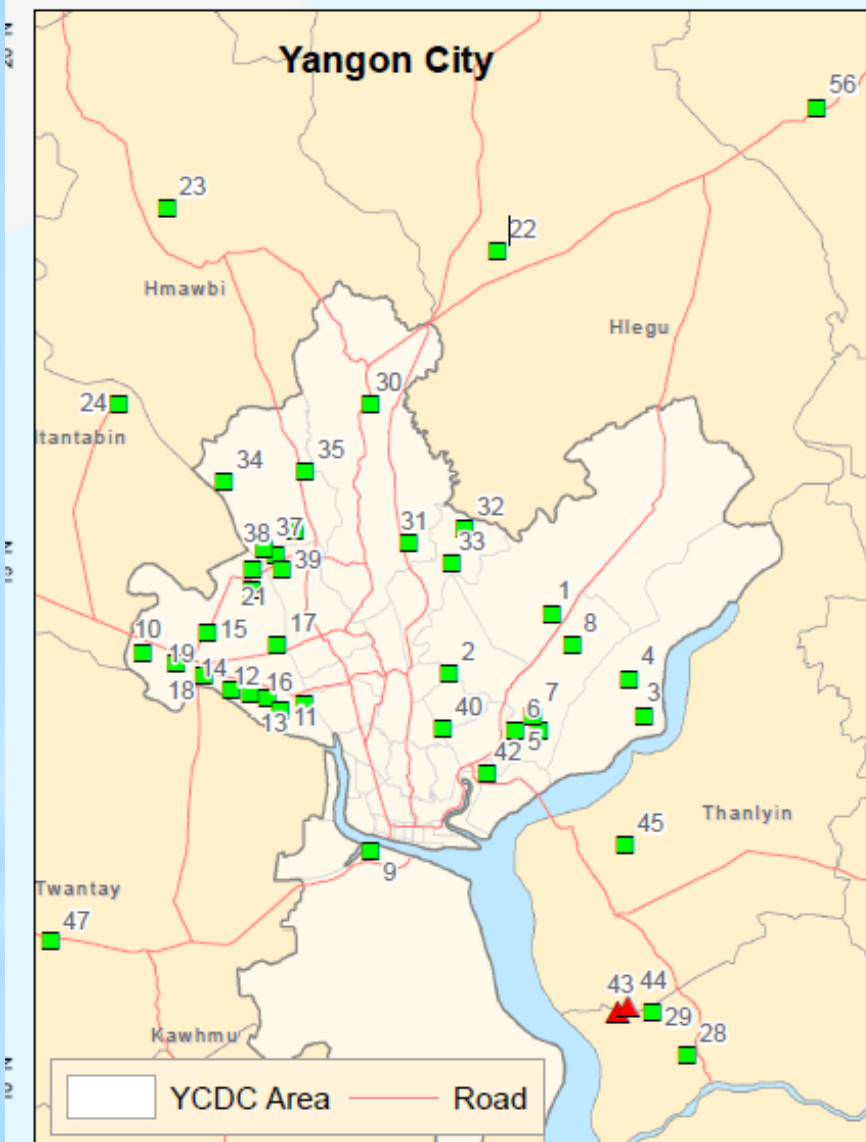
Suspended Solids are an extremely important cause of water quality deterioration leading to aesthetic issues, higher costs of water treatment, a decline in the fisheries resource, and serious ecological degradation of aquatic environments.

Surface Water Quality Assessment

- *Pan Hlaing River
- *Pazundaung Creek
- *Ayeyarwady River
- *Myint Nge River (Downstream of Yeywa Dam)
- *Downstream of Nga Moe Yeik Dam

*Effects of Industrial Zones

*Industrial/Economic Zone in Yangon City



There is no centralized Industrial wastewater treatment plants in most of existing industrial zones.

Production Date: 01 October 2019

Source : MIMU 2019

*Industrial/Economic Zone in Yangon City

Zone ID	Industrial/ Economic Zone
1	East Dagon Industrial Zone
2	North Dagon Industrial Zone
3	Dagon Seikkan Industrial Zone
4	Kyi Su Industrial Zone
5	South Dagon Industrial Zone (1)
6	South Dagon Industrial Zone (2)
7	South Dagon Industrial Zone (3)
8	Kyansitthar Industrial Zone
9	Dala Industrial Zone
10	Mya Sein Yaung Industrial Zone
11	Hlaingtharya Industrial Zone (1)
12	Hlaingtharya Industrial Zone (2)
13	Hlaingtharya Industrial Zone (3)
14	Hlaingtharya Industrial Zone (4)
15	Hlaingtharya Industrial Zone (5)
16	Hlaingtharya Industrial Zone (6)
17	Hlaingtharya Industrial Zone (7)
18	Anawrahta Industrial Zone
19	Shwe Than Lwin Industrial Zone
20	Shwe Lin Ban Industrial Zone
21	Ngwe Pin Lae Industrial Zone
22	Hlegu Industrial Zone
23	Hmawbi Industrial Zone
24	Htantabin Industrial Zone
25	Kawhmu Industrial Zone

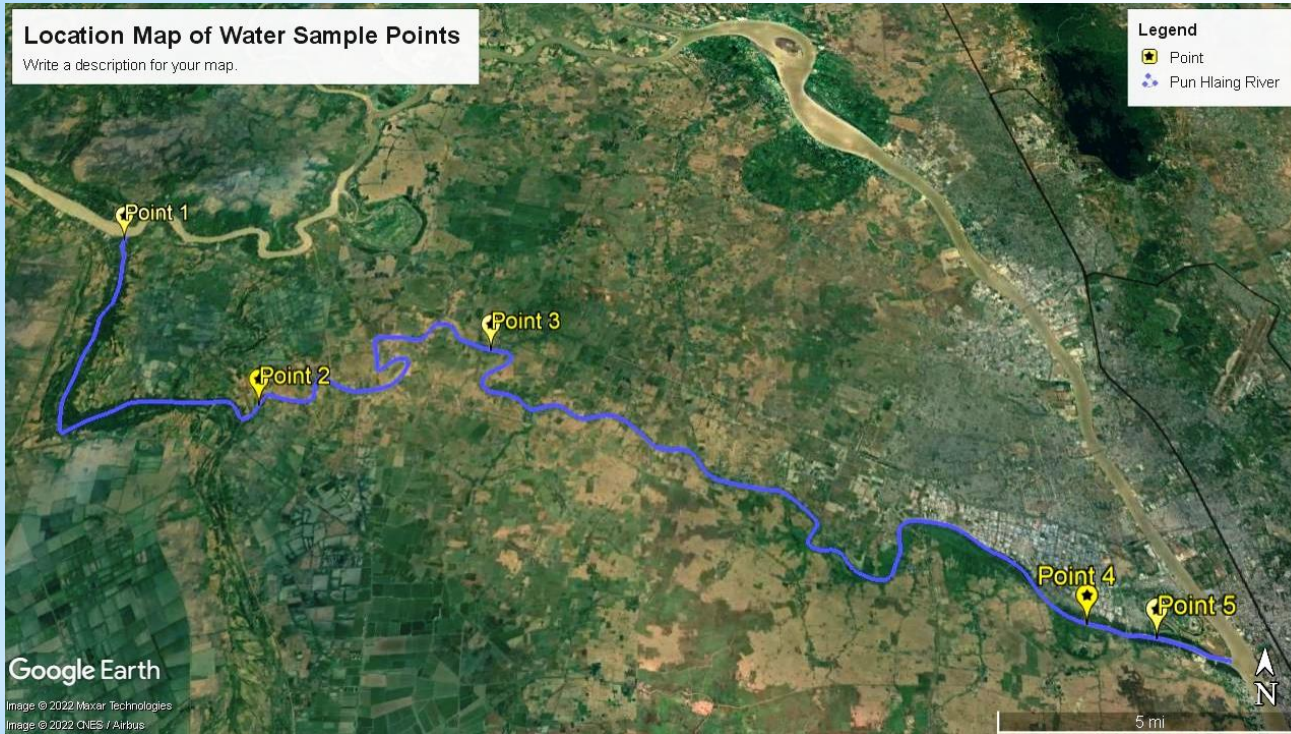
Zone ID	Industrial/ Economic Zone
26	Kayan Industrial Zone
27	Kungyangon Industrial Zone
28	Kyauktan Industrial Zone
29	Thilawa Industrial Zone
30	Pyin Ma Pin Industrial Zone
31	Mingaladon Industrial Zone
32	Shwe Pauk Kan Industrial Zone
33	North Okkalapa Industrial Zone
34	War Ta Yar Industrial Zone
35	Thar Du Kan Industrial Zone
36	Shwepyithar Industrial Zone (1)
37	Shwepyithar Industrial Zone (2)
38	Shwepyithar Industrial Zone (3)
39	Shwepyithar Industrial Zone (4)
40	South Okkalapa Industrial Zone
41	Taikkayi Industrial Zone
42	Thaketa Industrial Zone
43	Thilawa SEZ (Zone A)
44	Thilawa SEZ (Zone B)
45	Thanlyin Industrial Zone
46	Thongwa Industrial Zone
47	Twantay Industrial Zone

* National Water Quality Standards for Malaysia (Class II,III,IV)

No.	Physiochemical Parameters	Unit	National Water Quality Standard for Malaysia			
			Class IIA	Class IIB	Class III	Class IV
1.	Temperature	°C	Normal+2°C	-	Nor+2°C	-
2.	pH	-	6 – 9	6 – 9	5-9	5-9
3.	Color	TCU	150	150	-	-
4.	Turbidity	NTU	50	50	-	-
5.	Dissolved Oxygen	mg/L	5-7	5-7	3-5	<3
6.	Chemical Oxygen Demand	mg/L	25	35	50	100
7.	Electrical Conductivity	µS/cm	1000	-	-	6000
8.	Total Dissolved Solids	mg/L	1000	-	-	4000
9.	Total Suspended Solids	mg/L	50	50	150	300
10.	Total Solids	mg/L	-	-	-	-
11.	Total Alkalinity	mg/L	-	-	-	-
12.	Total Hardness as CaCO ₃	mg/L	250	250	-	-
13.	Ammonia	mg/L	0.3	0.3	0.9	2.7
14.	Nitrite	mg/L	0.4	0.4	0.4	1

CLASS	USES
Class I	Conservation of natural environment.
	Water Supply I - Practically no treatment necessary.
Class IIA	Fishery I - Very sensitive aquatic species.
	Water Supply II - Conventional treatment required.
Class IIB	Fishery II - Sensitive aquatic species.
	Recreational use with body contact.
Class III	Water Supply III - Extensive treatment required.
	Fishery III - Common, of economic value and tolerant species; livestock drinking.
Class IV	Irrigation
Class V	None of the above.

* Water Quality Assessment in Pan Hlaing River



Location Map of Water Sample Stations

Station	Place	Latitude	Longitude
1	Near Mazeli Sluice Gate 2	16° 56'47.21" N	95° 47'51.82"
2	Near Mya Ge Village	16° 53'30.80" N	95° 51'0.16" E
3	Near Sandayaw Bridge	16° 54'36.00" N	95° 54'53.52" E
4	Near outlet of Hlaing Thar Yar Industrial Zone	16° 50'1.20" N	96° 4'32.32" E
5	Near Confluence between Pan Hlaing River and Hlaing River	16° 49'49.07" N	96° 5'34.71" E

* Result of Water Quality in Feb 2022

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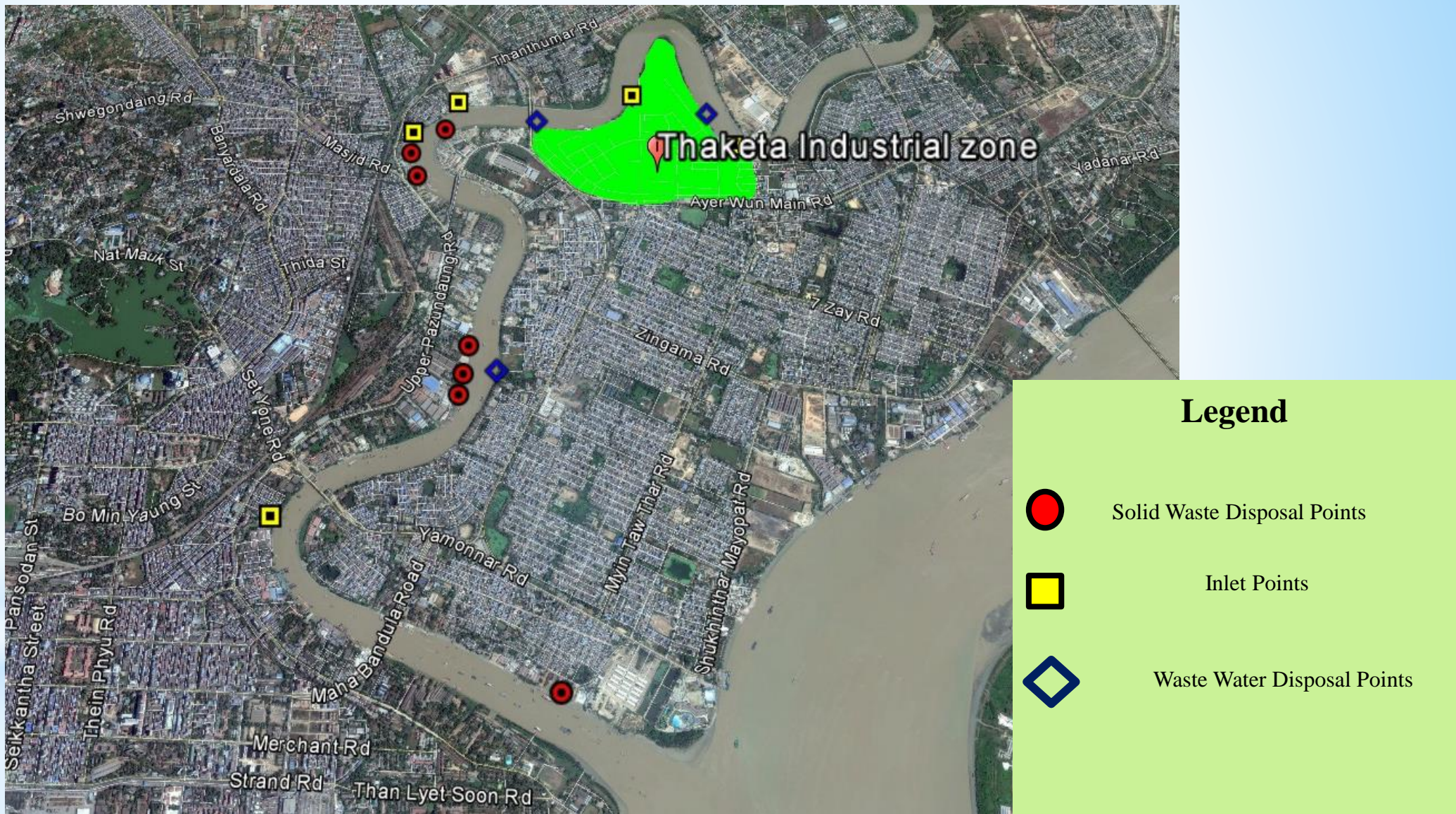
* Result of water quality in March 2022

No	Parameters	Unit	Point 1	Point 2	Point 3	Point 4	Point 5	NWQS Class II A	NWQS Class II B	NWQS Class III	NWQS Class IV
1	pH		7.6	7.4	7.4	7.3	7.4	6–9	6–9	5–9	5–9
2	Turbidity	NTU	92	77	54	1892	871	50	50	150	–
3	Conductivity	micro S/cm	230	416	1863	7232	7072	1000	–	–	6000
4	Temperature	C	28.9	29.5	30.5	31	31.2	Normal +2		Normal +2	
5	Total Alkalinity	mg/l	78	92	128	110	90	–	–	–	–
6	Iron	mg/l	0.98	1.23	0.78	16.9	7.12	1	1	1	1–5
7	Chloride	mg/l	13	61	350	147	1600	–	–	0.02	–
8	Sulphate	mg/l	20	23	58	111	120	250	250	–	–
9	Total Suspended Solid	mg/l	97	94	66	1316	684	50	50	150	300
10	Total Dissolved Solid	mg/l	115	208	931	3616	3536	–	1000	–	4000
11	Phosphate	mg/l	Nil	Nil	Nil	Nil	Nil	–	–	–	–
12	Salinity	ppt	0.1	0.3	0.9	3.6	3.5	–	–	–	–
13	Nitrate	mg/l	0.5	0.3	0.5	0.7	0.5	7	7	–	5
14	Dissolved Oxygen	mg/l	7.2	6.8	6	5.4	4.8	5–7	5–7	3–5	<3
15	Chemical Oxygen Demand	mg/l	96	96	96	128	128	25	25	50	100
16	Biological Oxygen Demand	mg/l	20	22	26	50	40	3	3	6	12

*Discussion

- pH, dissolved oxygen (DO) and Nitrate within the limits in all station
- Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) higher than the limits much more in points 4&5
- Cchloride & iron higher than the limits much more in points 4&5
- Total suspended solids (TSS) and turbidity higher than the limits much more in points 4&5

Water Quality Assessment Along Pazundaung Creek



Points of Pollution Source in the Study Area

Source: Thin Su Naing (2019)

Water Quality Assessment Along Pazundaung Creek

Location of Sampling Stations



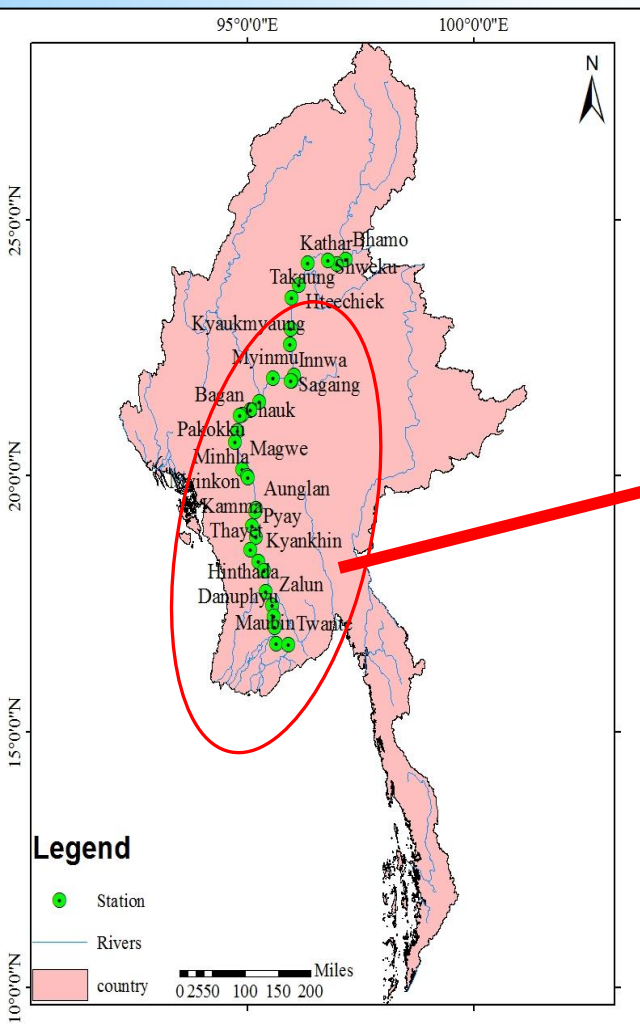
Source: Thin Su Naing (2019)

*Discussion

- All **BOD** results are higher than the standard limit. So, water quality is very poor and this place is much polluted. Then, it can be said that organic waste contains in the creek.
- **COD** values are much higher than the compared standard.
- **Total suspended solids** values in the study area are greater than 50 mg/L.
- **EC and Chloride** in the dry season are higher than standard limit and lower than the standard in the rainy season.
- In rainy season, the resulted value of **nitrogen** is higher than the standard limit only at the downstream of the creek. A lot of domestic wastes are found between the mid point and downstream point so the values of nitrogen are too much at the downstream.
- **Phosphorous** values of all stations are higher than NWQS Class II Limit of 0.2mg/L .
- Among heavy metals, **arsenic, iron, zinc, copper and manganese** are in the limit

* Effects of Changes of Land Use and Land Cover

Water Quality Assessment in Ayeyarwady River (from Bhamo to Twante station)



Sampling Locations

Stations	Description
Bhamo, Sinkham, Shweku, Katha, Htichaight, Takaung, Thabeikkyin, Kyaukmyaung, Mandalay, Sagaing, Innwa, Myinmu	Middle Ayeyarwaddy River Basin (north of the confluence with the Chindwin)
Myingyan, Pakokku, Naungoo, Bagan, Chauk, Sinphyukyoon, Magway, Myinkon, Minhla, Aunglan, Thayet, Kamma, Pyay, Seikathar, Kyankhin	Lower Ayeyarwaddy River Basin (between Myingyan and Kyankhin)
Myaungaung, Hinthada, Zalun, Dhanuphyu, Naungdone, Maubin, Twante	Ayeyarwaddy Delta

❖ The water sample stations also were chosen in the urban area, agricultural area and delta area along the Ayeyarwaddy River by **DWIR**. Source: Cho Cho Tun (2020)



Variation of Water Quality along Ayeyarwaddy River (From from Bhamo to Twante station)

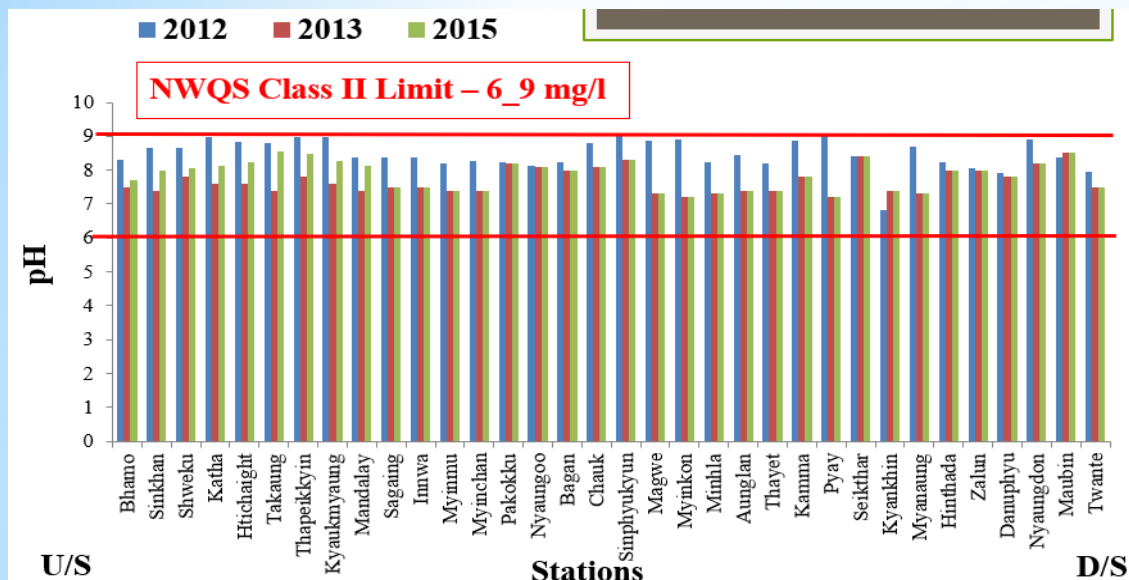


Fig.2 pH Comparison of Sample Stations with NWQS

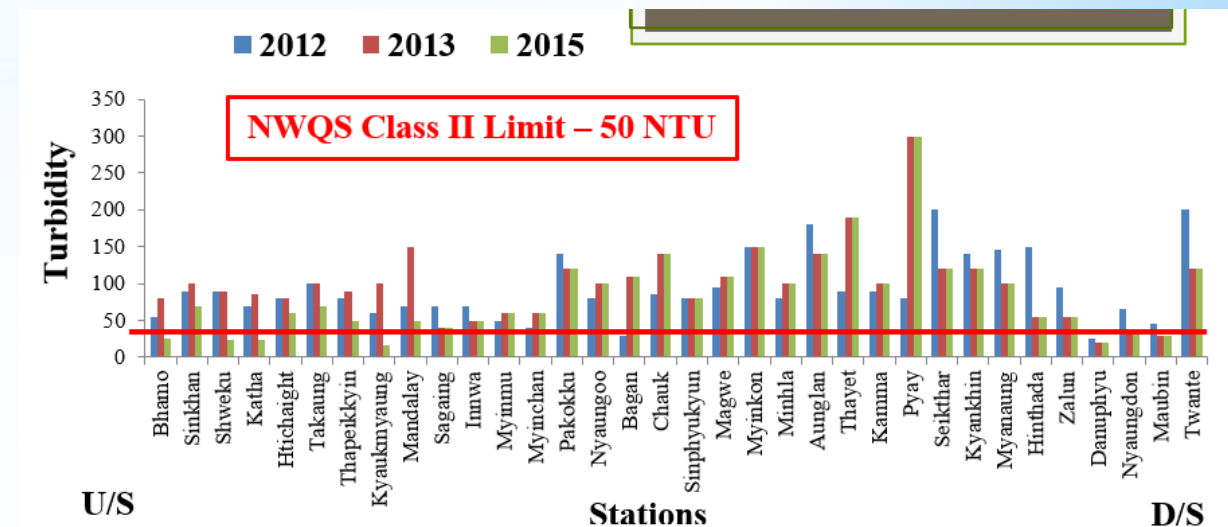


Fig.3 Turbidity Comparison of Sample Stations with NWQS

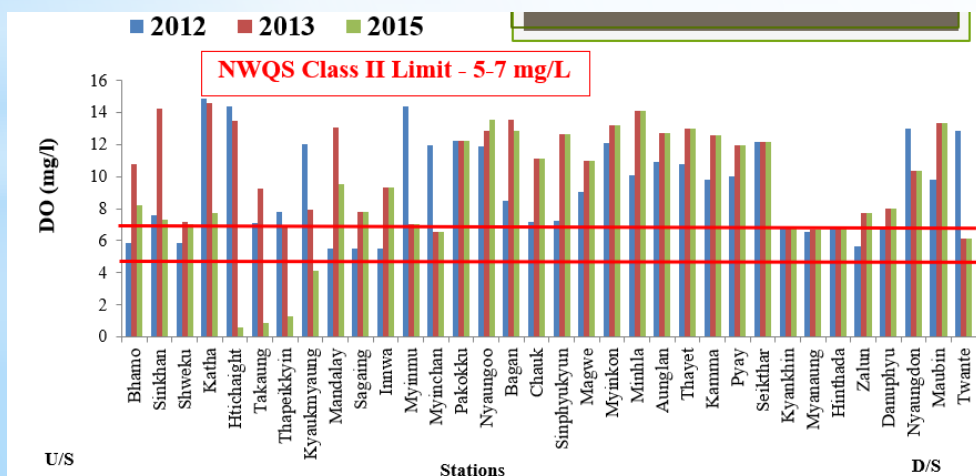


Fig.4 DO Comparison of Sample Stations with NWQS

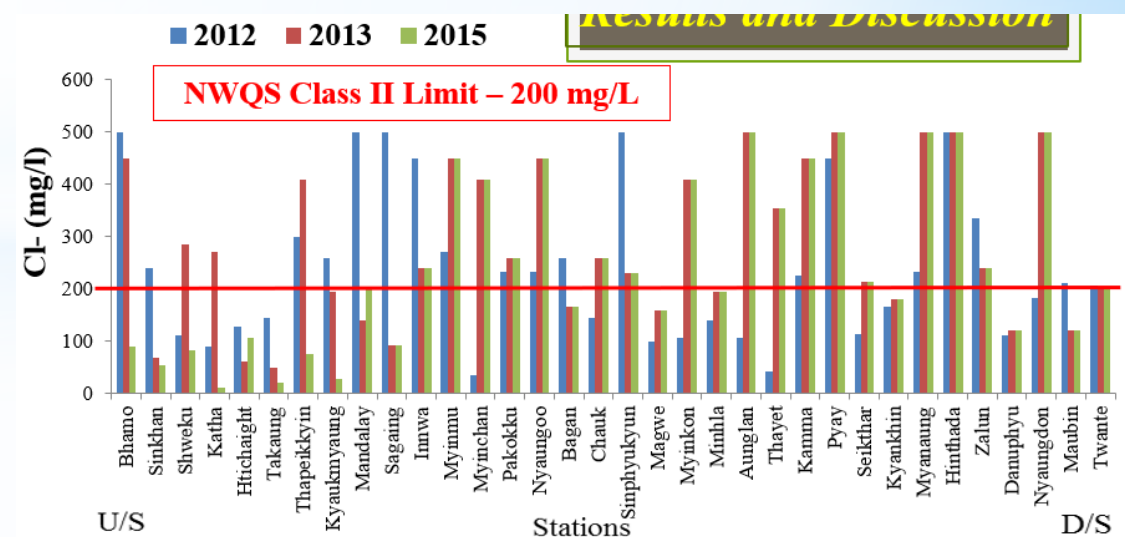
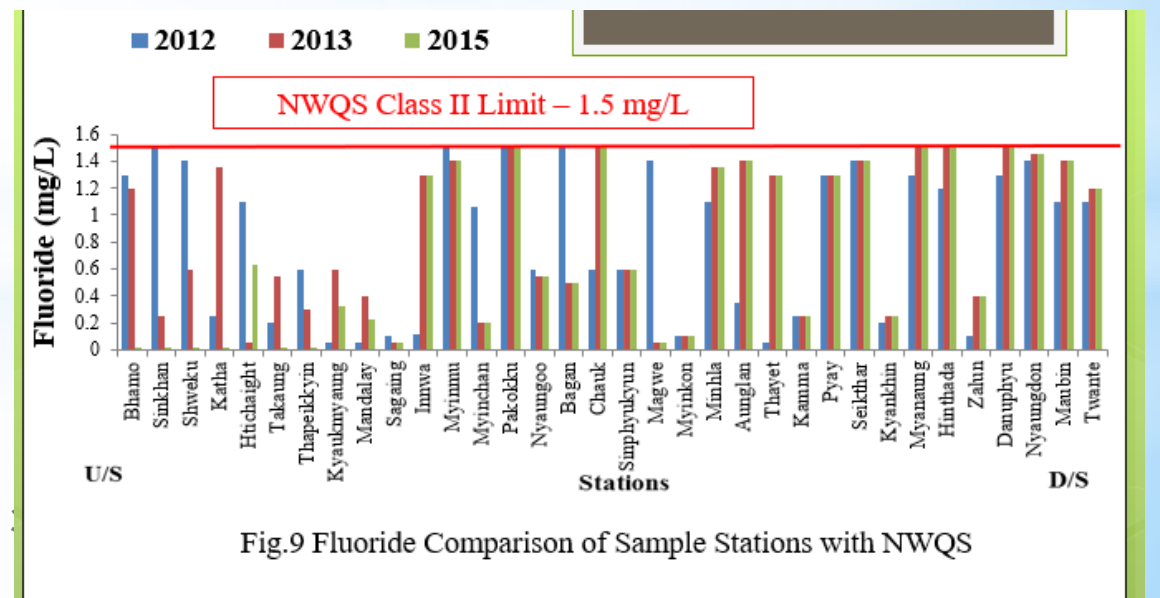
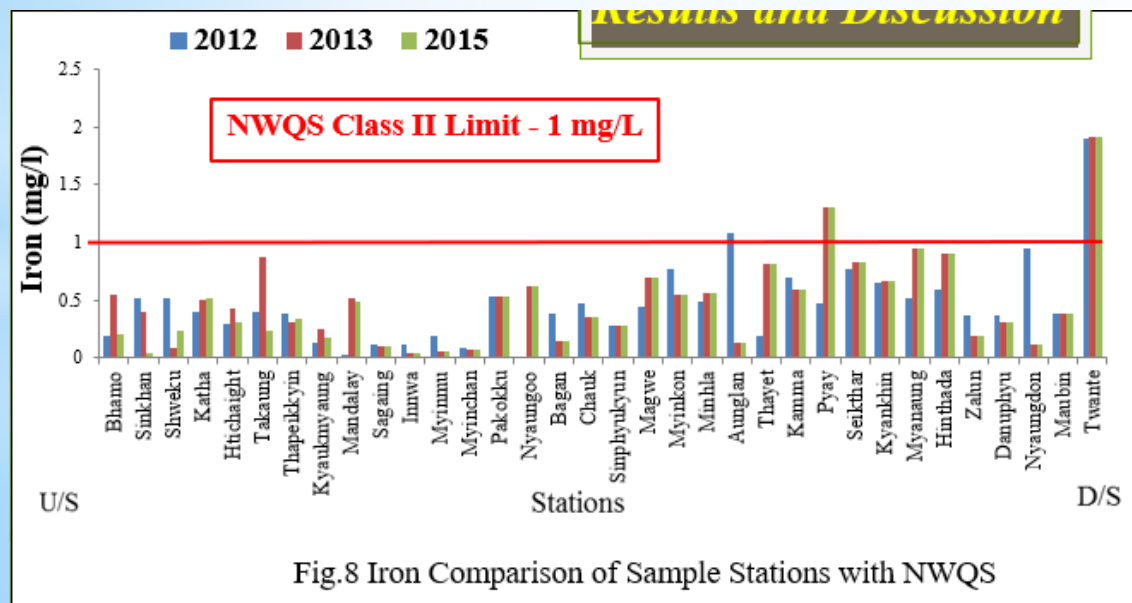
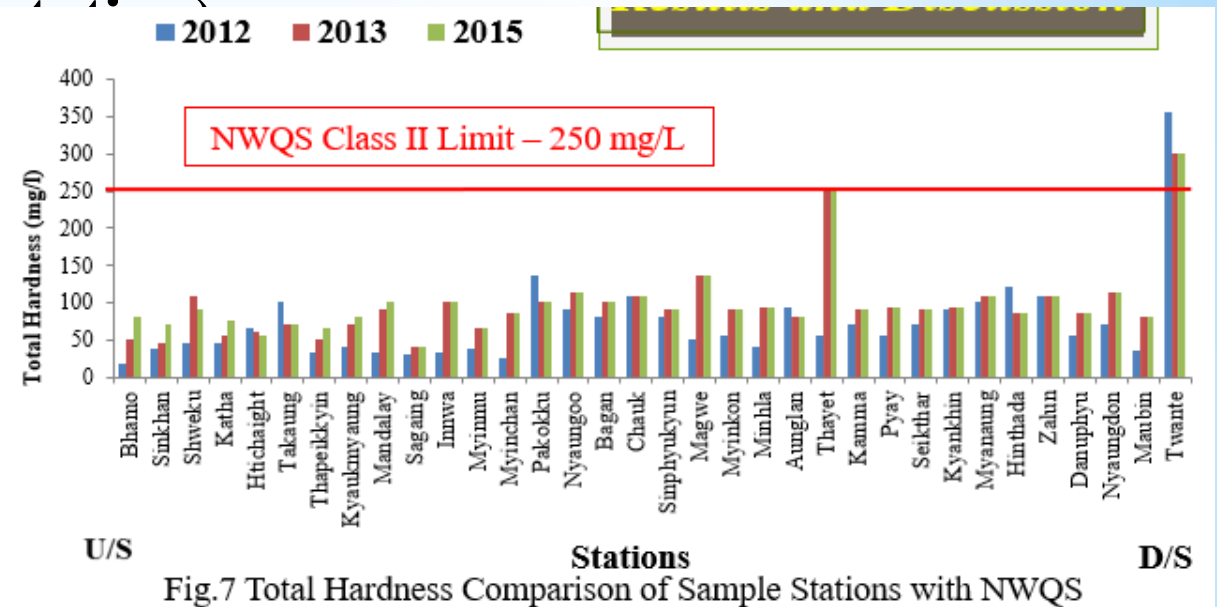
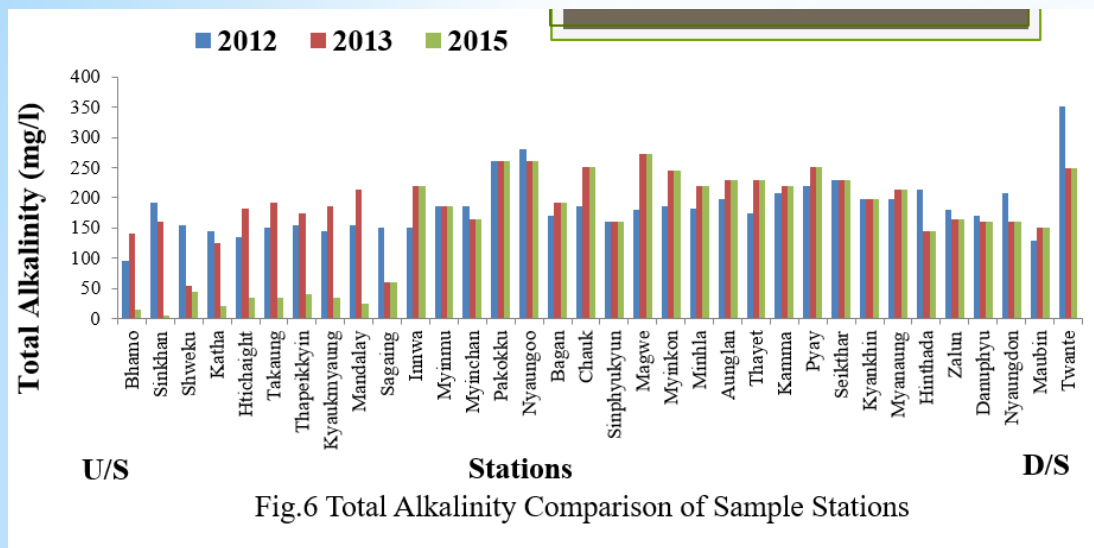


Fig.5 Chloride Comparison of Sample Stations with NWQS



Variation of Water Quality along Ayeyarwaddy River (From from Bhamo to Twante)





Variation of Water Quality along Ayeyarwaddy River (From from Bhamo to Twante station)

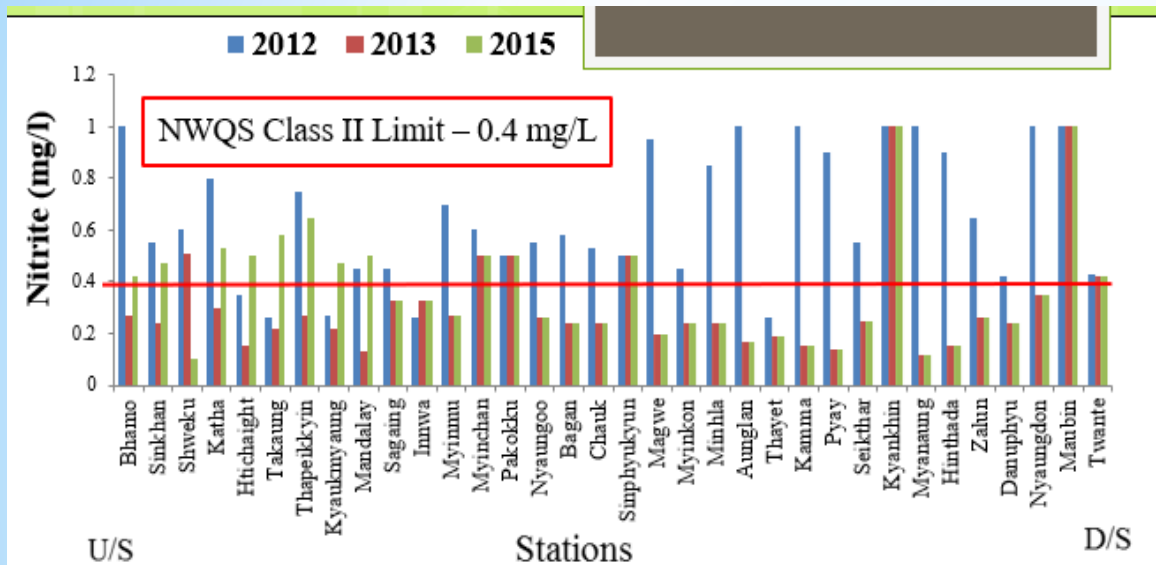


Fig.10 Nitrite Comparison of Sample Stations with NWQS

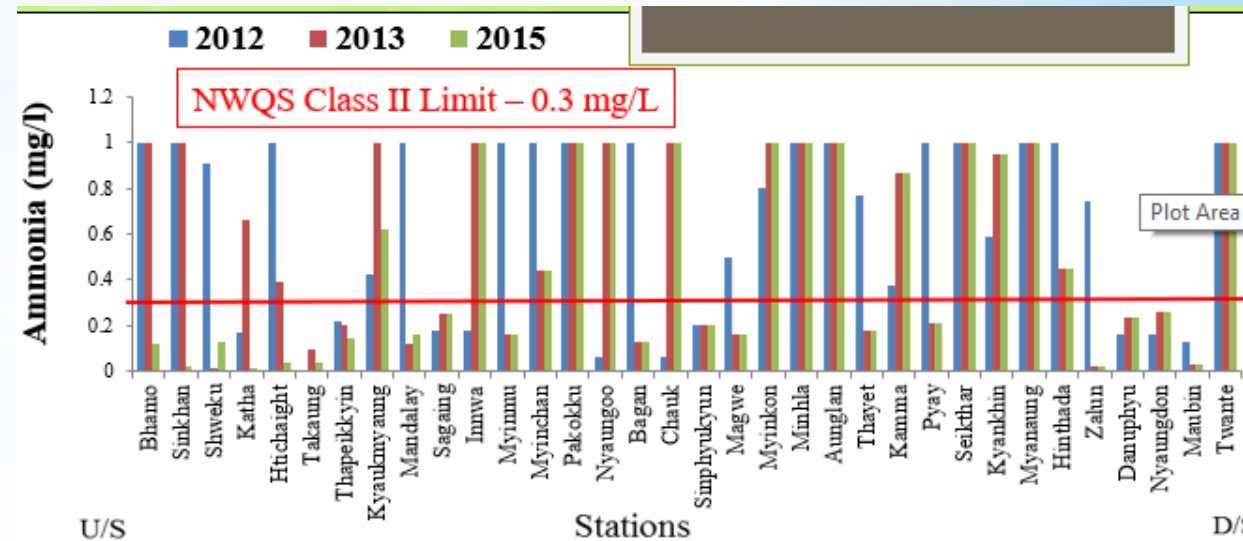
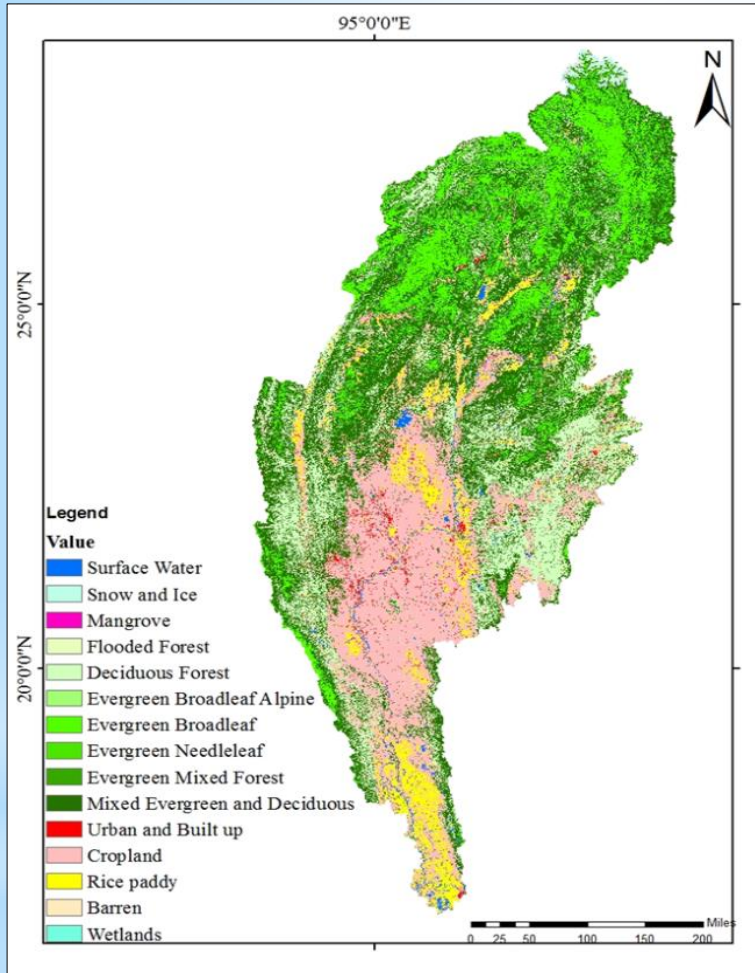


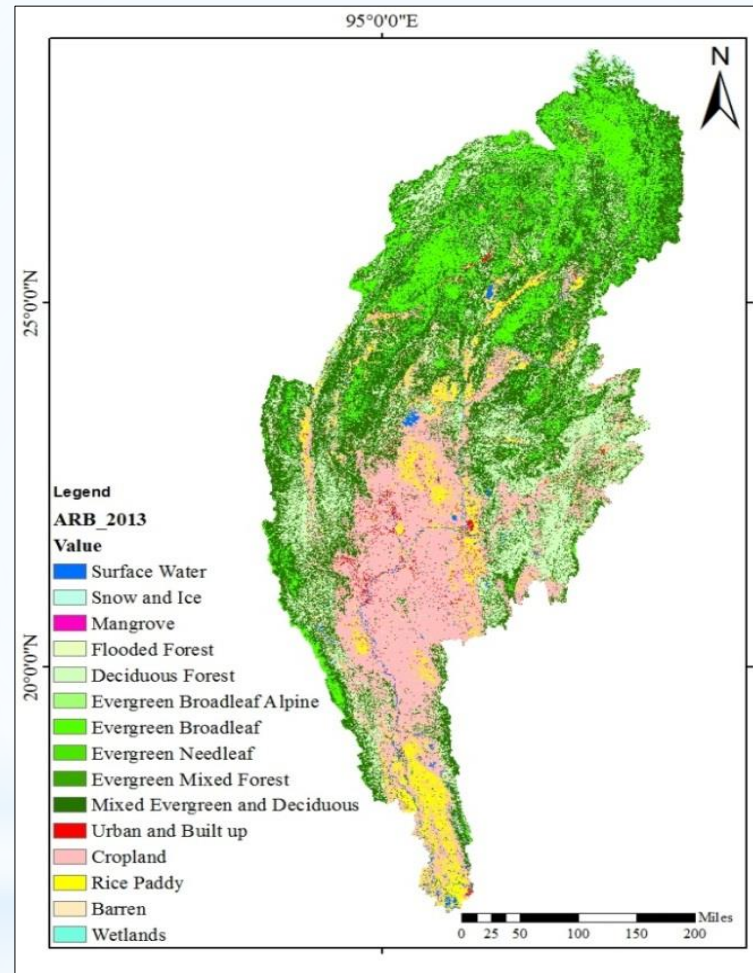
Fig.11 Ammonia Comparison of Sample Stations with NWQS

Source: Cho Cho Tun (2020)

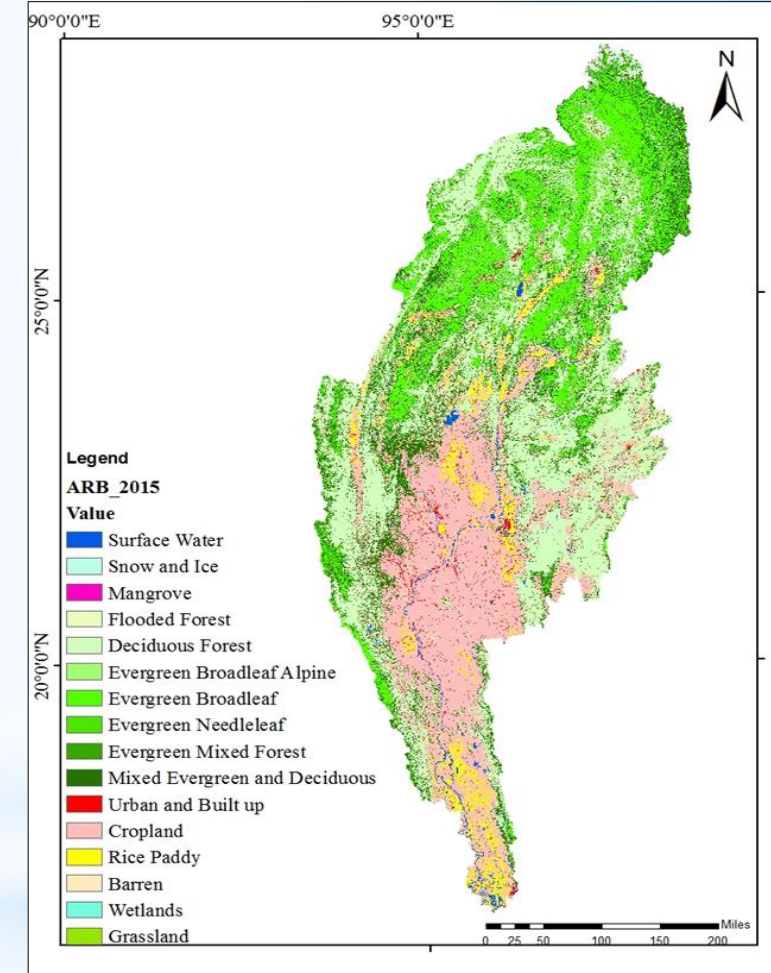
* Land Use Land Cover Changes In Irrawaddy River Basin



2012



2013



2015

* Land Use Areas

Value	Type	2012 (Area)		2013 (Area)		2015 (Area)	
		Hectare	%	Hectare	%	Hectare	%
1	Surface Water	352068.6	1.04	362259.7	0.99	366105.6	1.08
2	Snow and Ice	152925.0	0.45	147839.3	0.40	111078.7	0.33
3	Mangrove	30.4	0.00	34.3	0.00	30.4	0.00
4	Flooded Forest	22903.0	0.07	24432.9	0.07	22684.4	0.07
5	Deciduous Forest	5835251.8	17.31	6346338.6	17.29	10794309.8	31.97
7	Evergreen Broadleaf Alpine	594.9	0.00	759.6	0.00	603.7	0.00
8	Evergreen Broadleaf	5081649.9	15.07	5515029.6	15.02	5814995.0	17.22
9	Evergreen Needleleaf	181564.5	0.54	91551.1	0.25	419265.2	1.24
10	Evergreen Mixed Forest	1965.1	0.01	2215.0	0.01	25548.3	0.08
11	Mixed Evergreen and Deciduous	11748199.0	34.84	12893639.9	35.12	5402185.7	16.00
12	Urban and Built up	381543.1	1.13	353076.1	0.96	336871.2	1.00
13	Cropland	8184066.3	24.27	9064161.8	24.69	8951453.2	26.51
14	Rice paddy	1701450.7	5.05	1814252.3	4.94	1293631.0	3.83
17	Barren	65663.8	0.19	88663.8	0.24	220402.9	0.65
18	Wetlands	6214.8	0.02	7780.0	0.02	1290.8	0.00
19	Grassland	-	-	-	-	3.9	0.00
Total	ARB	33716090.8	100.00	36712034.0	100.00	33760459.9	100.00

*Discussion

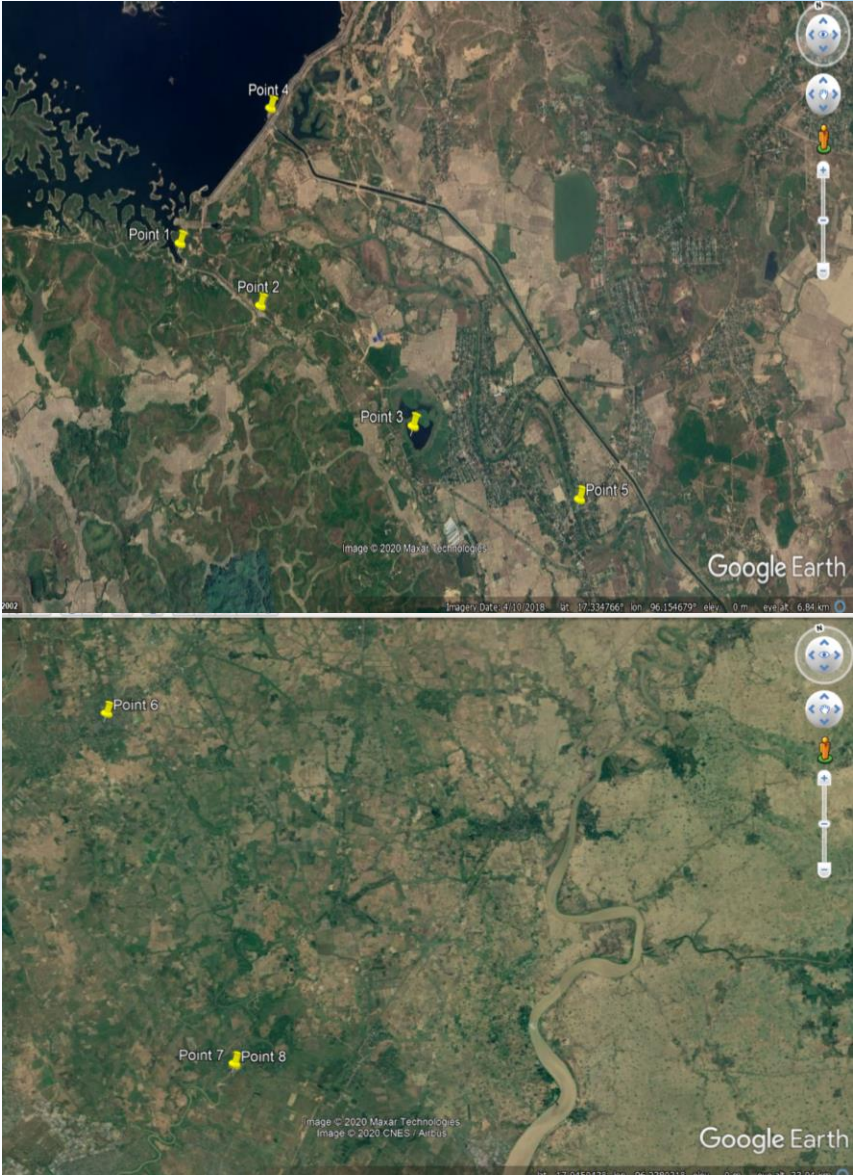
- pH value between the standards and so it cannot affect on the aquatic life
- The DO values are very low at the four stations (Htichaighat, Takaung, Thapeikkyin and Kyaukmyaung) in 2015 and it is harmful to the aquatic life. Low DO causes to an unbalanced ecosystem.
- Nitrate: Myinchau, Pakokku, Sinyuikyun, Kyaukhin, Maubin and Twante stations exceed the standard limit in Lower ARB and delta in 2013 and 2015.
 - Most of the stations above the standard limit
 - Ammonia in higher concentration is harmful to not only fish and other biota but also man at higher concentration.
- Chloride is higher than the limits in almost all the stations
- High value of iron in Twante station
- Total suspended solids (TSS) and turbidity higher than the limits

*Effects of Damming

Water Quality Assessment in Nga Moe Yeik Creek (Downstream of Nga Moe Yeik Dam)

Sampling Locations

Station No	Location	Description
1	17.347 N , 96.1506 E	Reservoir Outlet
2	17.34155 N , 96.1567 E	NMY creek (near reservoir)
3	17.3313 N, 96.168 E	Wetland
4	17.3553 N , 96.1598 E	Reservoir
5	17.3242 N, 96.1807 E	NMY creek (near the bridge of Phaung Gyi)
6	17.0695 N , 96.2212 E	NMY creek (near the bridge of Hlegu)
7	16.9630 N , 96.2454 E	NMY Spillway
8	16.9625 N , 96.2453 E	Downstream of Spillway



* Water Quality Results

Parameters	Unit	Reservoir	Res:out	NMY Creek	NMY PG	Halegu	Spillway	Creek D/S	Wetland	NWQS Class II	NWQS Class III	NWQS Class IV
pH		7.54	5.98	7.7	6.9	5.18	7.05	6.29	7.9	6.0-9.0	5.0-9.0	5.0-9.0
Colour	TCU	15	40	30	60	60	80	200	40	150		
Turbidity	NTU	23	62	58	92	90	120	278	57	50		
Conductivity	micro S/cm	132	128	220	224	210	324	328	18	1000		6000
Total Hardness	mg/l as CaCO3	38	40	40	60	48	58	58	4	250		
Total Alkalinity	mg/l	78	72	60	84	78	84	80	9			
Iron	mg/l	0.58	0.78	0.68	1.28	1.12	1.44	1.84	0.82	1	1	1
Chloride (CL)	mg/l	5	5	4	19	22	65	63	2	200		80
Total Solids	mg/l	96	146	170	212	217	294	494	71			
Total Suspended Solids	mg/l	30	82	60	100	112	132	330	62	50	150	300
Total Dissolved Solids	mg/l	66	64	110	112	105	162	164	9	1000		4000
Temperature	.C	33.7	32.5	32.8	30.5	32	31.6	31	35.6			
Ammonia Nitrogen (NH3)	mg/l	1.8	3.8	4.2	3.8	4	4.4	4	3	0.3	0.9	2.7
Chemical Oxygen Demand (COD)	mg/l	32	64	32	64	64	64	32	32	25	50	100
Nitrite (NO2)		0.2	0.3	0.3	1.1	0.4	1	0.8	0.2	0.4	0.4	1
Dissolved Oxygen	mg/l	6.5	7.1	7.8	6.9	7.1	3.9	3.8	6.9	5.0-7.0	3.0-5.0	<3

*Discussion

The pH value was 5.18 to 7.9. There is an acidity condition at Helgu point.

By the comparison with NWQS standards, the conductivity value was in the acceptable range.

The DO were lower at the spillway and D/S of NMY. It is harmful to the aquatic life and ecosystem.

The value of color near the NMY spillway was very higher than NWQS standards.

There was high turbidity due to discharging agricultural particles and soil particles from agriculture area along the creek.

Although the values of TDS were within the NWQS standards, TSS values are higher than the standard.

The total hardness of surface water from NMY was in the range of 4 mg/l to 60 mg/l that is less than 75 mg/l of CaCO₃ and thus, it is said that NMY water is soft water.

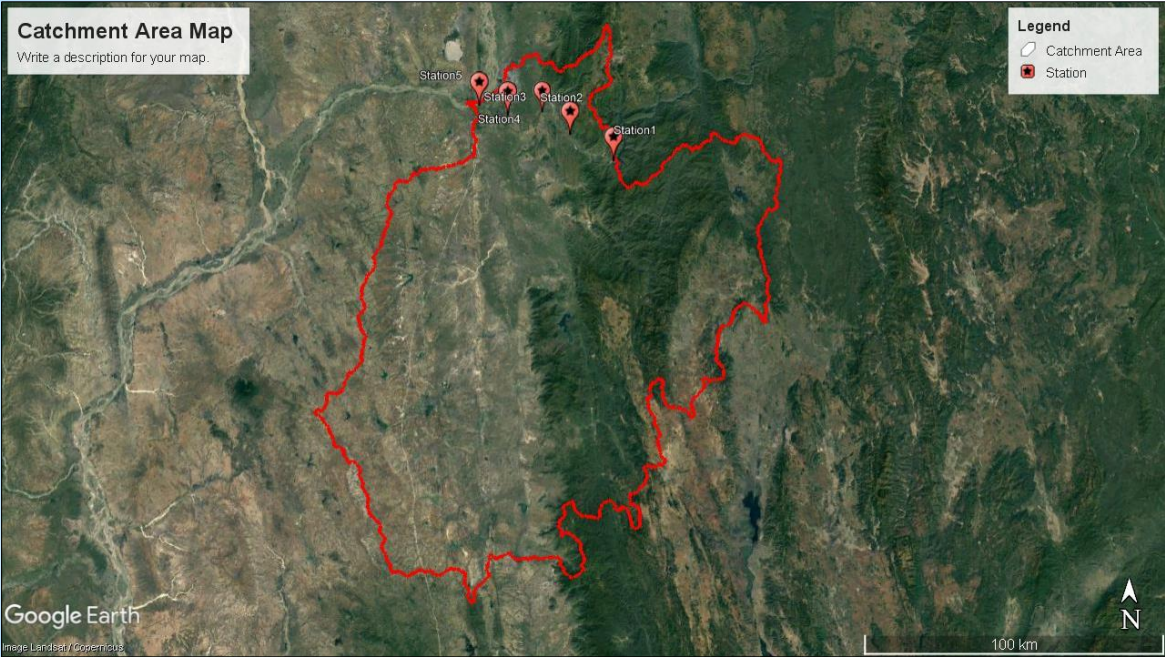
The iron from NMY was in the range of 0.58 mg/l to 1.84 mg/l that is higher than the standard.

The concentration of ammonia was in the range between 1.8 mg/l and 4.4 mg/l that is higher than the standard.

The COD of surface water from NMY was in the range of 32 mg/l to 64 mg/l that was higher than the standard limit of 25 mg/l.

Nitrite values were higher than the standard limit of 0.4 mg/l at NMY creek near Phaung Gyi, Spillway and D/S of the creek near spillway.

Water Quality Assessment in Myint Nge River (Downstream of Yeywa Dam)

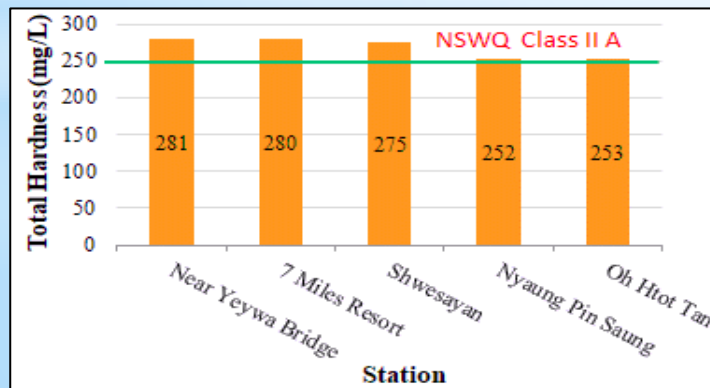
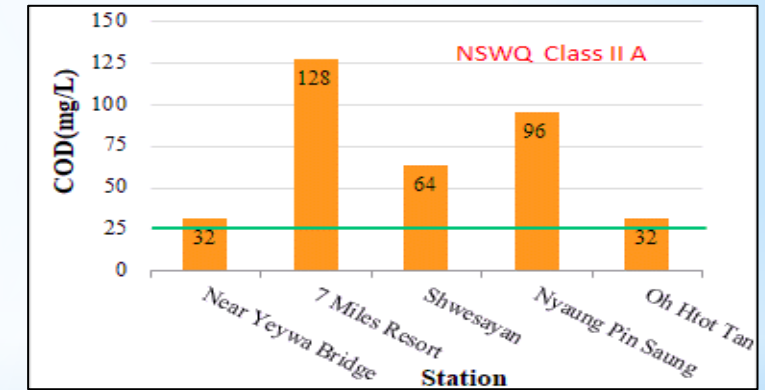
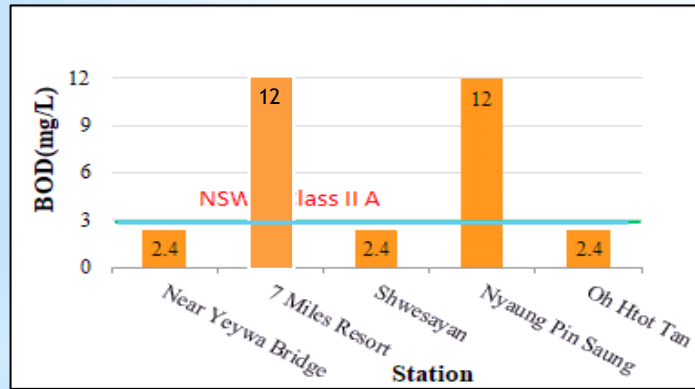
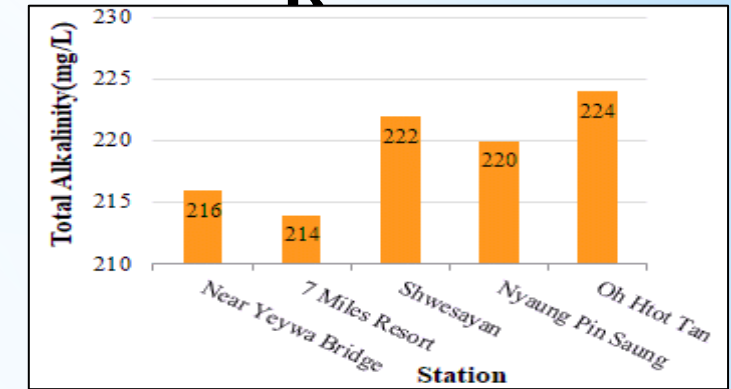
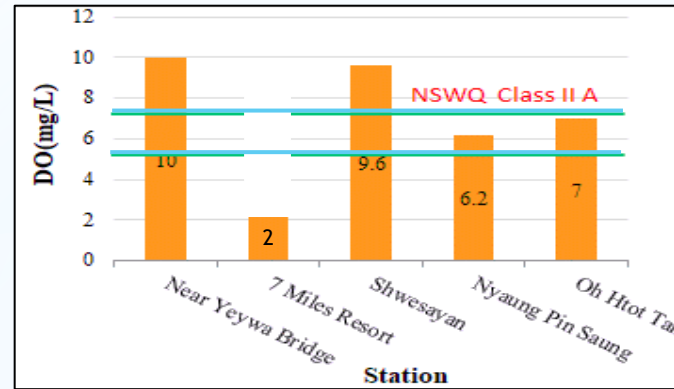
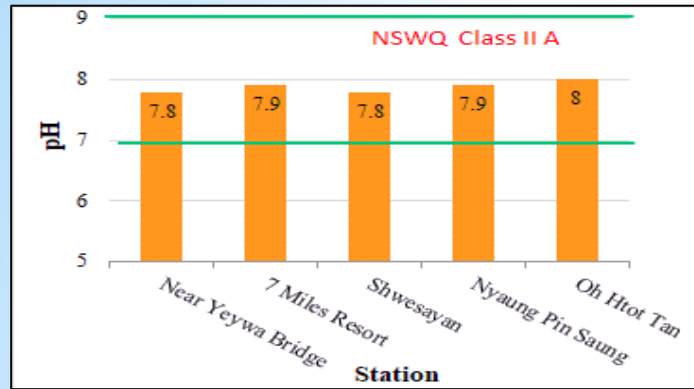


Location Map of Water Sample Stations

LOCATIONS OF WATER SAMPLING STATIONS

Station		Distance from Yeywa Dam	Latitude	Longitude
1	Near Yeywa Bridge	0.8 mile	21°40' 11.42"N	96° 27'48.66" E
2	7 Miles Resort	12 miles	21° 45' 32.73"N	96° 18' 47.48"E
3	Shwesaryan	21 miles	21° 50' 15.43"N	96° 12' 51.19"E
4	Nyaung Pin Zauk Village	28 miles	21° 49' 35.59"N	96° 5' 36.58"E
5	Oh Htot Tan	35 miles	21° 51' 35.57"N	95° 59' 32.46"E

* Results of Water Quality in Downstream of Yeywa



Source: Wai Mon Oo, 2020

*Discussion

- ❖ In January, the main causes of pollution is due to point sources such as untreated wastewaters from factories and recreational places.
- ❖ In July, Myitnge river is polluted by non-point sources like storm water which contains the municipal sewages, runoff from agricultural fields, and soil erosion.
- ❖ DO concentration is least at the point near 7 Mile resort.
- ❖ BOD and COD are higher at point near 7 mile resort and Nyaung Pin Saung.
- ❖ Hardness of all points ranged between 252 mg/l and 281 mg/l and thus the water in Myint Nge River is said to be hard.
- ❖ The water quality is affected by human activities but is not dramatically changed by damming in Myitnge river at downstream of dam.

* **Water Conservation, Wastewater Management and Water Rate**

*The key activities to conserve water are as follows;

- (1) Any beneficial reduction in water loss, use and waste of resources
 - (2) Avoiding any damage to water quality
 - (3) Improving water management practices that reduce the use or enhance the beneficial use of water.
- *In order to preserve water quality of natural water resources, it is essential to implement municipal/ industrial wastewater management.
- *The water quality from sources of water intake for water supply will be degraded due to the disposal of wastewater without any treatment.
- *The water price goes towards meeting the cost of water treatment, reservoir operations, desalination, used water collection and treatment, as well as the maintenance and expansion of network of water pipelines.

* Conclusion

- * Although the concentration of some parameters of treated effluent from **YCDC WWTP** are higher than NEQG values, there is no significant impact on water quality of Yangon River due to the natural flushing of tidal effects twice per day.
- * LULC changes along the tributaries of **Ayeyarwaddy River** mostly from human development and agricultural area can provide more nutrients and sediment to surface waters.
- * Katha, Htichaight, Myinchin, Innwa, Pakokku, Nyaungoo , Magwe, Minhla, Aunglan , Thayet and Kyankhin stations are dominant by not only agriculture but also the effluents from industries.
- * In case of **Pan Hlaing River**, most of the parameters of point1 ,point2 and point3 are within the standard, point4 and point5 parameters are higher than the standard because of the industrial wastes from industrial zones
- * From these result, some parameters of the river have to use suitable treatment method for irrigation purpose.

* Conclusion (Continued)

- * In **Pazundaung Creek**, Turbidity, BOD, TSS, TDS, Cl and EC at the upstream point of the catchment are found higher than the permissible limit of standard due to the contamination of the effluent discharge from the industries which are located at the upstream of Thaketa I.Z.
- * In June, the observed values of turbidity and total nitrogen are increased at the downstream point because of the contribution of contaminants from solid waste disposal sites at the mid point and downstream.
- * This observational study clearly reveals that the current water quality of Pazundaung creek (especially in the upstream of the study area) is not good for sustainability of the aquatic species as well as it is not also suitable for the purpose of domestic usage.
- * **Nga Moe Yeik Creek** can be described as the creek at high risk of pollution from the activities with extensive agriculture and wastewater discharge. According the comparison with NWQS Malaysia, NMY creek can be used as the water source for irrigation purpose.
- * According to present study finding, **Myitnge** river is regarded as hard water.
- * The results of some water quality parameters are found to be changed in ten years after dam construction comparing with the results before dam construction.

*Conclusion (Continued)

- *Laws, policy and regulations for wastewater management have been issued by respective authorized organizations, departments and ministries. However, the national water quality standard of Myanmar is still needed.
- *To achieve the wastewater management system, it is necessary to give incentives for the public participation by the owners of the industries.
- *Need systematic and effective wastewater management system to control the degradation of water quality of natural water body.
- *Achievement of water conservation can save energy, cost and human resources for water treatment, the affordable and reliable water price for the citizens can be assigned.

*** various development projects could be considered
water conservation of quantity and quality at the stage of planning,
implementation and operation
for our sustainability**

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THANK YOU SO MUCH!