



# **MINISTRY OF TRANSPORT AND COMMUNICATIONS**

**DIRECTORATE OF WATER RESOURCES AND IMPROVEMENT OF  
RIVER SYSTEMS ( DWIR )**

## **Improvement of River Systems in the Ayeyarwady Delta**

**1 June , 2017**

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- **Overview on the Ayeyarwady Delta**
- **Challenges**
- **Water Resources Management and Disaster Management in Myanmar**
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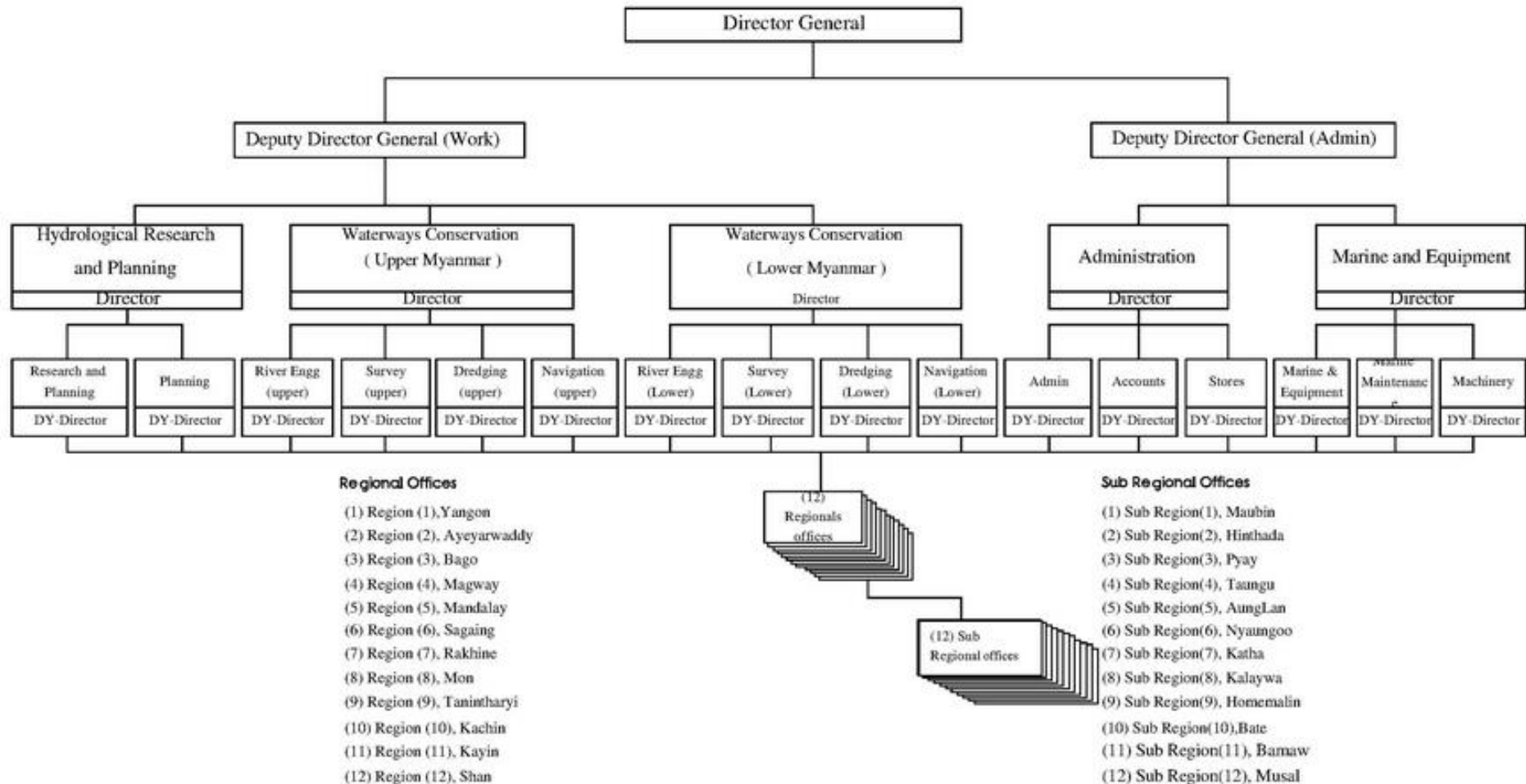


## Visions of DWIR

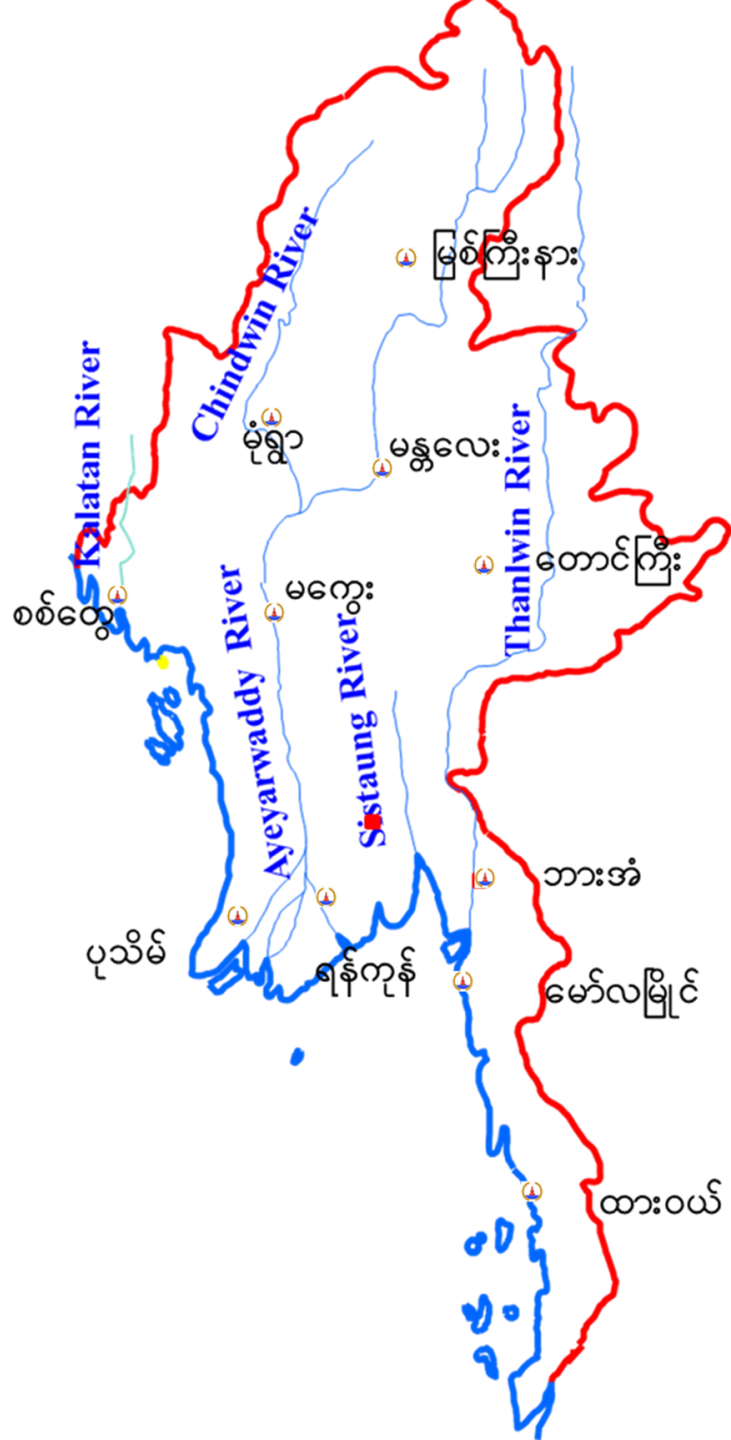
1. To conserve and protect the water resources
2. To smooth and safety waterways navigation
3. to contribute to the development of State economy
4. To protect environmental impact



# Organizational Structure of DWIR



(12) Regional offices



1. Yangon
2. Patheingyi
3. Bago
4. Magwe
5. Mandalay
6. Monywa
7. Sittwe
8. Mawlamyine
9. Dawei
10. Myittha
11. Hpa-an
12. Taunggyi



# Responsibilities of DWIR

- To improve the **navigation channel** and to stabilize the **inland river ports**.
- To protect the river **banks erosion**.
- To cooperate with other organizations in demarcation of **danger water level** of the towns.
- To utilize the river water for **domestic and agriculture** all the year round.
- To protect bank erosion of **border rivers**.
- To observe the long term existence of the cross **river bridges** by river engineering point of views.
- To manage the prevention of the river **water pollution**.
- To achieve adequate depth for maximum **loading capacity** of the vessels.

# Major Rivers in Myanmar



Name of River	(Length) (km)	(Catchment) (sq-km)
Ayeyarwady	2100	288900
Chindwin	1100	115300
Sittaung	420	34395
Thanlwin	2410	158000
Kaladan	650	22611

## Navigable Length of Major Rivers

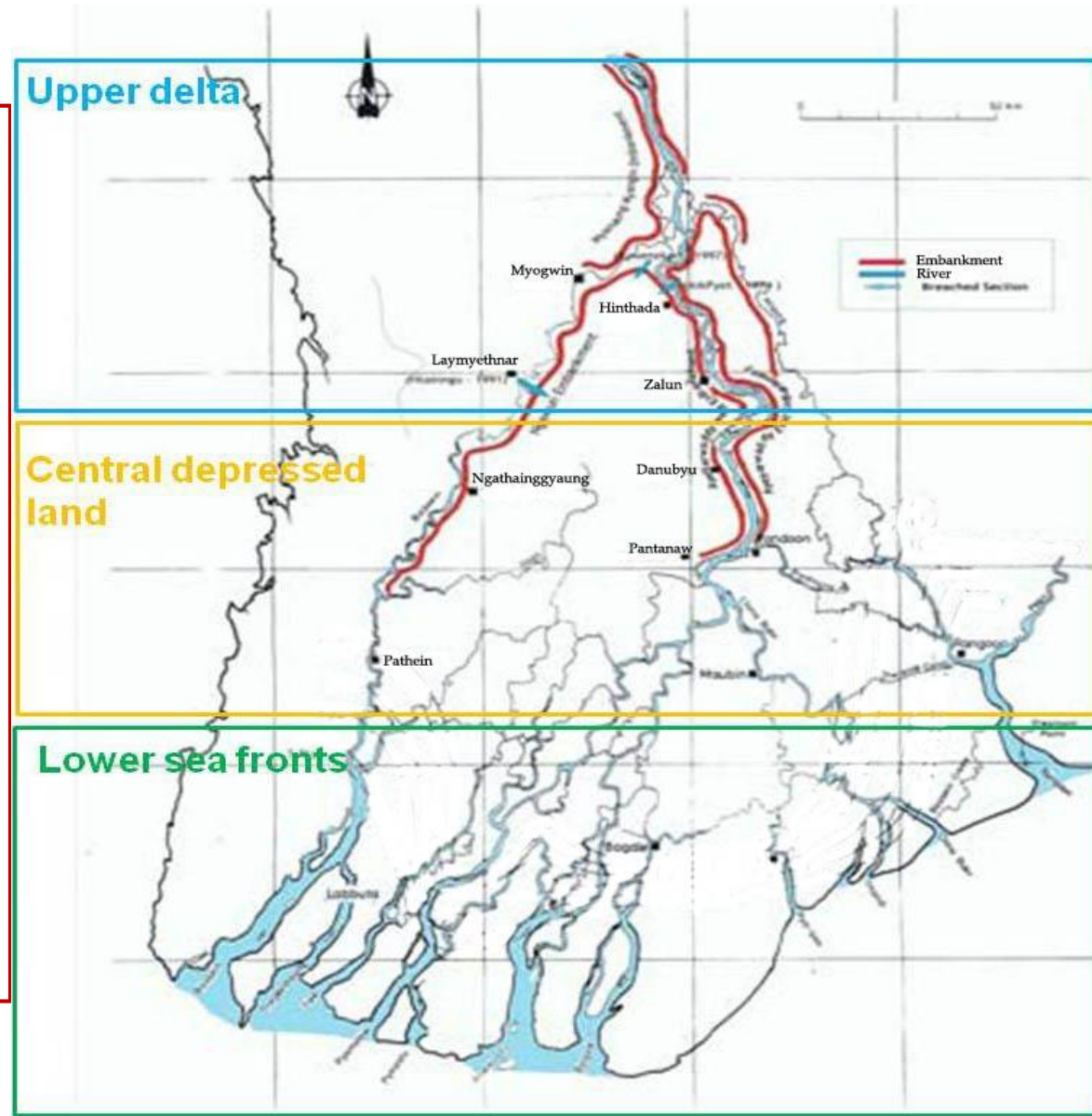
Name of River	Navigable Length (km)
<b>Ayeyarwady</b>	<b>1534</b>
<b>Chindwin</b>	<b>817</b>
<b>Thanlwin and other rivers in Mon State</b>	<b>380</b>
<b>Delta Region</b>	<b>2404</b>
<b>Rivers in Rakhaing State</b>	<b>1602</b>
<b>Total Length (km)</b>	<b>6737</b>

# Overview of the Ayeyarwady Delta

- Delta can be divided into three portions
  - Lower Sea Fronts
  - Central Depressed Land
  - Upper Delta
- The lands in the upper delta are prevented by river dikes
- Irrigation and Water Utilization Management Department controls 64 dykes and 190 sluices

## ➤ Related to Three Regions

- Ayeyarwady Region
- Yangon Region
- Bago Region

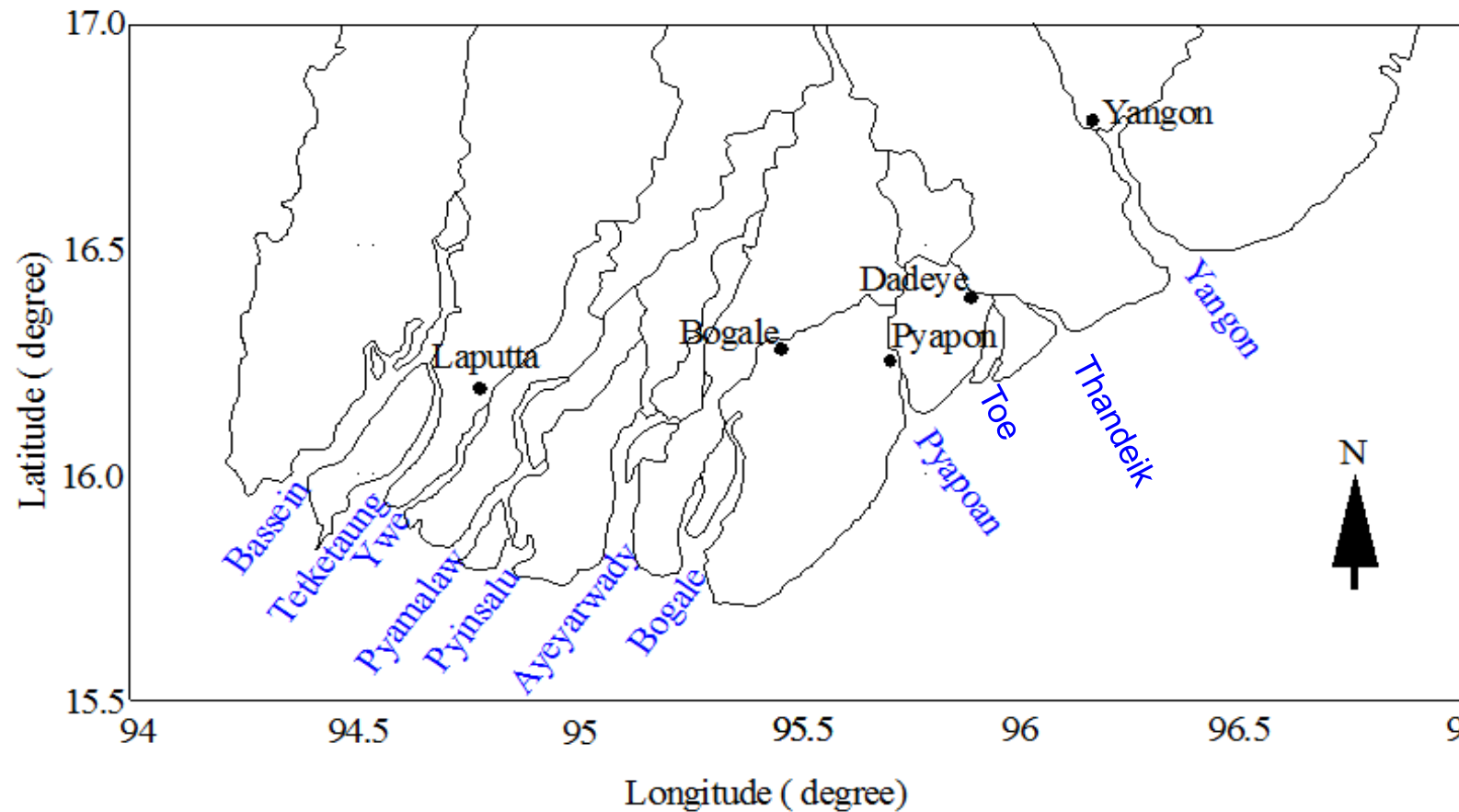




## River network in the Delta.

Ayeyarwady river flows into the Andaman sea through (9) large distributaries :

- (1) Pathein,
- (2) Thetkethaung,
- (3) Ywe,
- (4) Pyamalaw,
- (5) Ayeyarwady,
- (6) Bogale,
- (7) Pyapon,
- (8) Toe and
- (9) Yangon rivers



# Major Cities in Ayeyarwady Delta

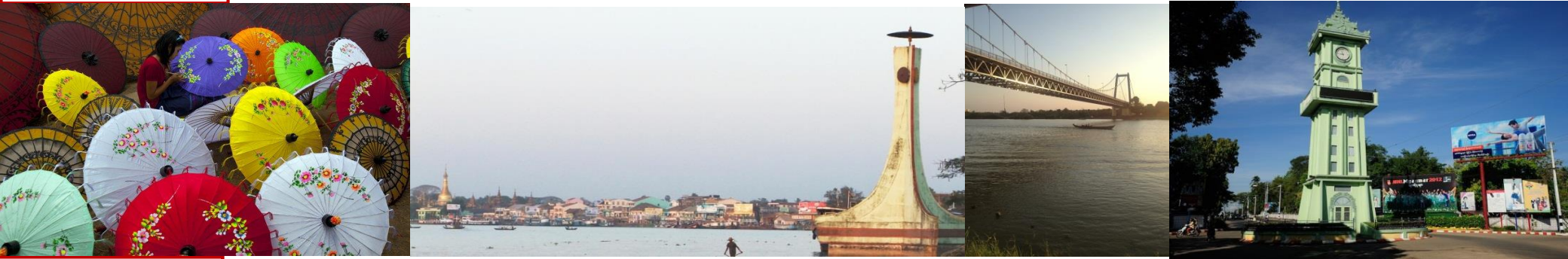
## Yangon

Capital of Yangon Region and Economic City of Myanmar  
(5 million population in urban area - 2014 census)



## Patheingyi

Capital of Ayeyarwady Region (over 287,000 population – 2014 census)



## Bago

Capital of Bago Region (500,000 population – 2014 census)



# Major Cities in Ayeyarwady Delta

## Nyaung Done

- located at the bifurcation of the Ayeyarwady river coming from the north, into the continuation of the Ayeyarwady river (to the southwest) and the Pan Hlaing River (to the east)
- Population of about 198,046
- City area about 348.23 sq. – mile.
- The city located at the border of the Ayeyarwady region and Yangon Region
- The Ayeyarwady river is a highly dynamic, meandering/braiding river system with an average discharge of 13.000 m<sup>3</sup>/s
- The Pan Hlaing River bifurcates from the Ayeyarwady river main branch
- About 50% percent of the flow diverts into the Pan Hlaing.

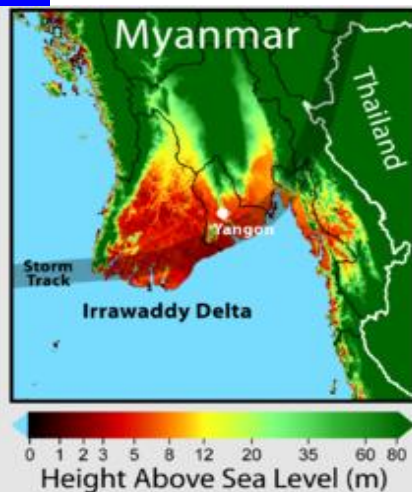


# Challenges

## Cyclones

### Cyclone Nargis 2008

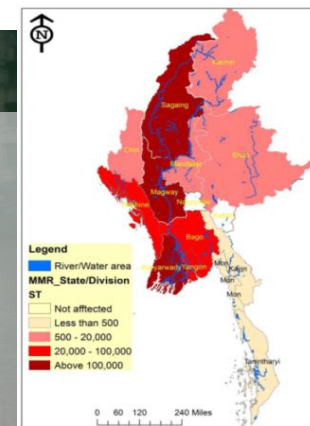
- 84,537 people were killed and 53,836 went missing.
- 2.4 million people were affected.
- 800,000 houses were totally damaged



## Flood

### 2015 flood

- 132 people were died
- 1,676,086 people were affected
- 38954 houses were totally damaged



## Water scarcity in the dry season



## River Bank erosion



## Arsenic and saline contamination of ground water

## Sea level rise

## Subsidence

# Some Measures

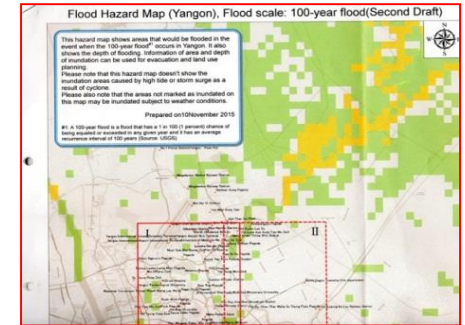
## Cyclone Shelter



## Hydromet Observation and Early Warning System



## Flood Hazard Mapping



## Water Supply System

## Embankment

## River Bank Erosion Protection



## City Development Planning

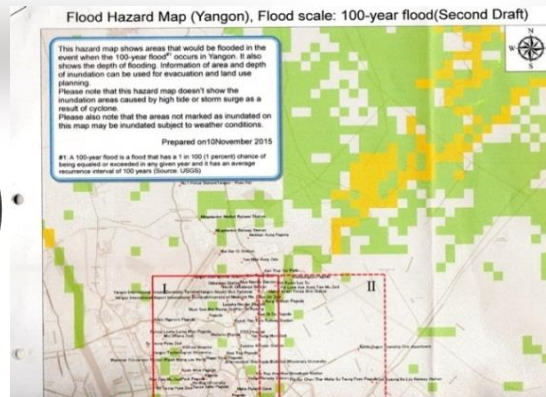
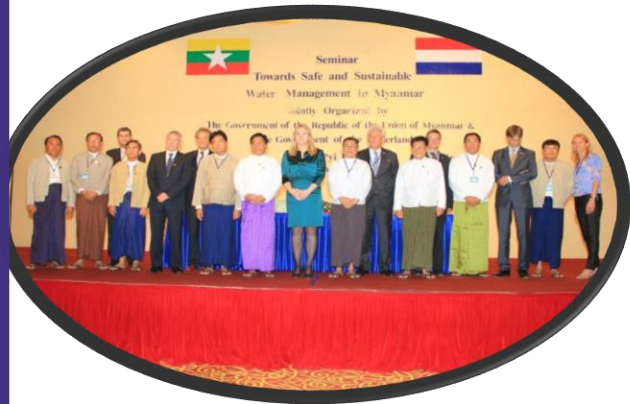
## Coastal Zone Management

## Capacity Building and public awareness

## Drainage System



# International cooperation and some of the activities



# Water Resources and Disaster Management in Myanmar

## National Water Resources Committee (NWRC)

Hydro Informatics  
Center

Secretariat

Advisory Group

Ayeyarwady Delta  
Development Working  
Committee

Officers Expert  
Group

## National Disaster Management Committee (NDMC)



## Advisory Group

- To support NWRC in technical point of views
- Water experts from various backgrounds as members
- Chairperson, Secretary, and Joint Secretary of Advisory Group as members of NWRC

## Ayeyarwady Delta Development Working Committee

- Members from Water Related Ministries and Regional Governments related to Ayeyarwady Delta, and some Advisory Group Member of NWRC
- Established in October 2016
- To facilitate and support cooperation, communication and information sharing for water related projects and activities in Ayeyarwady Delta among ministries, regional governments and international organizations
- Ayeyarwady delta development working groups



# Water Resources and Disaster Management in Myanmar

## AIRBM Project

### (1) Component 1

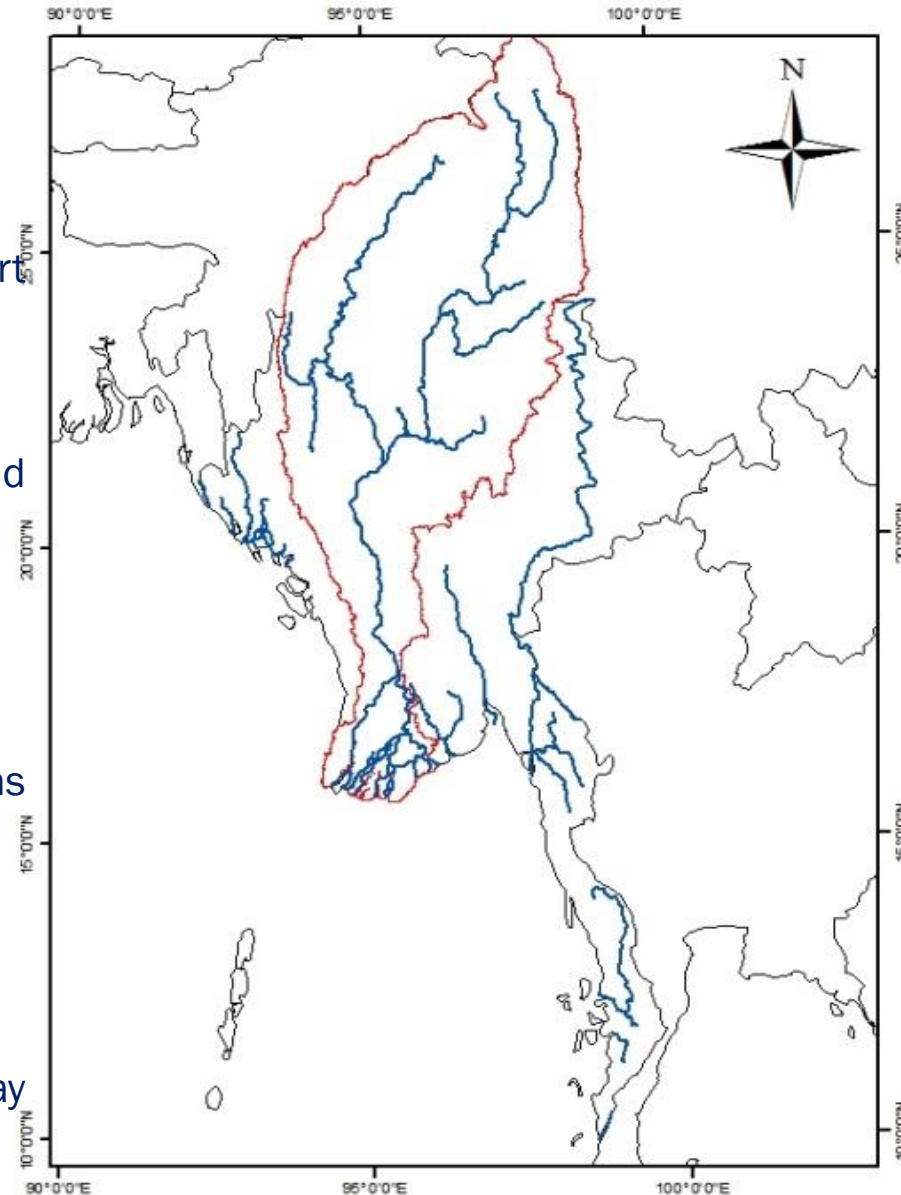
Water Resources Institutions (NWRC, etc.), Decision Support Systems, Hydroinformatics Centre, Ayeyarwady River Basin Master Plan, new Investments and Capacity Building

### (2) Component 2

Hydromet Observation and Information Systems Modernization

### (3) Component 3

Ayeyarwady River Navigation Enhancements from Mandalay to Nyaung U



# Myanmar – Netherlands Cooperation



➤ Bago-Sittaung Integrated Water System Analysis

➤ Feasibility Study on Mandalay-Bagan Navigability Improvement

➤ Bagan Multi-Purpose Pilot River Beautification

## Learning by Doing Projects

- Meiktila Lake Area Development
- Pan Hlaing Control Sluice cum Navigation Lock
- Integrated Ayeyarwady Delta Strategy

➤ Leapfrogging Delta Management in Myanmar – New Innovation

➤ Flood Risk Management in Nyaung Done

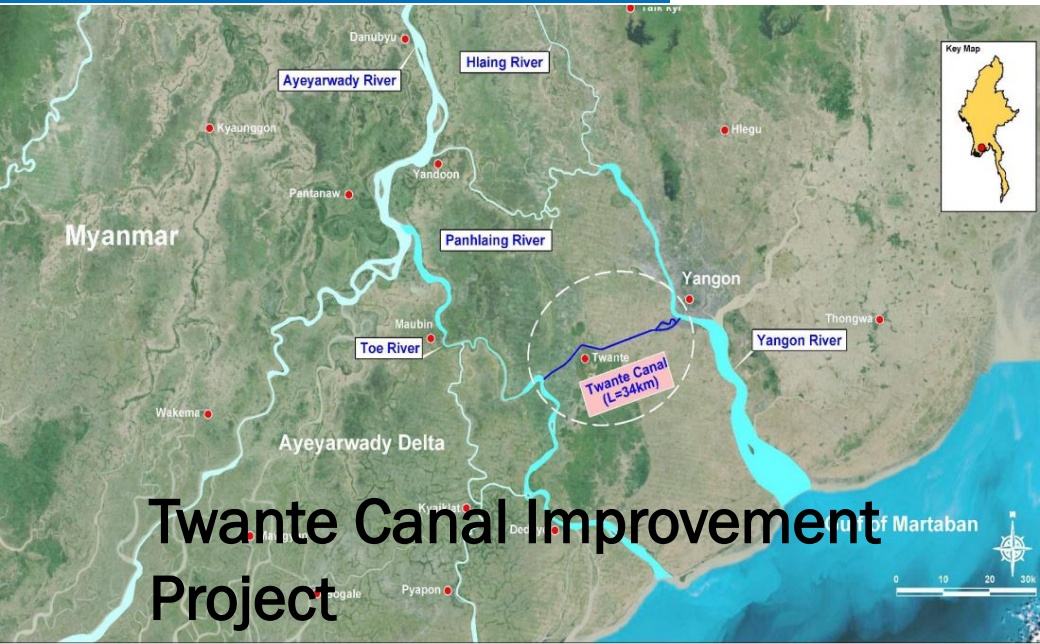
## Capacity Building Activities

- Young Water Professional Programme
- Myanmar Netherlands Water Challenge
- NICHE Project

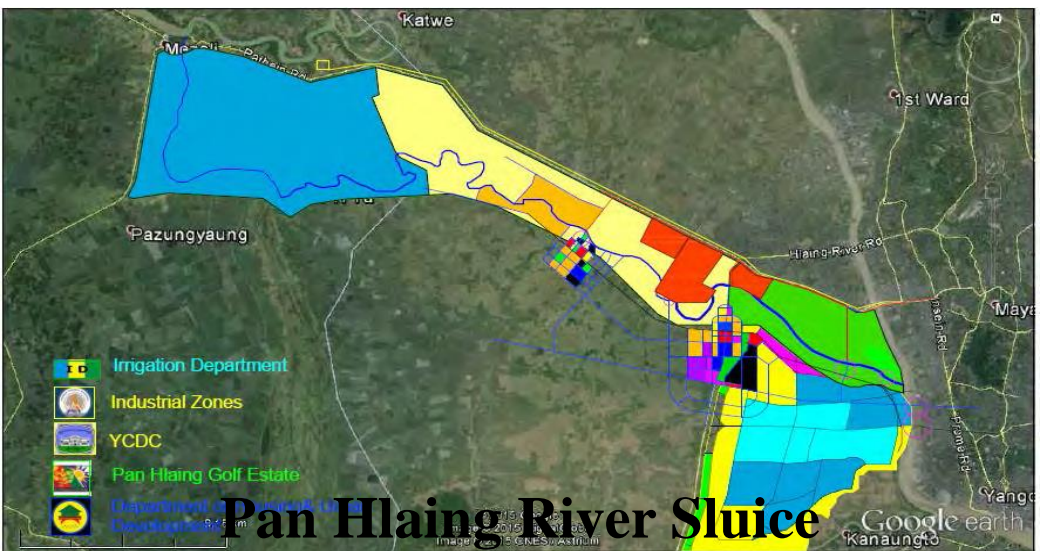
# Some Development Activities in Ayeyarwady Delta



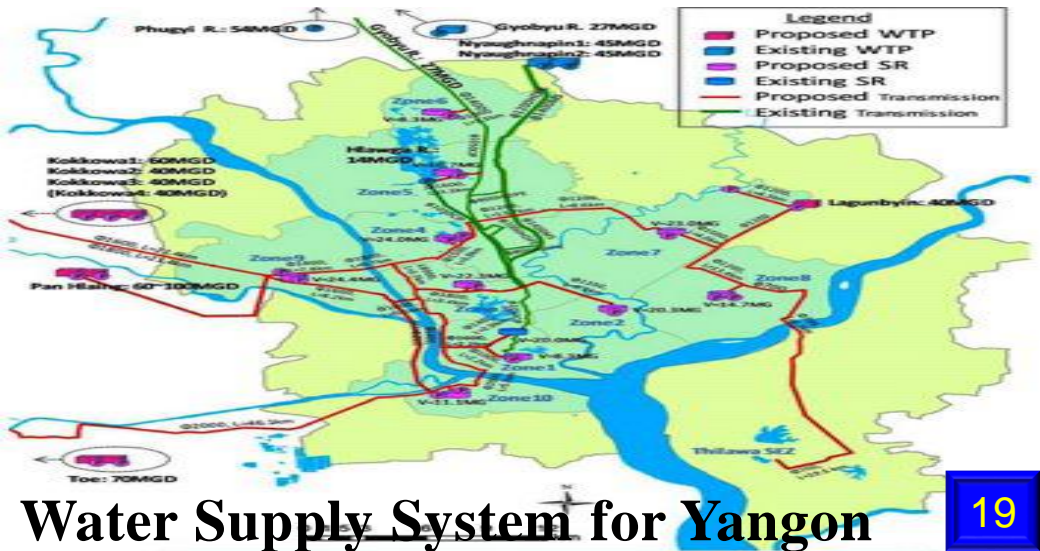
Flood Risk Management in Nyaung Done



Twante Canal Improvement Project



Pan Hlaing River Sluice



Water Supply System for Yangon

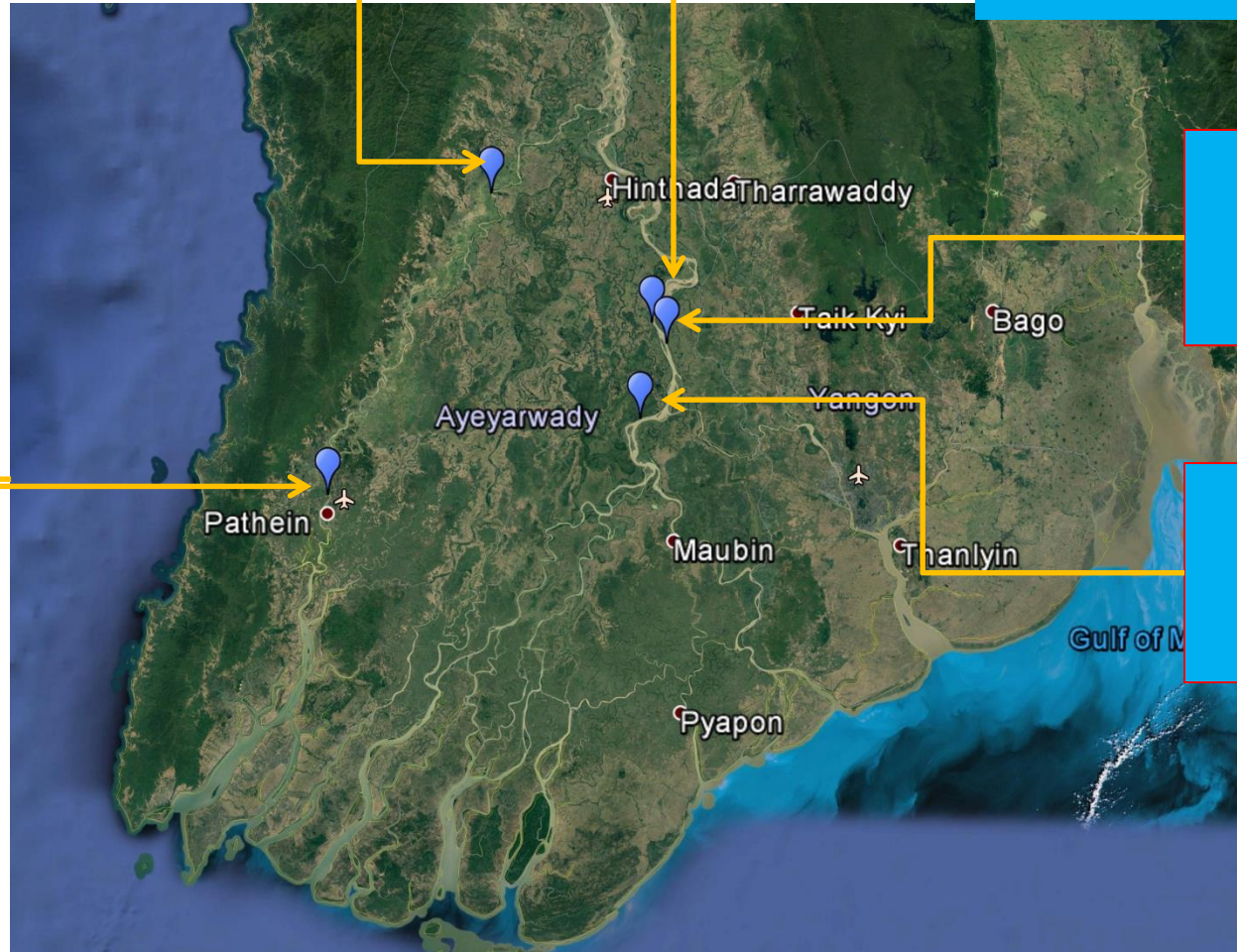


# Erosion Protection places in Delta Region

# Bank Erosion Protection Work in the Ayeyarwady Delta Region (2016 – 2017 Fiscal Yr., Union Special Budget for Natural Disaster )

(4). Laymyathna township ,  
Htuparyone Pagoda

(2). Mayanchaung village  
(Danuphyu)

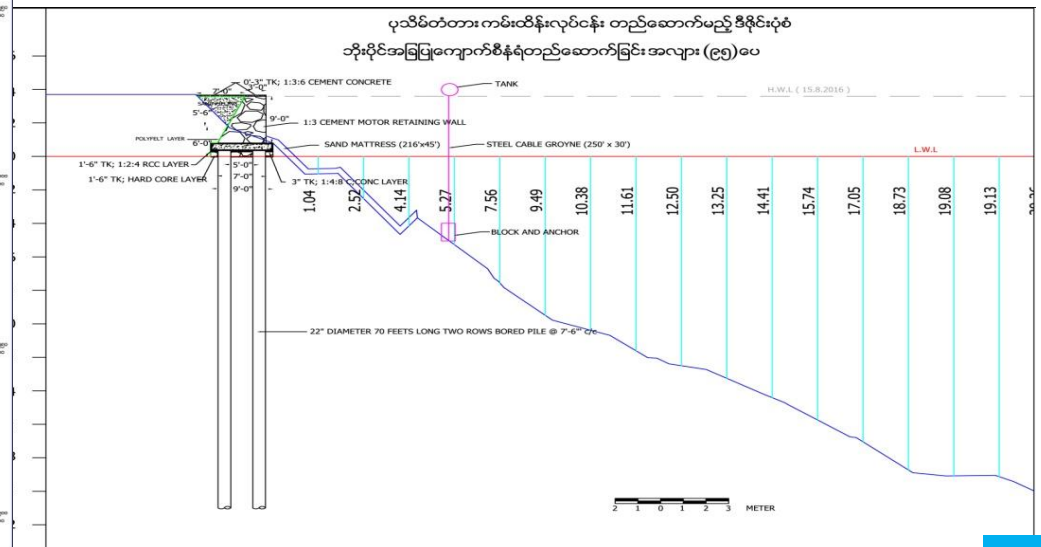
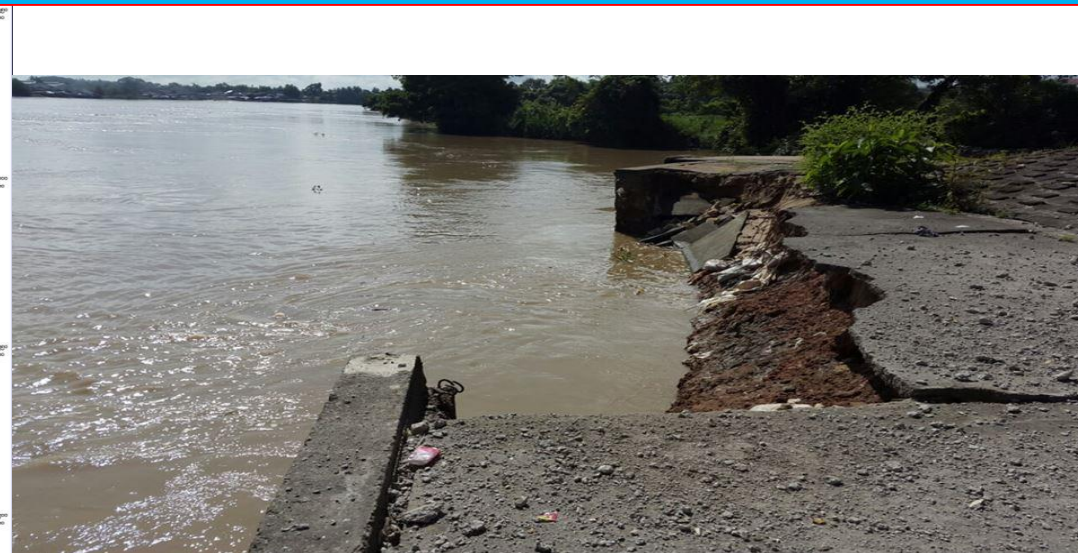
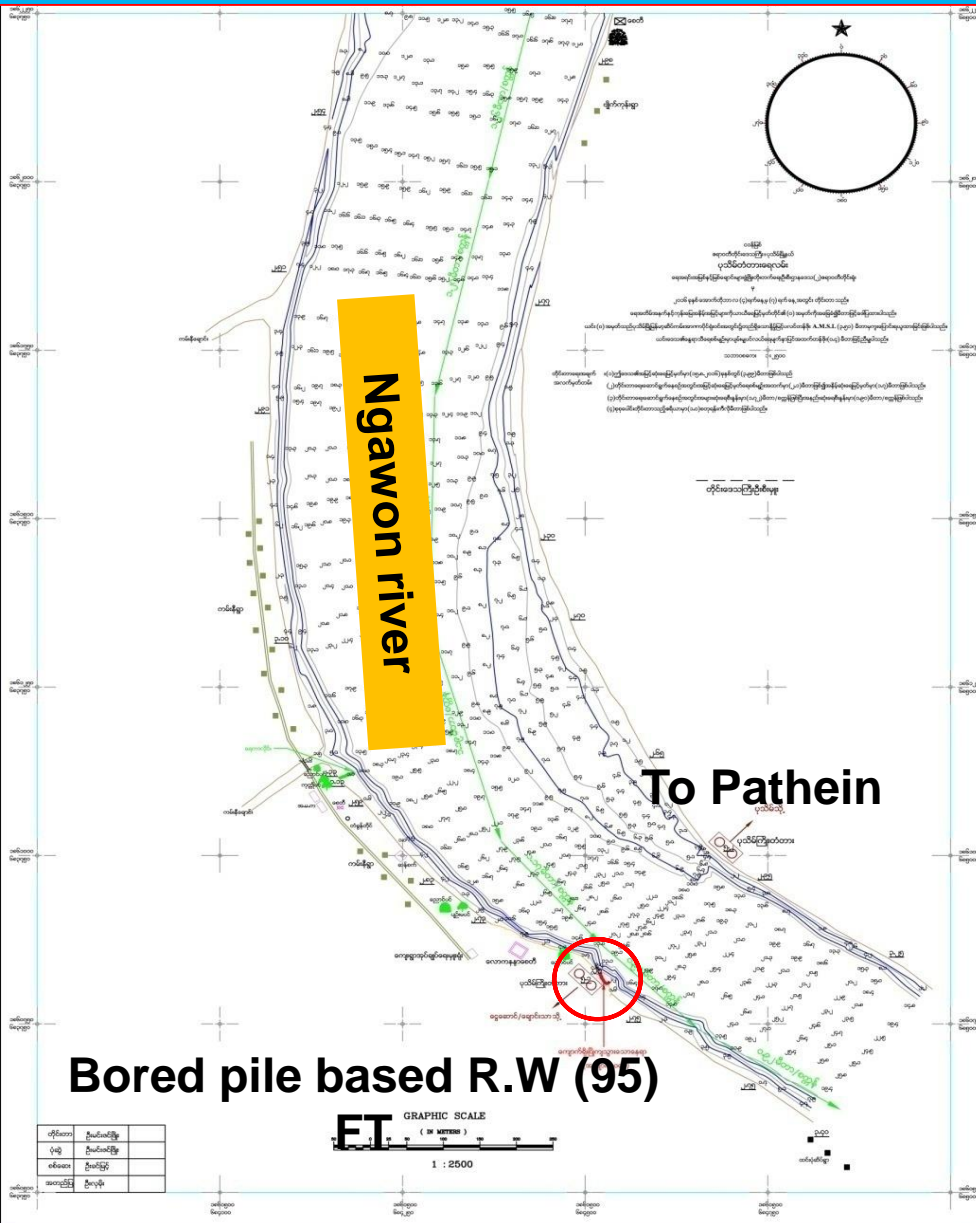


(3). Sankin village

(1). Pathein bridge  
(Ngawon)

(5). Bomyathtun  
bridge  
waterway

# 1. Pathein bridge (Ngawon) bank erosion protection

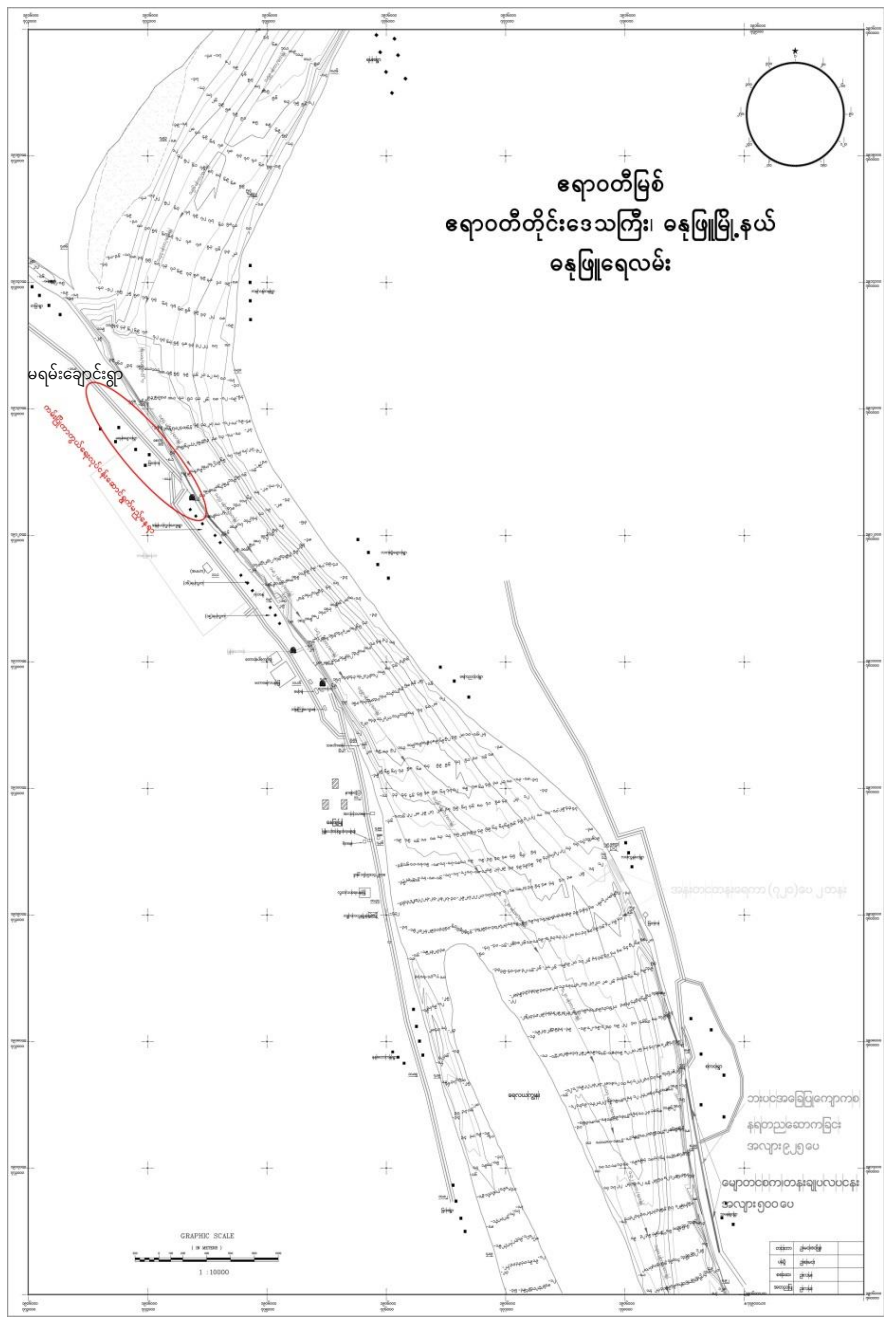


# 1. Pathein bridge (Ngawon) bank erosion protection

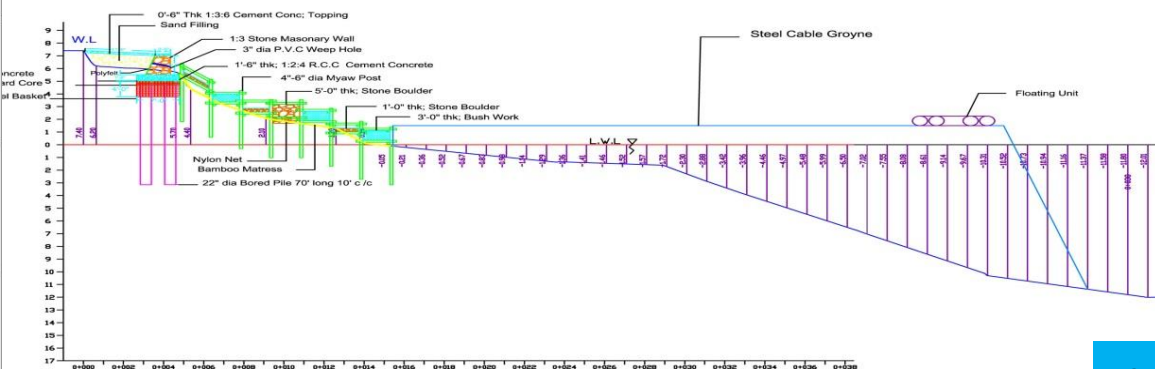
No.	Type	Length	Cost (Mil MMK)	Progress	Starting date	Completed
1	Bored pile based R.W	95 ft	93.263	100 %	20.1.2017	31.3.2017
2	Steel Cable Groyne	250 ft				



## 2. Mayanchaung village (Danuphyu) Bank erosion protection work



ဓနုဖြူမြို့နယ်၊ မရမ်းချောင်းကျေးရွာ ကမ်းထိန်းလုပ်ငန်း  
ဒီဇိုင်းပုံစံ



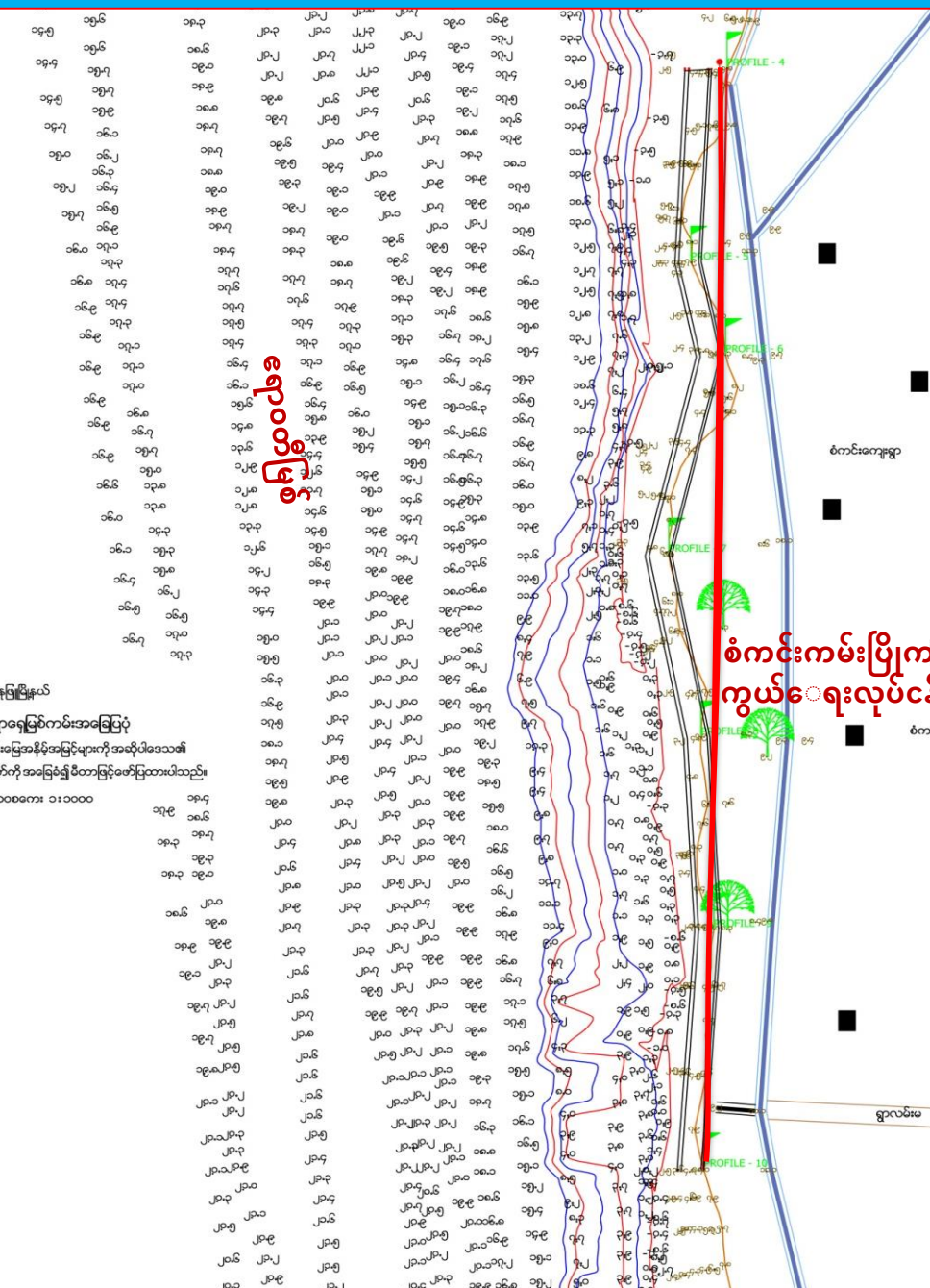


## 2. Mayanchaung village (Danuphyu) Bank erosion protection work

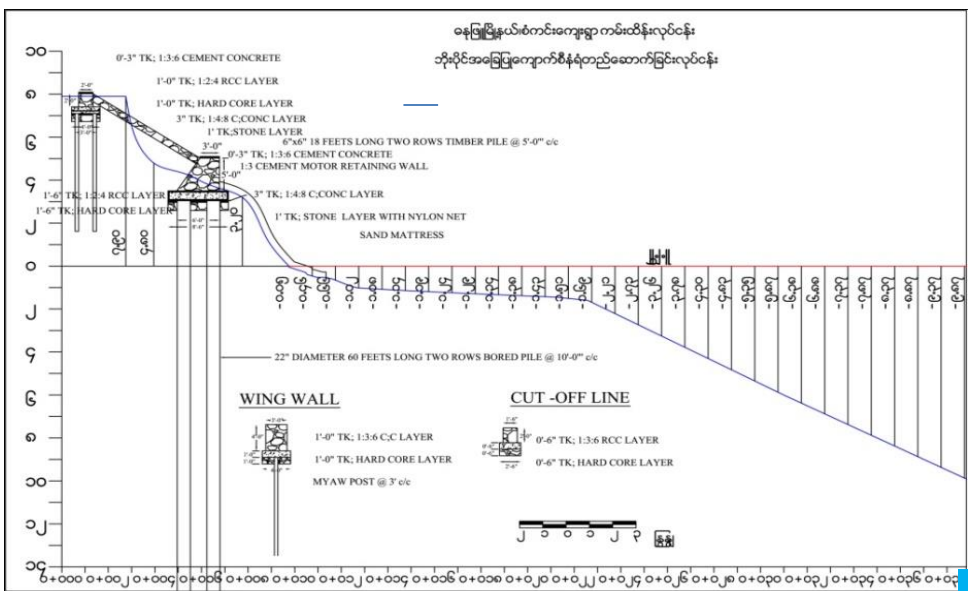
No	Type	Vol.	Cost (Mil MMK)	Progress	Starting date	To be Completed
1	Bored pile R.W	1120 ft	973.498	90 %	20.1.2017	10.6.2017
2	Stone filled Myaw groyne	1150 ft				
3	Steel Cable Groyne	1000 ft x 10 nos				
4	Floating Unit	11000 sq -ft				



### 3. Sankin village (Danuphyu) Bank erosion protection work



စံကင်းကမ်းပြိုကာ ကွယ်ရေးလုပ်ငန်း



### 3. Sankin village bank erosion protection work

No.	Type	Vol.	Cost (Mil MMK)	Progress	Starting date	Completed
1	Bored pile R.W	925 ft	971.578	97 %	20.1.2017	31.5.2017
2	Toe protection stone filled Myaw groyne	1300 ft				
3	Myaw post work	26000 sq - ft				
4	Coconut post groyne	720 ft x 2 nos				

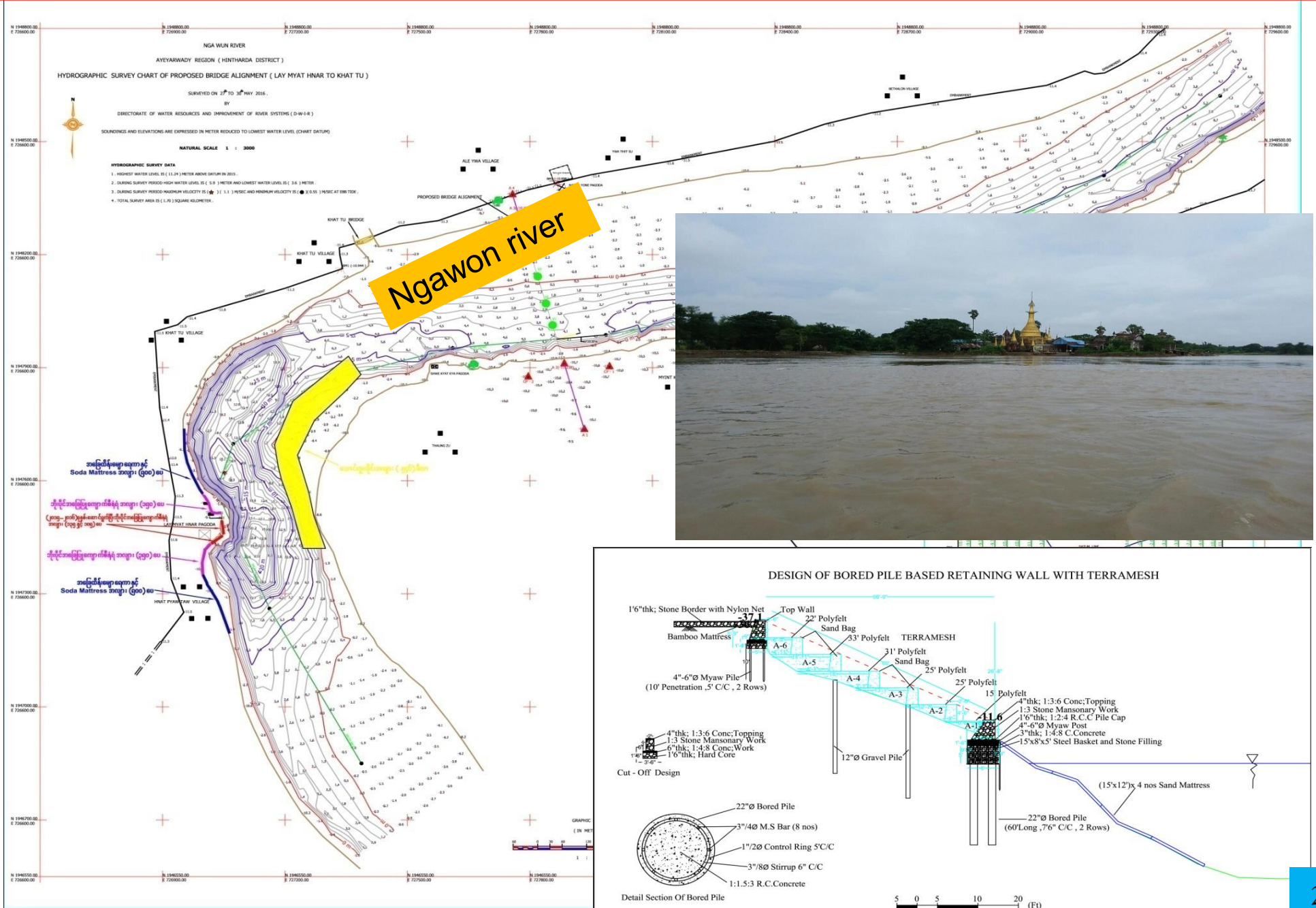


After construction

## 4. Laymyathna township , Htuparyone Pagoda bank erosion protection work



# 4. Laymyathna township , Htuparyone Pagoda erosion protection work

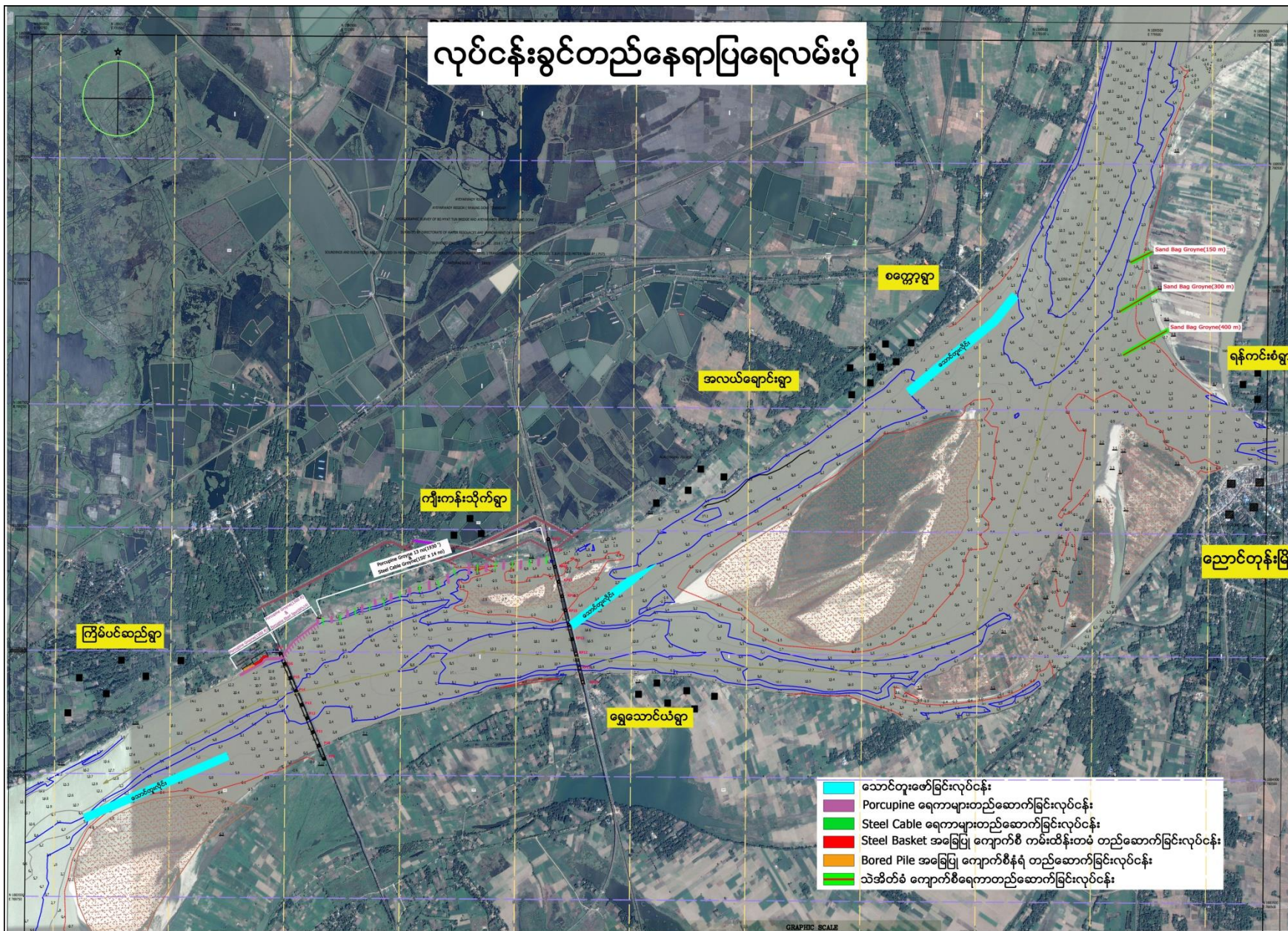


## 4. Laymyathna township , Htuparyone Pagoda erosion protection work

No	Type	Vol.	Cost ( Mil MMK)	Progress	Starting date	To be Complete
1	Bored pile R.W	500 ft	918.832	86 %	20.1.2017	10.6.2017
2	Toe protection stone filled Myaw groyne & Soda Mattress	500 ft x 2 nos				
3	Dredging	126362 cu - m				



# 5. Location of Bomyathtun bridge waterway conservation work , Nyaungdon township



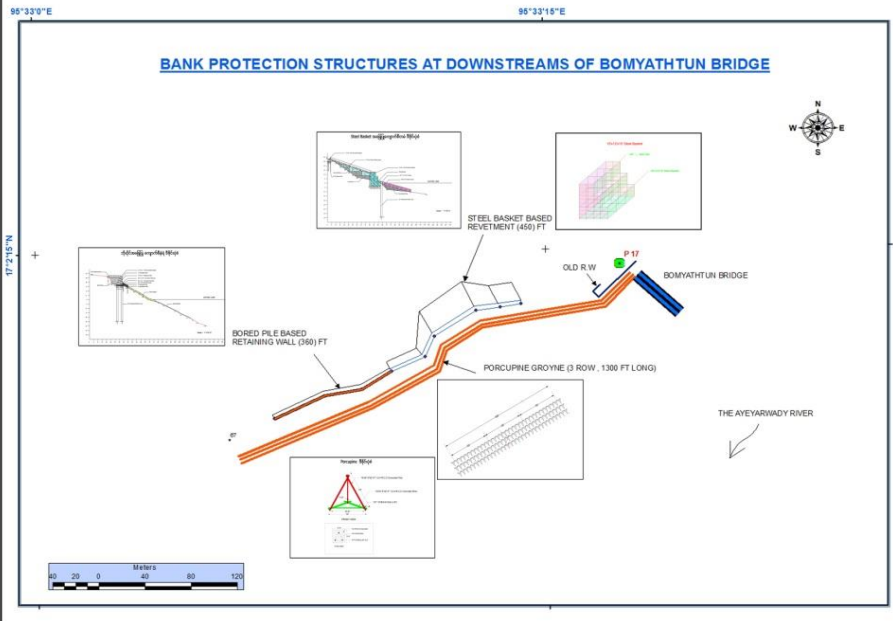
## 5. Bomyathtun bridge waterway conservation work , Nyaungdon township

No	Type	Vol.	Cost ( Mil MMK)	Progress	Starting date	Completed	
1	Dredging (3) places	428575 cu - m	251.103465	100 %			
2	Sand cored groyne	150 M	232.679687	100 %			
3	Sand cored groyne	300 M	448.113052				
4	Sand cored groyne	400 M	596.963720				
5	Porcupine groyne	13 nos (2830 ft)	165.670253	100 %			
6	Steel Cable Groyne	150 ft x 14 nos.	38.838789	100 %		20.1.2017	20.5.2107
7	(i) Porcupine toe protection (ii) Porcupine short spur	1300 ft x 2 nos. 60 ft x 14 nos.	117.350451 25.822186	100 %			
8	Bored pile R.W	615 ft	730.367534	98 %			
9	Steel Basket based R.W	225 ft	377.994864	97 %			
	<b>Tot.</b>		<b>2984.904</b>	<b>99 %</b>			

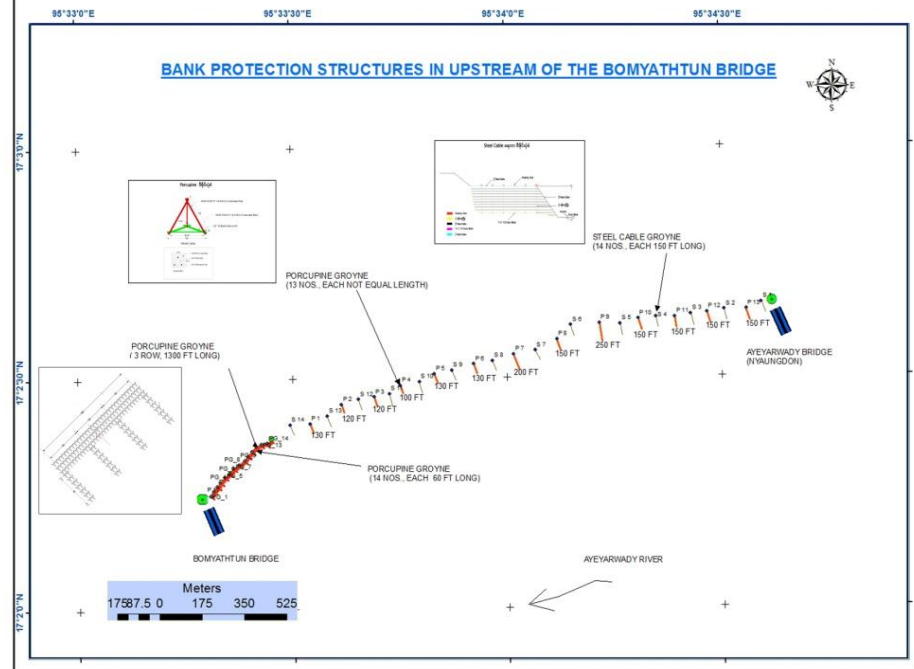


# 5. Bomyathun bridge waterway conservation work , Nyaungdon township

ပိုလ်မြတ်ထွန်းတံတား (အောက်ဘက်ပိုင်း) ကမ်းပါးထိန်းသိမ်းရေး လုပ်ငန်းများ တည်နေရာပြပုံ



ပိုလ်မြတ်ထွန်းတံတား (အထက်ပိုင်း) ကမ်းပါးထိန်းသိမ်းရေး လုပ်ငန်းများ တည်နေရာပြပုံ



## 5. Bomyathtun bridge waterway conservation work , Nyaungdon township



Bored pile R.W (615 ft) under construction



Steel basket based revetment (225 ft) under struction

## 5. Bomyathtun bridge waterway conservation work , Nyaungdon township



Steel basket based revetment (225 ft) & Bored pile R.W (615 ft)  
afterconstruction



## 5. Bomyathtun bridge waterway conservation work , Nyaungdon township



**Dredging work**



## 5. Bomyathtun bridge waterway conservation work , Nyaungdon township



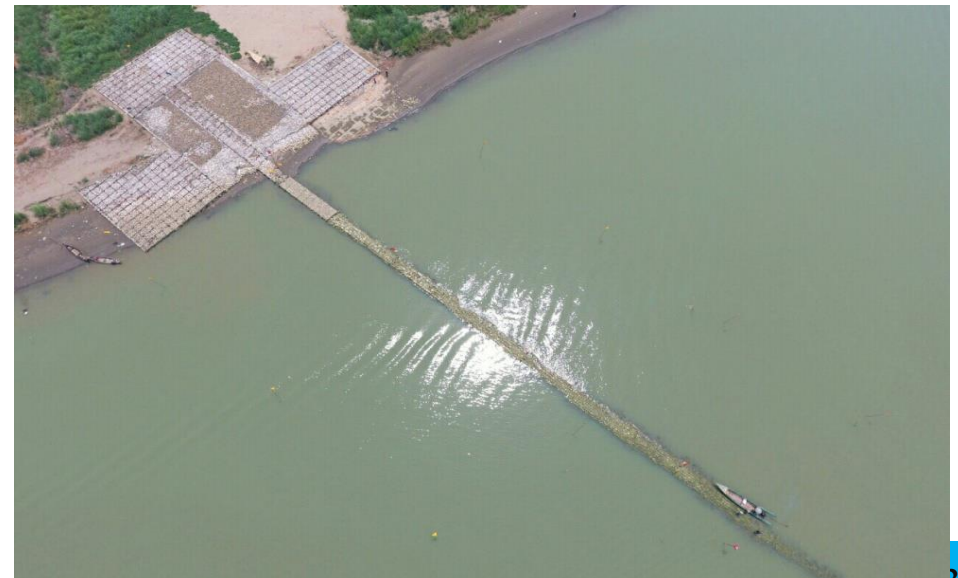
Porcupine installation



## 5. Bomyathtun bridge waterway conservation work , Nyaungdon township



Sand cored groynes (3 nos. – 150 M, 300M & 400M )



**Ayeyarwady delta region is flooded and eroded because of high sedimentation and composed by sandy soil. It is essential to implement 12 bank protection works in 2016-2017 financial year to prevent 1900 houses, 1,000 acres of land, 2 religious buildings, 14 monasteries, 2 Bridges, 10 schools and 9 earth fill dikes from erosion.**

# *Improvement of Twante Canal Project*

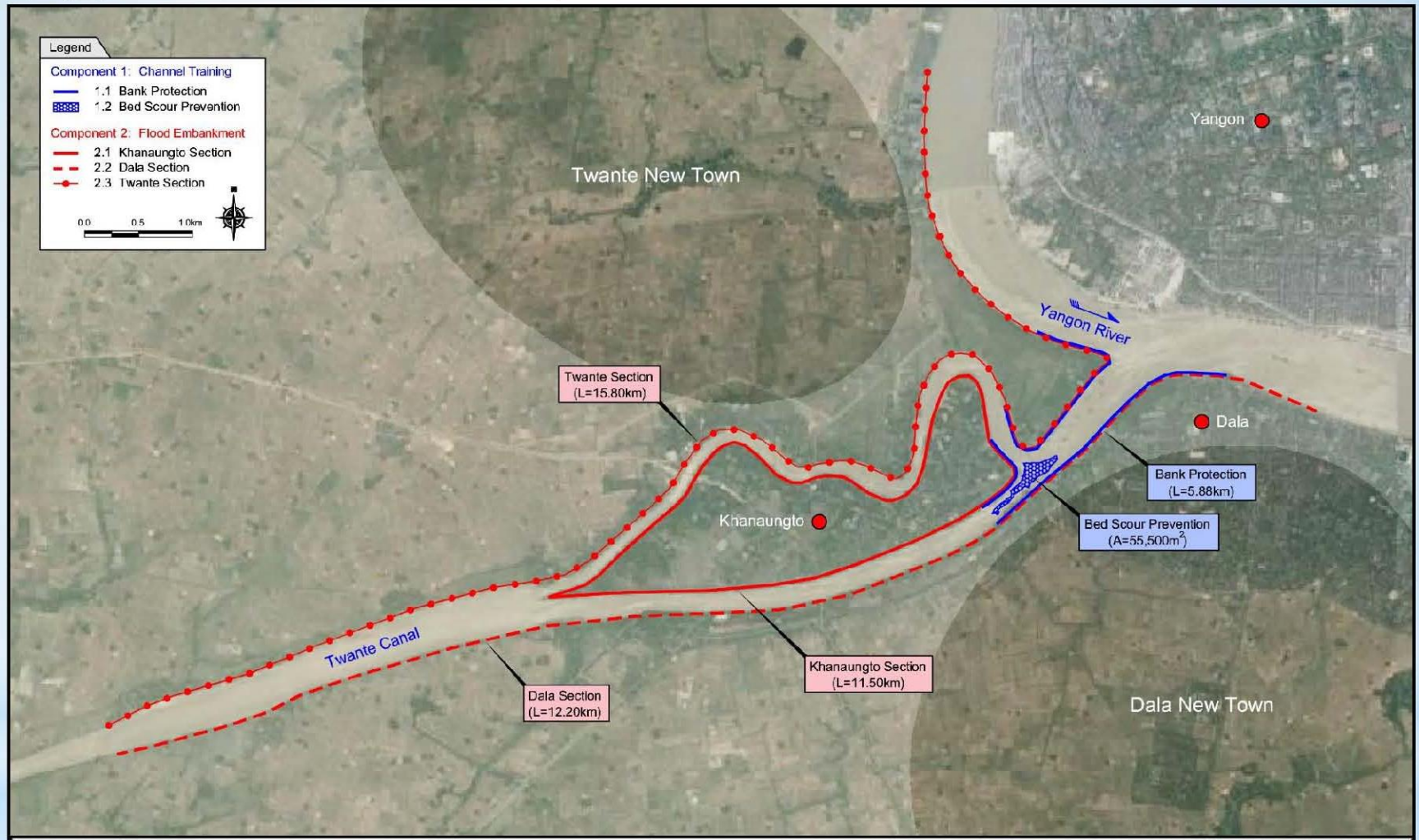
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# Project Scope (Phase 1 : Channel Training & Flood Embankment)



📌 **Channel Training:** to reduce the flow velocity at the tidal flow and to stabilize the flow field along Twante Canal

📌 **Flood Embankment:** to secure the design flood level during the largest spring tide

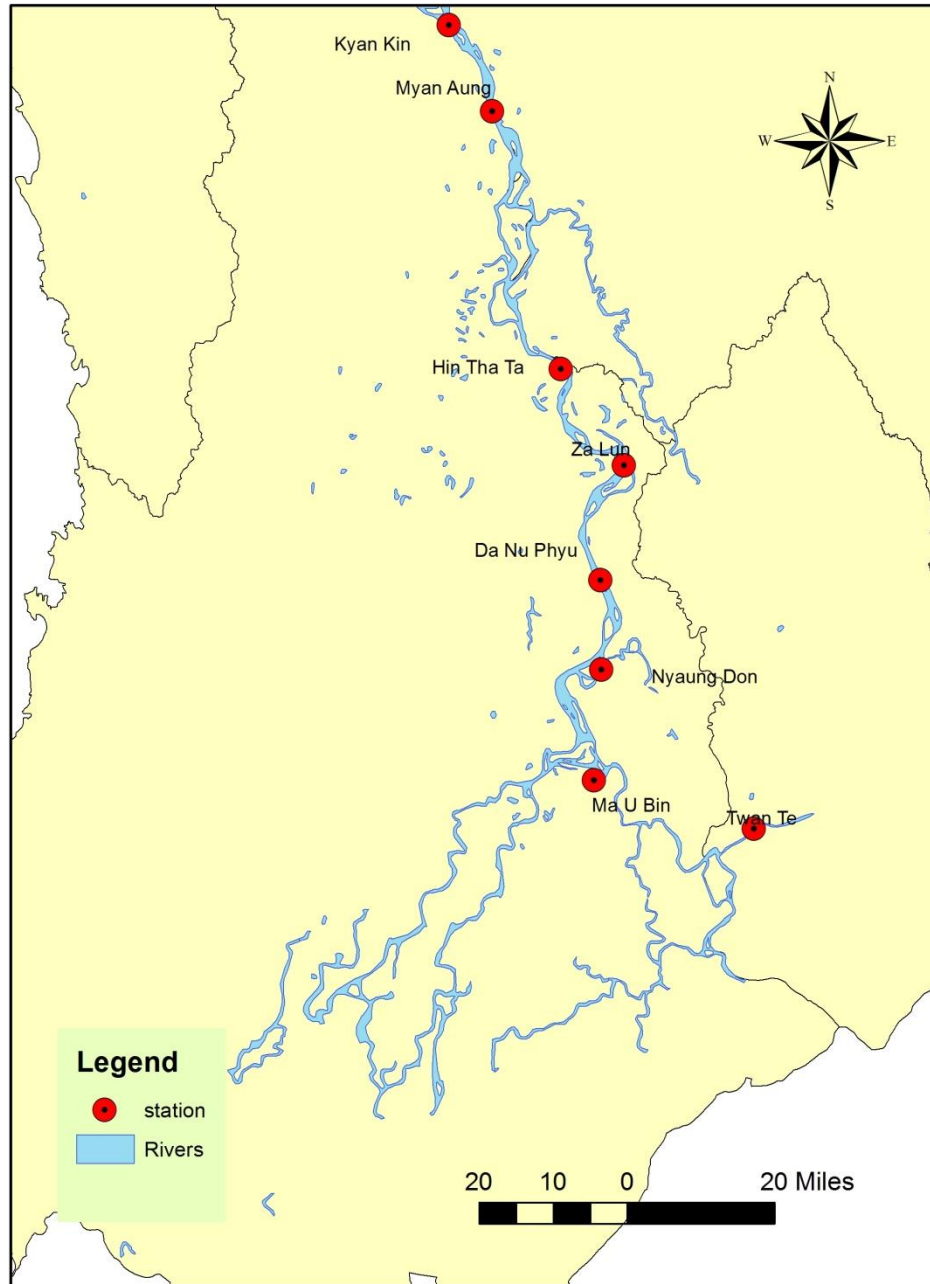


# Project Scope (Phase 2 : Multi-purpose Barrages)



✔ **Multi-purpose Barrages:** to secure constant safe ship navigation, mitigate the flood risk during the largest spring tide, and provide abundant fresh water from the upper Ayeyarwady

# Water Quality Test places in the Ayeyarwady Delta



2011 Water Quality Result Data( Delta Area)

2011-March		PH	Temp	D.O	Iron	Chloride	Chlorine	Alkalinity	Hardnes	Ammonia	Nitrate	Fluoride	Turbidity	Nitrite
			( C )	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	( NTU )	(mg/l)
Proposed National Drinking Water Quality Standard		6.5-8.5	-	5	1	250	<0.5	>20	500	1.5	50	1.5	5	3
1	Kyankhin	7.2	27.7	4.6	0.015	58	0.04	135	42	0.91	0.32	1.25	30	5
2	Myanaung	7.38	32.4	3.99	0.23	315	0.04	130	65	0.07	0.4	0.2	10	10
3	Hinthada	7.18	32	5.22	0.12	211	0.04	150	65	>1.0	0.7	1.5	25	5
4	Zalun	7.18	32.3	6.08	0.15	355	0.04	145	65	0.11	0.8	1.5	38	5
5	Aphauk	7.21	30.4	5.67	0.155	410	0.05	155	56	0.47	0.1	1.1	20	5
6	Danuphyu	7.15	31.5	5.7	0.12	260	0.18	155	60	0.96	0.8	1.35	15	5
7	Naungdone	7.25	29.9	5.71	0.165	270	0.04	160	70	0.77	0.24	1.5	22	5

Normal Range
  Below Normal Range
  Above Normal Range

2012 Water Quality Result Data( Delta Area)

2012-March		PH	Temp	D.O	Iron	Chloride	Chlorine	Alkalinity	Hardness	Ammonia	Nitrate	Fluoride	Turbidity
			( C )	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	( NTU )
Proposed National Drinking Water Quality Standard		6.5-8.5	-	5	1	250	<0.5	>20	500	1.5	50	1.5	5
1	Kyankhin	6.81	28.7	6.81	0.645	166	0.29	197	90	0.59	>1.0	0.2	140
2	Myaungaung	8.68	27.3	6.57	0.515	232	0.23	197	102	>1.0	1	1.3	145
3	Hinthada	8.23	28.8	6.75	0.59	>500	0.13	214	122	>1.0	0.9	1.2	150
4	Zalun	8.07	28.3	5.66	0.375	335	0.14	180	108	0.74	0.65	0.1	95
5	Aphauk	8.07	29.1	6.6	0.33	>500	0.05	165	47	>1.0	0.47	0.35	140
6	Zakargyi	8.16	28.9	6.4	0.15	100	0.18	145	0	>1.0	0.42	0.55	58
7	Dhanuphyu	7.91	28.4	6.83	0.365	112	0.11	170	56	0.16	0.42	1.3	25
8	Naungdone	8.89	28.4	12.99	0.95	182	0.19	208	70	0.16	1	1.4	65
9	Maubon	8.38	28.3	9.78	0.385	211	0.19	130	35	0.13	>1.0	1.1	45
10	Twantee	7.95	26.6	12.85	1.895	206	0.11	352	355	>1.0	0.43	1.1	200

Normal Range
  Below Normal Range
  Above Normal Range

2013 Water Quality Result Data( Delta Area)

2013-March		Chloride	Chlorine	Iron	Ammoniac	Hardness	Nitrate	Alkalinity	Fluoride	pH	Temp	D.O	Turbidity
		(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)		( C )	(mg/l)	(NTU)
Proposed National Drinking Water Quality Standard		250	<0.5	1	1.5	500	50	>20	1.5	6.5-8.5		5	5
1	Kyankhin	180	0.21	0.66	0.95	95	1	197	0.25	7.4	17.3	16.81	120
2	Myaungaung	500	0.13	0.95	1	110	0.12	214	1.5	7.3	27	16.7	100
3	Hinthada	500	0.52	0.9	0.45	85	0.15	145	1.5	8	26.8	6.9	55
4	Zalun	240	0.49	0.185	0.02	108	0.26	165	0.4	8	27	7.7	55
5	Dhanuphyu	120	0.14	0.31	0.23	85	0.24	160	1.5	7.8	29.6	8	20
6	Naungdone	500	0.13	0.12	0.26	115	0.35	160	1.45	8.2	28	10.33	35
7	Maubon	120	0.02	0.39	0.03	80	1	150	1.4	8.5	28.5	13.35	30
8	Twantee	200	0.12	1.92	1	300	0.42	250	1.2	27.5	27.5	16.12	120

Normal Range
  Below Normal Range
  Above Normal Range

2014 Water Quality Result Data( Delta Area)

2014-March		PH	Temp	D.O	Iron	Chloride	Chlorine	Alkalinity	Hardness	Ammonia	Nitrate	Fluoride	Turbidity
			( C )	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	( NTU )
Proposed National Drinking Water Quality Standard		6.5-8.5		5	1	250	<0.5	>20	500	1.5	50	1.5	5
1	Kyankhin	5.8	-	-	0.805	380	0.14	202	115	0.1	0.33	1.55	95
2	Myaungaung	6.5	-	-	0.165	94	0	135	95	0.07	0.37	0.05	58
3	Hinthada	4.4	-	-	0.685	205	0.19	150	108	0	0.26	1.2	70
4	Zalun	5.9	-	-	0.025	410	0.74	120	95	0.01	0.37	1.55	13
5	Dhanuphyu	6.2	-	-	0.02	285	0.18	135	80	0	0.23	1.06	13
6	Naungdone	8.4	-	-	0.025	335	0.05	160	130	0	0	1.4	35
7	Maubon	8.9	-	-	0.35	150	0.12	150	100	0.05	0.35	1.3	70
8	Twantee	8.5	-	-	1.85	230	0.16	250	370	1.8	0.45	1.5	170

Normal Range
  Below Normal Range
  Above Normal Range

2015 Water Quality Result Data( Delta Area)

2015-March		Chloride	Iron	Ammonia	Hardness	Nitrate	Alkalinity	Fluoride	pH	Temp	D.O	Turbidity
		(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)		( C)	(mg/l)	(NTU)
Proposed National Drinking Water Quality Standard		250	1	1.5	500	50	>20	1.5	6.5-8.5		5	5
1	Kyankhinn	180	0.66	0.95	95	1	197	0.25	7.4	17.3	16.81	120
2	Myaungaung	500	0.95	1	110	0.12	214	1.5	7.3	27	16.7	100
3	Hinnthata	500	0.9	0.45	85	0.15	145	1.5	8	26.8	6.9	55
4	Zalun	240	0.185	0.02	108	0.26	165	0.4	8	27	7.7	55
5	Danuphyu	120	0.31	0.23	85	0.24	160	1.5	7.8	29.6	8	20
6	Naungdone	500	0.12	0.26	115	0.35	160	1.45	8.2	28	10.33	35
7	MaUbin	120	0.39	0.03	80	1	150	1.4	8.5	28.5	13.35	30
8	Twante	200	1.92	1	300	0.42	250	1.2	7.5	27.5	16.12	120

 Normal Range     
  Below Normal Range     
  Above Normal Range



**THANK YOU**

