World Water Day Presentation

The Final Workshop of ASEAN-ROK Cooperation Project on

"Building Resilience for Sustainable ASEAN (from Water Related Disasters)"

National Assessment Report on Water Related Disaster in Myanmar

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Abstract

In this assessment report based on Last 10-20 years conditions of water related disaster in Myanmar. In the past how Myanmar faced severe disasters and their impact beside whatever Myanmar response activities.

Actually last before 10 years, we have weakness in all sectors such as Technical know-how, instrumentals or materials supplying, less of Financial supports, non-readiness of communities knowledge sectors.

Current status of water related disaster risk reduction activities with Local government agencies and Regional Organizations in the Technical and Financial (ODA and Loan) cooperation are describe in the report.

Meteorological ,Hydrological and Geological Hazards some historical events and records are shown in the report with case study , field assessments and inter views.

Some extreme weather event and abnormal Tropical Monsoon feature have been occurred under influence of Climate Change.

Some initial step of water security and first phase activity are also summited. The important points out in this report, Myanmar whatever they needs to do in future agenda to Mitigate and Adapt to Water Related Disasters. Another points are proposals for regional cooperation of Myanmar.

Contents

1.Background

Country Profile

Provide a brief background on the Country - its location, size, population size and distribution, the economy (GDP, growth, per capita statistics), impact of water-related disasters on the economy, major cities, population centers, deltas, etc

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- Southeast Asia country
- Sharing border with China, Thailand, Laos, Bangladesh and India
- Andaman Sea and Bay of Bengal
- Area - 677,000 square km
- International boundary - 6151 km
- Coastal line – 2229 km
- Population – 59.37 m
- Population growth rate – 1.29%
- Estimated Older Population (above 60) is 5.46 Million (9.1%)
- Older Person ratio -1:11

1.2.Myanmar Economy Data

	2011	2012	2013	2014	2015
Population (million)	50.1	50.5	51.0	51.4	51.8
GDP per capita (USD)	1,118	1,100	1,112	1,228	-
GDP (USD bn)	56.0	55.6	56.7	63.1	-
Economic Growth (GDP, annual variation in %)	5.6	7.3	8.4	8.5	-

	2011	2012	2013	2014	2015
Unemployment Rate	3.4	3.3	3.3	3.3	-
Fiscal Balance (% of GDP)	-4.6	-1.7	-1.8	-2.9	-
Public Debt (% of GDP)	49.3	43.1	34.8	31.6	-
Inflation Rate (CPI, annual variation in %)	2.8	2.8	5.7	5.9	-
Policy Interest Rate (%)	12.00	10.00	10.00	10.00	10.00
Exchange Rate (vs USD)	5.56	851.7	983.8	1,031	1,301

	2011	2012	2013	2014	2015
Exchange Rate (vs USD, aop)	5.44	640.7	933.6	984.4	1,163
Current Account (% of GDP)	-1.9	-4.2	-5.2	-6.1	-
Current Account Balance (USD bn)	-1.1	-2.3	-3.0	-3.9	-
Trade Balance (USD billion)	0.2	-0.3	-0.8	-5.2	-
Exports (USD billion)	9.2	8.9	11.2	11.0	-
Imports (USD billion)	9.0	9.2	12.0	16.2	-

	2011	2012	2013	2014	2015
Exports (annual variation in %)	6.7	-3.9	26.5	-1.8	-
Imports (annual variation in %)	89.5	1.4	31.6	34.8	-
International Reserves (USD)	7.0	7.0	4.5	4.8	-
External Debt (% of GDP)	14.6	14.1	12.8	10.1	-

Myanmar GDP 1998-2017

- The Gross Domestic Product (GDP) in Myanmar was worth 64.87 billion US dollars in 2015.
- The GDP value of Myanmar represents 0.10 percent of the world economy.
- GDP in Myanmar averaged 29.49 USD Billion from 1998 until 2015, reaching an all time high of 74.69 USD Billion in 2012 and a record low of 6.46 USD Billion in 1998.

2. Climatic and Physical Characteristic of the Country

- Myanmar's climate conditions are defined as summer, rainy and winter season.
- Two third of Myanmar falls within the tropics and the remaining one third enjoys temperate climate conditions.
- Coastal regions receiving over 5000 mm and while average annual rainfall in the Dry Zone which is located in Central Myanmar is less than 750mm.

•Northern regions of the country are the coolest, with average temperatures of 21°C and mean temperatures of 32°C in the coastal area.

•During the hot seasons, temperature sometimes reach to 40°C and over in central dry zone areas.

- Like other ASEAN countries, Myanmar also suffers from climate change impacts on water cycle by sudden change of weather pattern such as flood and long drought and thus sustainability of water environment in some areas are facing difficulties.
- Due to the climate change impacts rainfall pattern and rainfall intensity are significantly changed occasionally in some parts of the country depending on the topographical condition.

3.Hydrology and Meteorology

Natural and man-made flood disasters present dangers to humans and to their property.

They present risks, which can be high especially if they are ignored or proper precautions are not taken.

The most common natural disasters that are experienced in Myanmar are tropical cyclone associated with surge, flood and drought.

Flood is an event resulting due to the conditions such as abnormally heavy precipitation, rapid snow melts, coastal storm surges, failure of dams and other control works.

- It is characterized by quick inception, vigorous growth and evident spread terminating eventually with disastrous impacts.
- Floods of all kinds cause a considerable loss of human life and great property damage.
- Floods become disasters mostly when human settlements occupy the flood plain.
- The floods in Myanmar, mainly occur during the monsoon months (June to October) .
- The type of floods occur in Myanmar may be generally classified into two; the wide spread flood and flash flood.
- The wide spread flood mostly occur along Ayeyarwady, Chindwin, Sittaung and Thanlwin rivers which are major rivers and the flash flood usually occur at the small rivers and stream.
- The main cause of wide spread flood is heavy rainfall striking at the head water regime for considerable period (1 to 3 days), the flood wave forming at the head water started to move downward and causing flood along the river up to the deltaic area.

- The flash flood is caused by heavy rainfall fell on the source and the flood wave move downward swiftly.
- Observation shows that the percentage of occurrence of floods (exceeding danger level) in medium and large rivers of Myanmar are 6% in June, 23% in July, 49% in August, 14% in September and 8% in October.
- The severe floods had occurred in 2004, 1974, 1997, 1976, 1991,1973,1988 and 1997, and order of the years are arranged with respect to their intensities.
- On May 2, 2008, tropical cyclone Nargis made landfall in Myanmar causing the worst natural disaster in the country's recorded history – with a death toll that may have exceeded 138,000.
- A Category 4 storm, Nargis was the eighth deadliest cyclone recorded worldwide. It is one of seven tropical cyclones generated in the Bay of Bengal that had death tolls in excess of 100,000.
- With damage estimated at more than $10 billion, the storm is the most destructive ever recorded in the Indian Ocean.

Historical Records of Cyclones activities in the Bay of Bengal.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL No.
1981					1	1		2	3		3	1	11
1982					2	2		1	2	2	1		10
1983						1			1	2	5	1	10
1984							1		1	1	2	1	6
1985					1				1	2	1	1	6
1986					1			1	1	1	1		5
1987	1				1	1		2		1	1	1	8
1988					1					2	2	1	6
1989					1	1	1			1	2		6
1990								2		2	1	1	6
1991				1			1	1		2	1		6
1992					1					2	3		6
1993					2	1			2			1	6
1994			1	1	1					2			5
1995					1				1		2		4
1996						1				2	3	1	7

1997								2	1	1	1		5
1998										2	1		3
1999					1	2		1		2			6
2000			1		1	1		1		1	1	1	7
2001									1	1	1		3
2002					1					1	2	1	5
2003					1	1				2	1	1	6
2004					1	2			1	2	1		7
2005	1					1	1		2	1	2	2	10
2006	1			1			1	4	3	1		1	12
2007					2	2	1		1	1	1		8
2008				1				1	1	1	2	1	7
2009				1	1		1		1			1	5
2010					1					3	1	1	6
2011		1				1			1	1		1	5
2012										1	2		3
2013										1	2		3
2014	1				1		1	1		1	1		6
2015							1	1			1		3
												Normal	6.2

Total	4	1	2	5	23	18	9	20	24	45	48	19	436

May Oct Nov

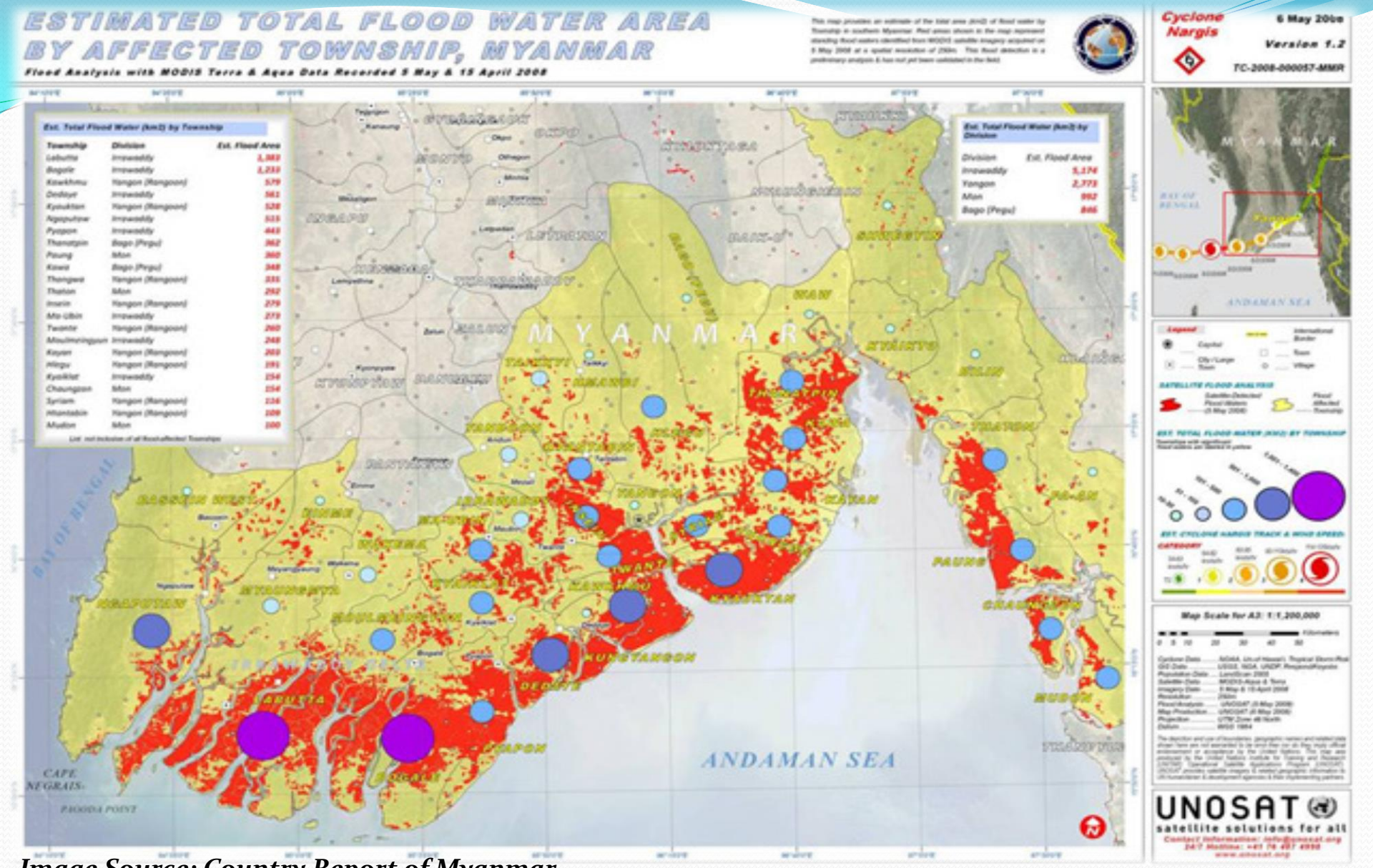


Image Source: Country Report of Myanmar

Fig.3 Flood water Area Map caused by Tropical Cyclone Nagis.

Overview

- No. of events: 27
- No. of people killed: 139,208(+ 43800 losses)
- Average killed per year: 4,491
- No. of people affected: 3,892,069
- Average affected per year: 125,551
- Ecomomic Damage (US$ X 1,000): 4,645,643
- Ecomomic Damage per year (US$ X 1,000): 149,859

Lead Time for Ayeyarwady River

Stations	Lead Time
Myitkyina to Bhamo	1 day and 12 hrs
Bhamo to Katha	1 day and 12 hr
Katha to Mandalay/Sagaing	3 days and 12 hrs
Mandalay/Sagaing to Nyaung Oo	1 day and 18 hrs
Nyaung to Chauk	1 day
Chauk to Minbu/Magway	1 day
Minbu/Magway to Aunglan	1 day
Aunglan to Pyay	1 day
Pyay to Hinthada	1 day

If the water level rose at upstream of Ayeyarwady river (Myitkyina), its can reach at Hinthada and Zalun next 12 to 15 days

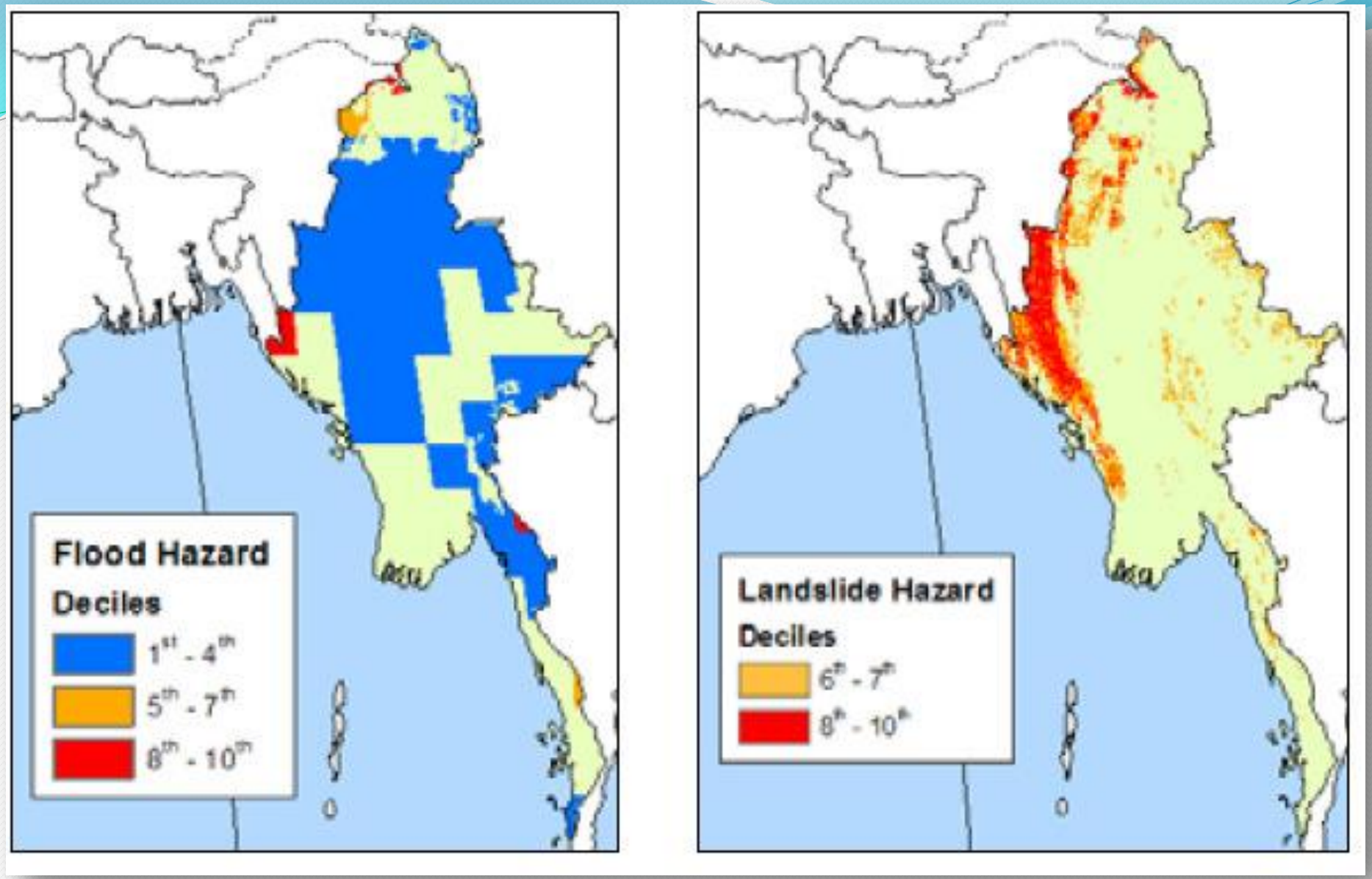
Highest Water Level aand Height of above Danger Level (DL)at each Towns at all rivers in Myanmr during 2016 Monsoon period.

River/ Station	Danger Level (cm)	highest Level	Date of Highest level	Duration Above DL	Starting Date and time at DL	Ending Date and time at DL	Height of above DL(cm)	Record of floods
Ayarwady River								
Myit Kyi Nar	1200	1011	25/7/16(06:30)				-189	
Bamaw	1150	1153	27/7/16(06:30)	22 hrs	27/7/16(06:30)	28/7/16(04:30)	+3	
Shwe Ku	930	992	27/7/16(10:30)	4 days 22 hrs	25/7/16(07:30)	30/7/16(05:30)	+62	
Katha	1040	1059	28/7/16(11:30)	3 days 1 hrs	27/7/16(05:30)	30/7/16(06:30)	+19	
Thabaik Kyin	1480	1534	30/7/16(17:30)	4 days 18 hrs	28/7/16(11:30)	2/8/16(05:30)	+54	
Mandalay	1260	1325	1/8/16(06:30)	7 days 10 hrs	28/7/16(18:30)	5/8/16(04:30)	+65	72-16 Third
Sagaing	1150	1218	1/8/16(06:30)	7 days 21 hrs	28/7/16(14:30)	5/8/16(12:30)	+68	
Myin Mu	1150	1198	2/8/16(06:30)	8 days 9 hrs	28/7/16(18:30)	6/8/16(04:30)	+48	
Pa Khok Ku	2150	2246	3/8/16(17:30)	10 days	29/7/16(02:30)	8/8/16(02:30)	+96	96-16 Second
Nyoung Oo	2120	2134	16/7/16(16:30)	2 days 20 hrs	15/7/16(08:30)	18/7/16(04:30)	+14	
		2292	3/8/2016(05:30)	14 days 18 hrs	25/7/16(14:30)	9/8/16(08:30)	+172	66-16 Highest
Chauk	1450	1509	4/8/16(09:30)	5 days 7 hrs	2/8/16(18:30)	8/8/16(01:30)	+59	73-16 Second
Minbu	1700	1833	5/8/16(17:30)	8 days 20 hrs	31/7/16(19:30)	9/8/16(15:30)	+133	
Magway	1700	1816	5/8/16(17:30)	8 days 3 hrs	1/8/16(06:30)	9/8/16(09:30)	+116	
Aung Lan	2550	2632	5/8/16(17:30)	7 days 18 hrs	1/8/16(06:30)	9/8/16(10:30)	+82	
Pyay	2900	2974	6/8/16(06:30)	7 days 22 hrs	1/8/16(21:30)	9/8/16(19:30)	+74	
Seik Thar	1200	1261	5/8/16(17:30)	10 days 2 hrs	2/8/16(06:30)	10/8/16(08:30)	+61	
Hintha Da	1342	1458	7/8/16(15:30)	27 days 2 hrs	18/7/16(06:30)	14/8/16(08:30)	+116	67-16 Third
Zalon	1160	1277	7/8/16(15:30)	15 days 20 hrs	29/7/16(14:30)	14/8/16(10:30)	+117	85-16 Highest
KhamTi	1360	1417		3 days 1 hrs	5/7/16(11:30)	8/7/16(12:30)	+57	
		1545	26/7/16(05:30)	7 days 6 hrs	23/7/16(05:30)	30/7/16(12:30)	+185	
Homemalin	2900	2963		7 days 19 hrs	5/7/16(09:30)	13/7/16(04:30)	+63	
		3029	27/7/16(17:30)	15 days 20 hrs	17/7/16(09:30)	2/8/16(05:30)	+129	
Paung Pyin	1325	1395		7 days 23 hrs	7/7/16(05:30)	15/7/16(04:30)	+70	
		1451	28/7/16(11:30)	16 days 23 hrs	18/7/16(05:30)	4/8/16(04:30)	+126	
Maw Like	1230	1357		7 days 23 hrs	8/7/16(05:30)	16/7/16(04:30)	+127	
		1449	29/7/16(18:30)	17 days 10 hrs	18/7/16(16:30)	5/8/16(04:30)	+219	
Kalewa	1550	1620		5 days 22 hrs	9/7/16(06:30)	15/7/16(04:30)	+70	
		1729	31/7/16(11:30)	8 days 11 hrs	23/7/16(06:30)	5/8/16(17:30)	+179	
Min Kin	1350	1421		5 days 10 hrs	9/7/16(05:30)	15/7/16(15:30)	+71	
		1512	2/8/16(11:30)	14 days 12 hrs	22/7/16(06:30)	6/8/16(04:30)	+162	
Kani	1130	1228		4 days 11 hrs	9/7/16(05:30)	15/7/16(15:30)	+98	
		1305	3/8/16(05:30)	15 days 4 hrs	21/7/16(05:30)	6/8/16(20:30)	+175	
Monywa	1000	1019		4 days 5 hrs	11/7/16(11:30)	15/7/16(16:30)	+19	
		1064	3/8/16(09:30)	11 days 3 hrs	26/7/16(12:30)	6/8/16(15:30)	+64	
Dote Hta Wady River								
Thipaw	600	374	21/8/16(06:30)	under			-226	
Shwe Sar Yan	1050	941	22/8/16(17:30)	under			-109	
Myit Nge	870	943	2/8/16(06:30)	8 days 2 hrs	28/7/16(19:30)	5/8/16(22:30)	+73	
Sittaung								
Taung Ngu	600	554	6/10/2016(11:30)	under			-46	
Ma Dauk	1070	1044	18/8/16(18:30)	under			-26	
Shwe Kyin River								
Shwekyin	700	569	18/8/16(18:30)	Under			-131	
Thanlwin River								
Pha An	750	745	24/8/16(10:30)	Under			-5	
Bago River								
Zaung Tu	900	595	11/6/16(08:30)	Under			-305	
Bago	880	862	12/6/16(16:30)	Under			-18	
Ngawon River								
Nga Thaing Chaung	1130	1236	8/8/16(18:30)	37 days 12 hrs	12/7/16(10:30)	19/8/16(01:30)	+106	
Pathein	350	401	16/8/16(13:30)	17 days 13 hrs	4/8/16(18:30)	22/8/16(07:30)	+51	2005-2016 Highest
Toe River								
Maubin	720	786	9/8/16(12:30)	13 days 12 hrs	31/7/16(18:30)	14/8/16(06:30)	+66	
Kalatan(Kissapa Nady)River								
Paletwa	1600	1045	6/7/16(06:30)	Under			-555	
Kyaut Taw	550	551	5/7/16(18:30)	12 hrs	5/7/16(18:30)	6/7/16(06:30)	+1	
Lay Myo River								
Myrauk Oo	980	888	1/8/16(12:30)	Under			-92	

2015-16 Flood records in Myanmar.

4. Water related Hazards and Disasters

- In general, the catchment areas of major rivers in the north and central zone are prone to riverine floods.
- The Southern Delta faces riverine floods when there is flood tide and high river water flow at the same period.
- In these areas, the lands are protected from floods by eastern dykes, but there are times when flood overpower the dykes and cause losses of lives and properties.
- The mountainous and hilly Kayin, Kachin, Shan, Mon and Chin States areas are threatened by flash floods.
- In Kachin State, at the confluences of the Ayeyarwady River,the snow in the higher altitude melt and flash floods occur quite frequently at the beginning of summer.
- Along the coastal region in Rakhine State, floods are secondary hazard generated by cyclones.
- Furthermore, the Ayeyarwady River basin and the catchment occupy 60% of the country area traversing Chin, Kachin, Shan States and Mandalay, Magwe, Bago,Yangon and Ayeyarwady Divisions.
- Floods, in consequence, can occur over a wide range of region.



Source: Hazard Profile of Myanmar

Fig.4 Flood risk area and Landslide risk area

4.1. Landslides in Myanmar

- Myanmar has experienced many types of geologic hazards including earthquakes, landslides and subsidence in karst area.
- Among these, earthquakes and landslides are major hazards affecting the country.
- Geographically, Myanmar has two mountainous provinces: namely the Western Ranges and the Eastern Highland.
- These provinces are inherently unstable regions of the country.

4.2. Frequency and Impact

Various sizes of landslides had frequently occurred in mountainous regions of Myanmar especially in the Western Ranges and some localities in the Eastern Highland, especially along the western flank of the Tanintharyi Ranges.

The collapses of river bank are found along the Ayeyarwady River and its distributaries.

The western Ranges has experienced many types of landslides and earth, movement, i.e. rock falls, rock slides, soil avalanche and mud flows of various scales due to the wedge failure, plane failure, toppling, and circular failure.

4.3. Landslide Prone Areas in Myanmar

- Tectonically and geomorphologically, the physiographic unit of Myanmar can be divided into three provinces: the Western Fold Belt (WFB), the Central Lowland (CL), and the Eastern Highland (EH).
- Structurally and lithologically, potential landslide hazards can be found in parts of Eastern Highland and Western Fold Belt.
- One of the major rivers of Myanmar, River Ayeyarwady flows from north to south in the Central Lowland.
- Because of erosion and flooding of this river, landslide hazards occur along the bank of this river and its distributaries.

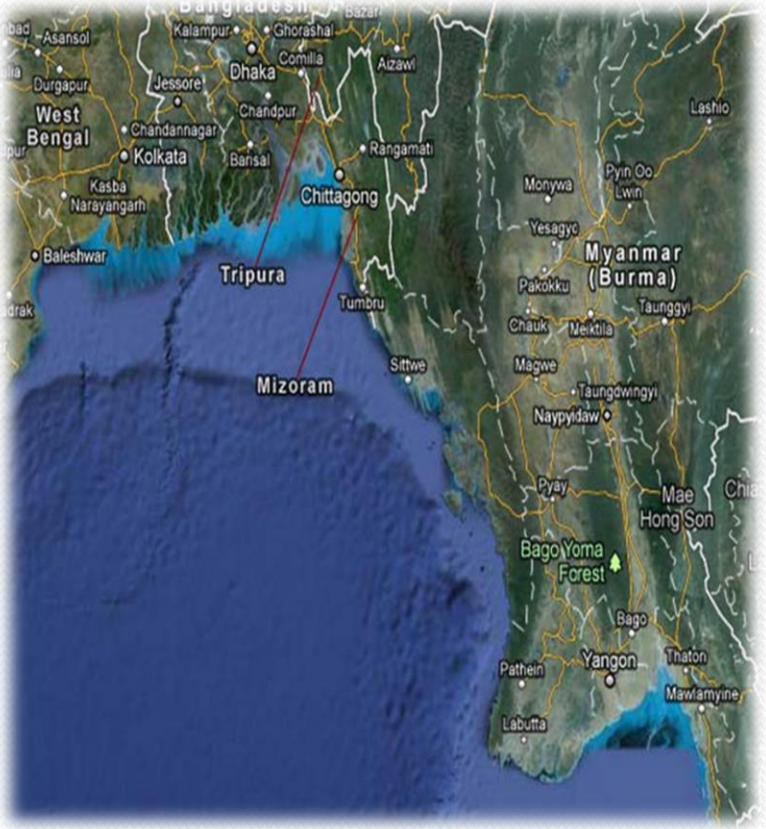
Source: Hazard Profile of Myanmar

Fig.5 Location of Past Landslide, Myanmar

4.4. Storm Surge

Powerful storm winds push water up onto the shoreline. This event are most frequently occurs when a severe cyclonic storm makes landfall. Severe cyclonic storms are especially effective at producing a storm surge for these reasons:-

1. **Severe cyclonic storms have very powerful sustained winds that can reach over 100 miles per hour.**
2. **Severe cyclonic storms are low pressure storms and that low pressure causes a rise in sea level beneath the storm.**
3. **dump a lot of rain**
4. **strong winds of the storm can generate large waves on top of the combined high tide and storm surge elevations.**


Asansol
Durgapur
Kalampur
Ghorashal
Dhaka
Comilla
Aizawl
Jessore
Chandpur
West Bengal
Chandannagar
Kolkata
Barisal
Rangamati
Kasba
Narayangarh
Chittagong
Lashio
Monywa
Pyin Oo Lwin
Yesagyo
Myanmar (Burma)
Baleshwar
Tripura
Tumbru
Pakokku
Taunggyi
Chauk
Meiktila
Sittwe
Magwe
Mizoram
Taungdwingyi
Naypyidaw
Pyay
Mae Hong Son
Bago Yoma Forest
Bago
Pathein
Yangon
Thaton
Mawlamyine
Labutta

- *Notable storm surges, which have affected Myanmar, have been during May 1967, 1968, 1970, 1975, 1982, 1992, 1994, 2008 and 2010; of which the 1982 (Gwa), 1994 (Maungdaw)2006(Malar), 2008 (Nargis) 2010 (Giri) and 2015(Komen) caused the heaviest loss of lives and damage.*

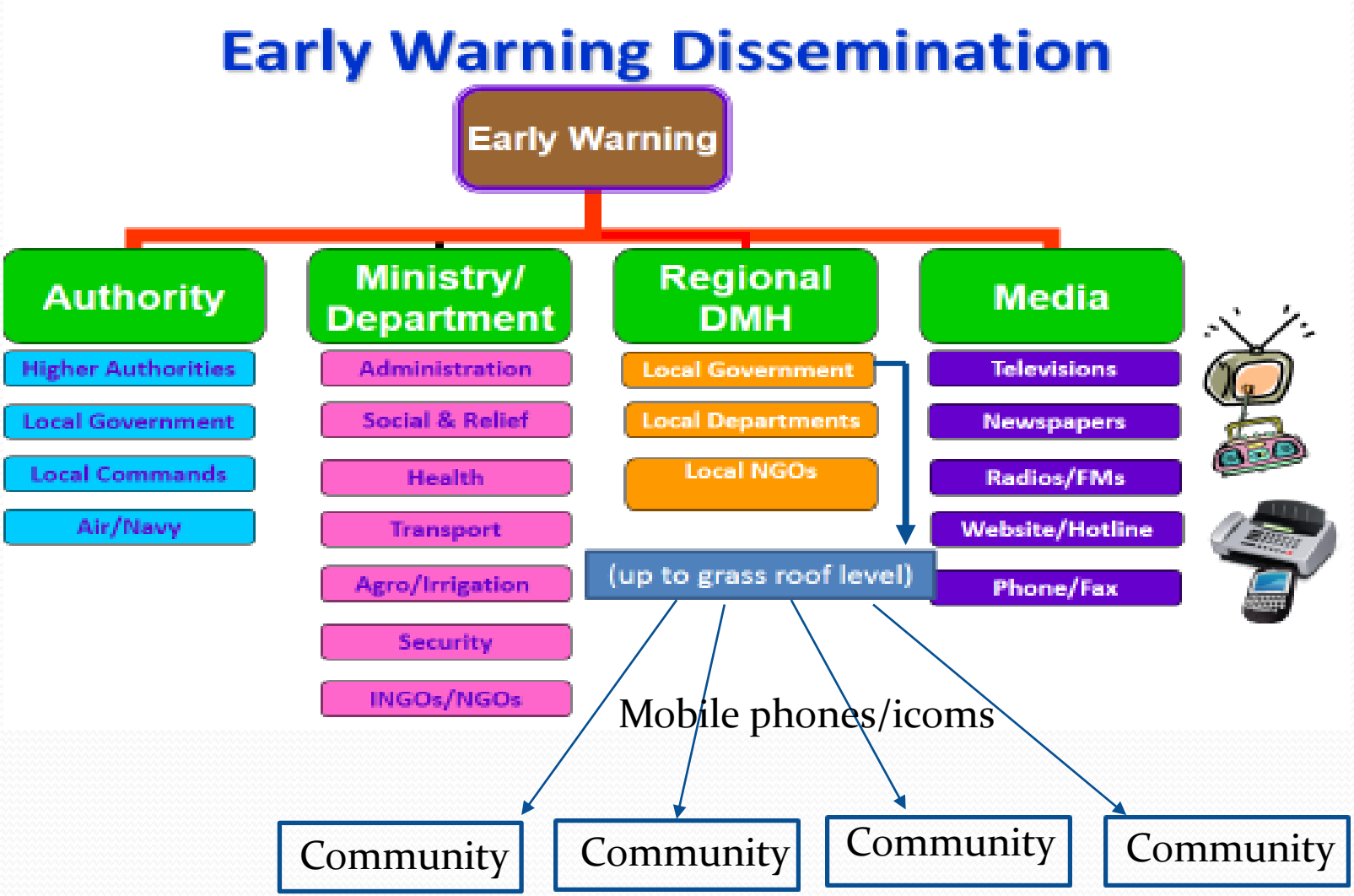
5. Legal and Institutional Setup in the Country.

5.1. Department of Meteorology and Hydrology (DMH)

- The Department of Meteorology and Hydrology (DMH) of Myanmar is under the administration of the Ministry of Transport and Communication.
- The objectives of the DMH are to take precautionary measures against and minimize the effects of natural disasters, to promote safety, comfort, efficiency and regularity of air, land (rail & road),sea and inland water transportation, to bring sustainable development of natural resources (hydro-electric power, forest produce, water ultilization, wind energy, etc.), to promote agricultural and food production, to ensure efficient operation, planning and development of activities in natural defense, industry, health, social welfare and all sectors of national economy and to undertake international collaboration for all development activities and works of the DMH.

- The Department of Meteorology and Hydrology (DMH) of Myanmar has an Organizational Structure, headed by the Director General and followed by the Deputy Director General.
- The major divisions under the Department of Meteorology and Hydrology of Myanmar and organization structure are as follows:
  - Meteorological Division
  - Hydrological Division
  - Aviation Meteorological Division
  - Agro-meteorological Division
  - Instrument and Communication Division
  - Seismological Division
  - Administration, Budget and Account Division
  - States and Regional offices

EWS Flow Chart

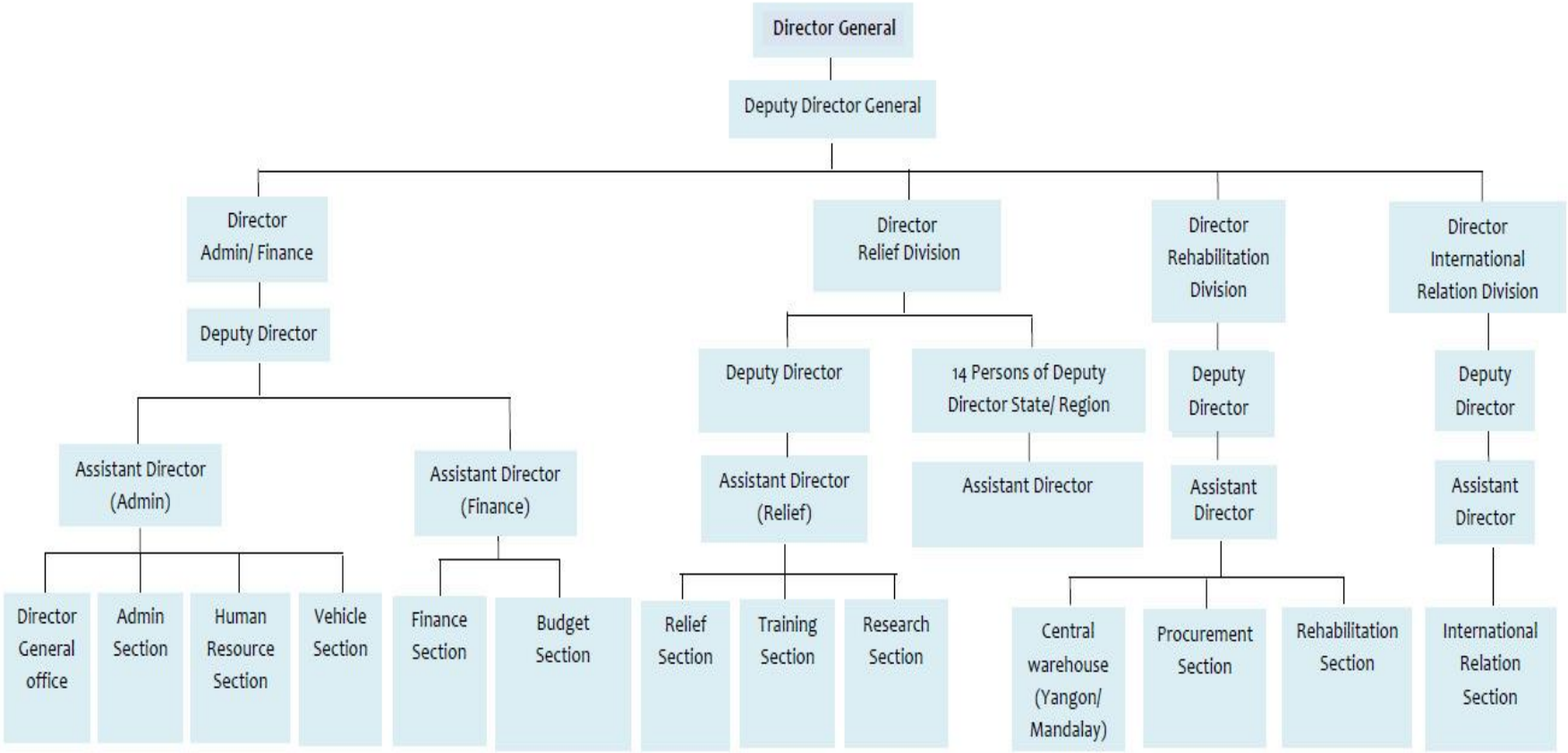


5.2. Relief and Resettlement of Department (RRD)

- The Relief and Resettlement Department (RRD) was established with the objectives to provide relief for victims of natural disasters to ease their sufferings and take precautionary steps as to minimize loss of lives and property of the victims of natural disasters.
- It is part of the Myanmar Ministry of Social Welfare, Relief and Resettlement.

- RRD has a responsibility for certain objectives as follows;
  - To offer self-learning opportunities to respective authorities and local communities who have not participated in regular Disaster Management Courses (DMCs).
  - To strengthen the close connectivity amongst the DRR practitioners and institutions locally, regionally and globally.
  - To accelerate the collaboration on Disaster Risk Management in ASEAN as the member state.
  - To give the disaster information of the country in time and to publicize the Relief and Rehabilitation activities in a transparent way.

- RRD's organization structure is shown as follow;



Source: Web site of RRD

- In case of natural disaster occurs, the national level of subcommittee for national disaster preparedness relief and resettlement will be organized for countermeasures, and at the same time, district and town level of subcommittee for national disaster preparedness relief and resettlement and other stake holders will be also set up for management and disaster mitigation activities.

5.3. Other Organization Structure and Hazard Control

- **On the other hand, in line with the guidelines of the State Peace and Development Council, a Hazard Control Committee has been set up within the flash flood management program.**
- **The main duties and responsibilities of the Hazard Control Committee are listed below.**
- **To draw up long-term and short-term plans for prevention, relief and resettlement based on the following:**
- **Construction as a preventive measure; and**
- **Public education for prevention, relief and resettlement.**

a) To prevent loss of life and to minimize damage to state own property, cooperative property, the property of the people and to agricultural livestock by drawing and implementing long-term and short-term plans.

b) To arrange a contingency plan for speedy relief, resettlement and rehabilitation before and after the flood.

c) To disseminate timely warnings and forecasting throughout flash flood prone area.

d) Education about flash flood hazard control and the ‘dos’ and ‘don'ts’ is taught to students at school according to their age by the Ministry of Education. Articles about flash flood prevention, preparedness lectures and plays are published and telecast through the public media.

e) To provide a safe water supply and appropriate sanitation for public health.

f) To maintain river training aspects on dams, weirs, reservoirs and dykes, etc.

g) To ensure that security measures for flash flood victims and responders are made by the authority concerned.

h) To ensure that security measures for flash flood victims and responders are made by the authority concerned.

- The Ministries under the Government of the Union of Myanmar must implement their main duties and, at the same time, do sector-wise work on flash flood control in coordination with the committee as follows:
  a) Ministry of Defense: military assets are used for flash flood prevention, relief and rehabilitation and security measure.
  b) Ministry of Social Welfare, Relief and Resettlement: public education, relief, resettlement and livelihood supplies.
  c) Ministry of Communication, Post and Telegraph: communication services (Now under Ministry of Transport and communication).
  d) Ministry of Transport(Now so called Ministry of Transport and communication): weather forecasting, issue of warnings for flash flood transport service, maintenance of water ways of rivers and creeks .
  e) Ministry of Construction: urban development, durability of buildings, roads and bridges
  f) Ministry of Health: health care activities
  g) City Development Committee (Yangon, Mandalay): urban development and hazard reduction
  h) Ministry of Progress of Border Areas and National Races and Development Affairs: urban, rural development affairs all over the country.
  i) Ministry of Information: public education, release of warnings through media

j) Ministry of Home Affairs: preventative measure against flash flood hazards in various regions, relief and resettlement activities and security measures

k) Ministry of Agriculture: the construction and maintenance of dams and dykes before, during and after flash floods.

- Voluntary organizations such as, the Myanmar Red Cross Society, Myanmar Maternal and Child Welfare Association, Union Solidity and Development Association and Voluntary Fire Brigade also participate in flash flood preparedness and relief measures and organization-wise cooperation with ministries and committees.

5.3.1. Community Awareness and Preparedness

- In compliance with the State Peace and Development Council, the awareness and preparedness framework was established with nine components that include vulnerability assessment; planning; institutional framework; information systems; response mechanisms; public education and training and rehearsals.

- The Ministry of Social Welfare, Relief and Resettlement, Myanmar Red Cross Society and the respective state/division, district and township are especially involved.
- The Peace and Development Council responds to the flood prone area by dispatching teams of experienced staff to organize emergency relief distribution and to conduct damage and needs assessments in the main affected areas with the active involvement of local authorities and volunteers.
- In addition, the International Hydrological Program (IHP) was established in 2002 to carry out projects concerning hydrological sequences. The IHP has been implemented by the DMH as a focal point for the entire nation.

5.3.2. Indigenous Knowledge

- The loss of human life and property from flash flood events is due to ignorance and lack of knowledge.
- Flash floods are usually caused by unexpected local weather conditions.
- The return period for this kind of flood is between 10 to 50 years.
- Therefore, indigenous knowledge of flash floods should be distributed through the people.
- Indigenous knowledge is an essential part of any flash flood preparedness plan to educate those who may be threatened by flash floods. Such education may take the following forms:

a) Public Education in Schools: A standardized curricula for children and young adults including information about the actions that should be taken in case of a flash flood threat.
b) Special Training Courses: Workshops should be designed for an adult population, either specifically, or as an extra dimension to on-going programs, such as literacy or cooperative training sites.
c) Extension programs: Community or village-based outreach workers should be trained to provide relevant information.
d) Public information: The Relief and Resettlement Department must coordinate with all disaster related organizations and NGOs in planning flash flood preparedness exercises.
e) INGOs partnerships

5.4 Necessity of the Weather Surveillance and Disaster Risk Reduction System

- Especially disasters have over the years been a major concern in which Myanmar is no exception.
- These increasing natural calamities imposing threats, sufferings and has lost of lives to humanity, and negative social economic and environmental consequences are critical elements to the achievement of sustainable development of Myanmar.

5.5.1. Rainfall Observation System

- The rainfall observation system will be a real time monitoring system of the rainfall intensity continuously.
- The rainfall observation system will be considered that consists of a rainfall and water level telemetry system monitoring the rainfall intensity on the surface of ground and the radar rain gauge system covering Homalin area and *X-band radar rain gauge system monitoring upper air rainfall intensity in real time for detecting possibility of flood and/or landslide in disaster prone area.*

5.5.2. X-band Radar Rain Gauge System

- Usually, the X-band radar rain gauge system is a dual polarization type of radar used to locate precipitation, calculate its motion, estimate its type (rain, snow, hail, etc.).
- Modern radars are mostly pulse-Doppler radars, capable of detecting the motion of rain droplets in addition to the intensity of the precipitation.
- Both types of data can be analyzed to determine the structure of storms and their potential to cause severe weather.

6.Water Security

Water Security in Myanmar

Image: boat-Inle-lake-shan-state-myanmar-traditional. 20 Jun 2016

- Starting on May 24th, a three-day meeting for the High Level Roundtable on Water Security took place in Yangon, Myanmar.
- The talks — which received wide support from various UN agencies, regional development partners, and leaders within civil society — supplemented initiatives put forth by the Global Water Partnership (GWP), a worldwide intergovernmental network focused on creating a water-secure world built on responsible water management and sustainable government practices.
- The United Nations has emphasized the issue of water security as crucial in ameliorating high poverty levels, overturning systemic violence, addressing human rights inequities, mitigating and adapting to climate change, improving agricultural and manufacturing practices, and providing for sustainable energy production — all of which, because of Myanmar's tumultuous past, are somewhat overdue and yet, due to Myanmar's new democratic posturing, now provide the country with the opportunity to lead in efforts to address a multitude of issues.

1) The objectives laid out at the High Level Roundtable focus on three key areas: reimagining Myanmar's current approach with regional objectives for water security in South Asia, integrating the Sustainable Development Goals of UN Agenda 2030, and furthering cooperation with regional partners undergoing similar challenges
2) In particular, the Global Water Partnership highlights the importance of supporting the new democratic government of Myanmar in achieving water resource development.

7. National Policies and Plans on Water Related Disasters.

Myanmar Hosts High-Level Roundtable on Water Security and Sustainable Development Plans and Policies.

Background

On 24 May 2016, a High-Level Roundtable on Water Security and the Sustainable Development Goals was convened in Yangon, Myanmar. The meeting was organized by Stockholm-based facilitator Global Water Partnership (GWP), an international network involved in the promotion of integrated approaches to water resources management.

The meeting identified the challenges posed by water insecurity in Myanmar, as well as addressing the link between water security and five key Sustainable Development Goals (SDGs) – SDG Five on Gender, SDG Six on Water and Sanitation, SDG 11 on Cities, SDG 13 on Climate Change and Disaster Risk Reduction, and SDG 17 on Partnerships.

Comment

Myanmar is naturally endowed with plentiful water sources, with 1,168 km^3 per year of total renewable water resources.

Despite this abundance, regional and seasonal variation is so great that the country suffers from a range of climate-related water insecurities, including flooding, droughts, and cyclones.

Decades of mismanagement and weak investment under past government rule has led to poor water access, with one-third of the population continuing to drink from unimproved water sources.

- The roundtable emphasized the interconnectedness of water and other challenges in sustainability, such as urbanization, through the discussion of five key SDGs and how they relate to water security.
- The 2030 Agenda for Sustainable Development established 17 Sustainable Development Goals agreed on at the UN General Assembly in September 2015.
- SDG Six aims to ensure Water, Sanitation and Hygiene (WASH) for all as well as the promotion of Integrated Water Resources Management (IWRM).
- WASH projects are currently being carried out across Myanmar by both government and non-governmental agencies in a bid to improve the health of Myanmar's people and work towards achieving SDG Six.
- Myanmar is yet to develop a comprehensive plan for IWRM, however it has taken steps toward the goal with initiatives such as the Ayeyarwady (Irrawaddy) Integrated River Basin Management (AIRBM)Project (2015-17), an initiative funded by a US$1 million ($1.39 million) loan from the World Bank.
- The project aims to improve the ability of the Myanmar Government to sustainably manage the Ayeyarwady River. The project includes plans to modernise Myanmar's hydro-meteorological observation and warning systems to improve Disaster Risk Reduction in line with SDG 13, helping to mitigate the effects of climate-related events on vulnerable communities along the Ayeyarwady.
- This will work towards achieving part of the Fifth SDG on gender equality, as women in Myanmar are disproportionately affected by disasters.
- The Fifth SDG on gender equality can be further realised through water management as women in Myanmar sources for those living in cities.
- Cities in Myanmar have high poverty and low health indicators, demonstrating the urgent need to improve basic services.

- In the city of Yangon, Myanmar's largest city, only a small percentage of the population receives treated water, and for only part of the day.
- Myanmar must improve water system capacity, quality, and coverage in its cities in order to cope with urbanization and meet SDG 11. (Yangon Chief Minister U Phyo Min Thein, who attended the roundtable, is set to sign off on a new water system to improve Yangon's ancient and inadequate sewerage system.)
- SDG 17, the final goal, is to revitalize global partnership and regional cooperation for sustainable development.
- The roundtable recognized the importance of this goal to water security by virtue of its very existence as a multilateral forum.
- Myanmar is set to benefit from the involvement of the GWP, a network that has broad knowledge and experience from its collaboration with governments and regional bodies in Asia and beyond.
- Various countries sent officials to the roundtable, including delegates from Japan, Australia, and the Netherlands, who shared their countries' experiences with water management.
- The outcomes of the roundtable will be presented to the High Level Panel on Water to be held sometime in June 2016.

8.Lessons Learnt from the Past

8.1 Near Current Water related Disasters in Myanmar with some significant events

(Myanmar mine landslide leaves 14 dead, 200 missing (30 May 2016))

A landslide at a jade mine in northern Myanmar, last week killed at least 14 people, with hundreds more buried by the collapsed hillside.

The landslide in Kachin state on the night of May 23 came after several days of heavy rainfall.

One week after the tragedy there has been no official confirmation of the final numbers of dead and injured. As many as 200 workers remain missing.

According to the Myanmar Times, the disaster occurred around 8:15 p.m. at a site owned by Yadanar Star Company.

The company had ceased operations for the day due to the bad weather, but hundreds of so-called hand pickers, who scour the excavation site for leftover jade deposits, moved in to work over the tailings.

One witness said there was a creek flowing down the middle of the workings, displacing soil from the hill.

-

-Administrators, police, a funeral service team, aid workers and the fire brigade worked with company backhoes to clear the slide until the search was called off due to heavy rain and the continuing threat of landslides.

-In the past year, dozens of mine workers have been maimed or killed picking through waste dumps.

-The worst disaster occurred last November when 113 miners were killed and 100 left missing when a 60-metre mountain of earth and waste collapsed, burying the makeshift huts where the miners slept.

-The activities of 12 companies were briefly suspended after the incident.

8.2.Monsoon floods in Chin State, Myanmar.

Hakha. Eighty-seven families displaced by floods and landslides are currently staying in tents on the school 2015.Children at a school in grounds. Photo: OCHA/Eva Modvig

Children at a school in Hakha. Eighty-seven families displaced by floods and landslides are currently staying in tents on the school grounds. Photo: OCHA

- The road to Hakha, in remote Chin State in western Myanmar, is not an easy one to travel at the best of times.
- Even without landslides and rains, it takes between seven and eight hours to drive.
- Now it often takes longer as sections are still blocked by mud and stones following landslides caused by the heavy rains and floods in July and August(2015).

Further investment in disaster risk reduction and emergency preparedness is needed to ensure vulnerable communities are better equipped to deal with future emergencies.

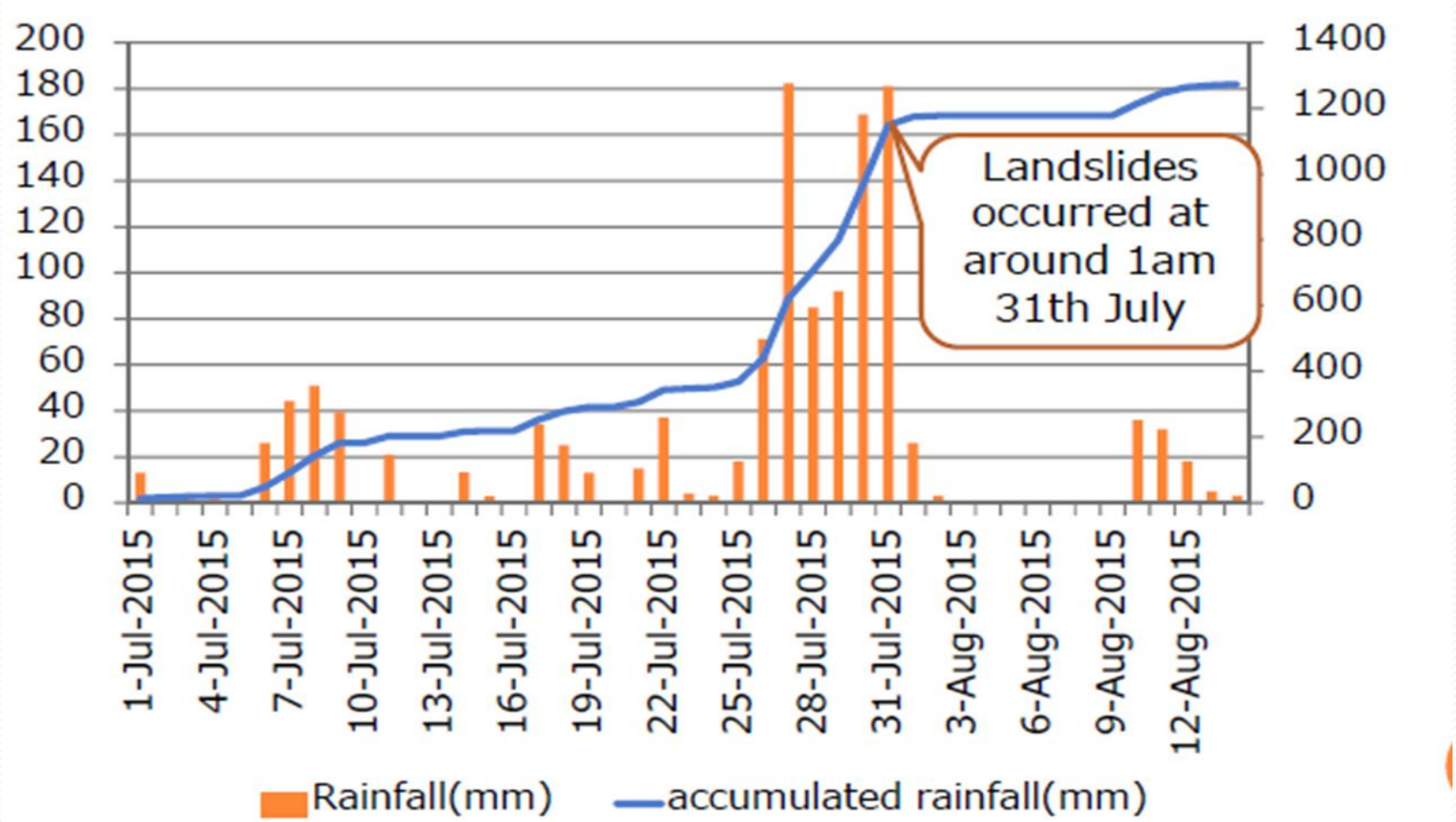
OCHA has been working with the Government of Myanmar and partners to strengthen emergency preparedness, including through training and capacity-building, Disaster law development and improving coordination.

For families who remain displaced, a new home and support to rebuild their livelihoods is the number one priority.


JCB

- Floods and landslides in the Chin region of Myanmar displaced thousands of people this summer**.(When I arrived at Kalay and Hakha last Nov 29 to Dec 10 2016,I have seen and some measuring study in that areas for my report)** Almost 20,000 people were displaced by severe weather in western Myanmar, formerly known as Burma, say relief groups.
- Locals called the heavy rains of July the worst natural disaster in memory.
- Towns and villages across the region were destroyed.
- Months after the landslides, roads in the capital of Chin state, Hakha, have been cleared. But in the rural areas, aid is hard to find.(Now JICA renovate that Kalay to Hakha road by their funds).

Case Study


200
180
160
140
120
100
80
60
40
20
0
1400
1200
1000
800
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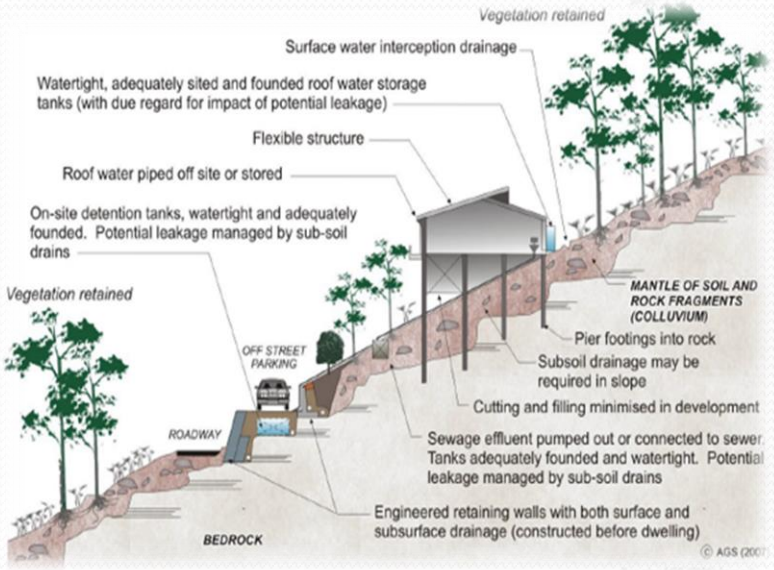
400
200
0
Landslides occurred at around 1am 31th July
1-Jul-2015
4-Jul-2015
7-Jul-2015
10-Jul-2015
13-Jul-2015
16-Jul-2015
19-Jul-2015
22-Jul-2015
25-Jul-2015
28-Jul-2015
31-Jul-2015
3-Aug-2015
6-Aug-2015
9-Aug-2015
12-Aug-2015
Rainfall(mm)
accumulated rainfall(mm)

Heavy Rainfall due to Landslide at Hakha(Chin State)

Relocate housing



Design for land slide DRR

Alternative ways

Slope cut design

Retaining wall design

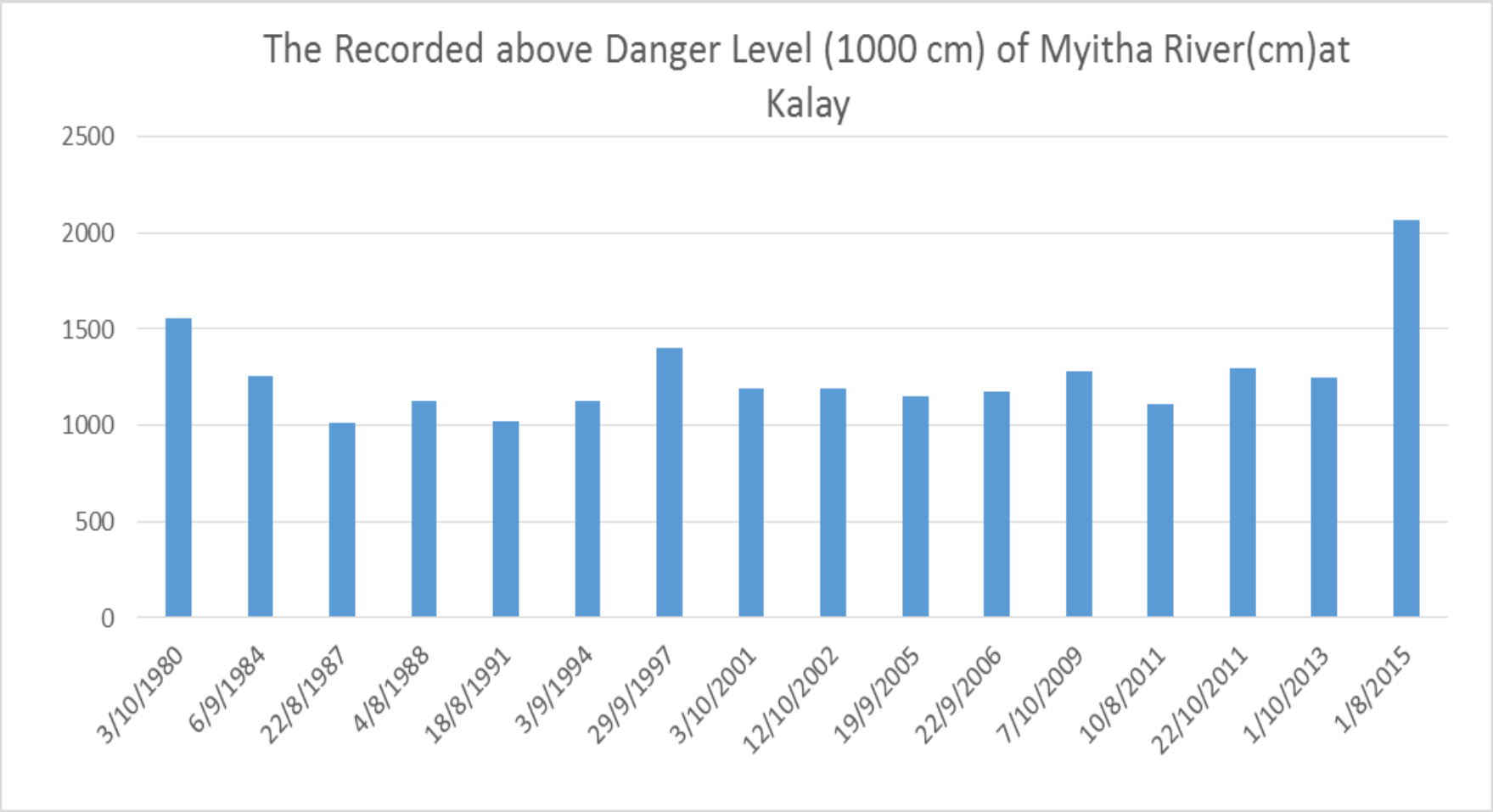
Drainage design

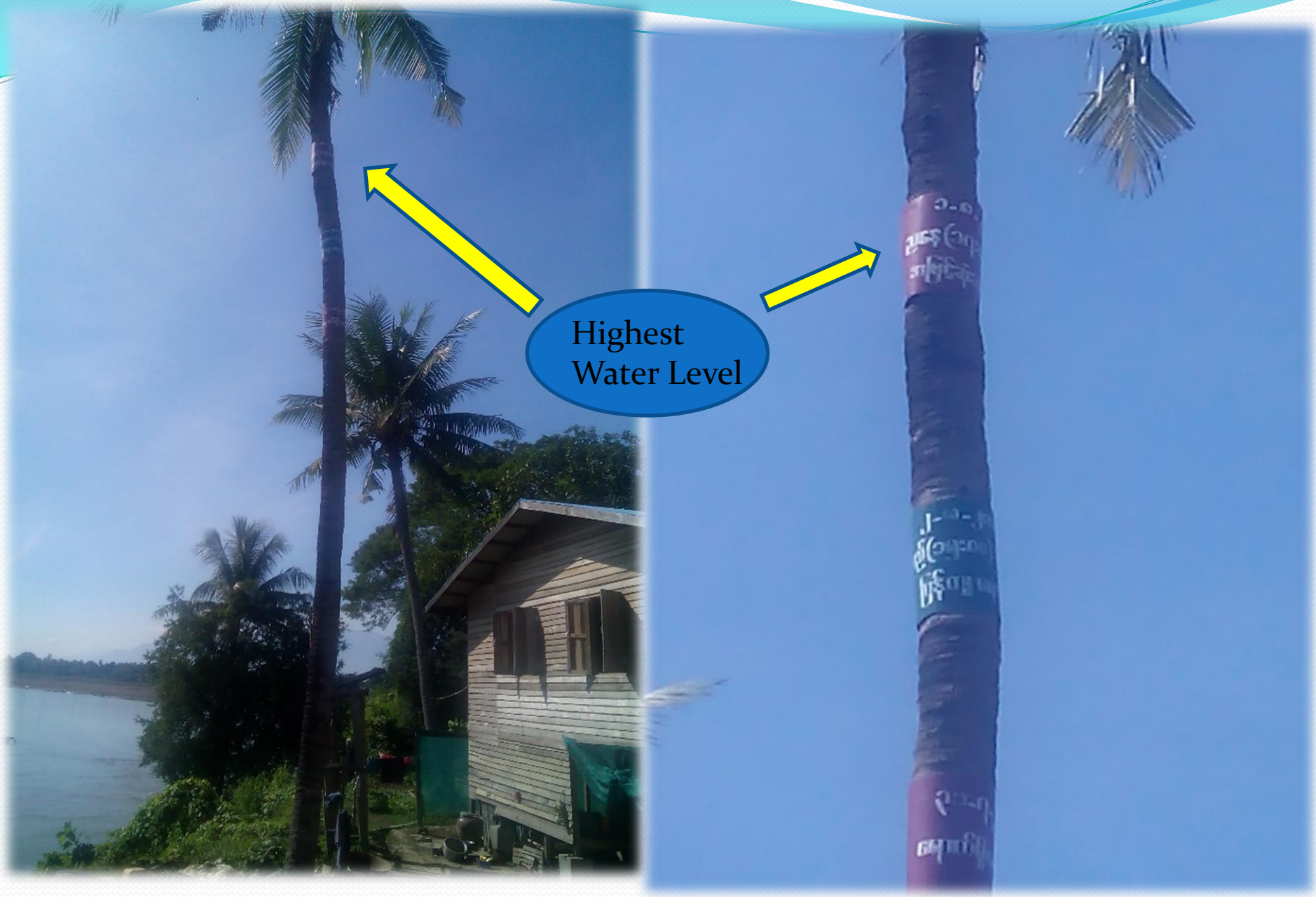
Current Renovation Activities.

a) Transportation Sector

- Slope cut design
- Drainage design
- Retaining wall design
- Alternative ways

8.3. Severe Flood in Kalay(lower Sagaing region)




Highest
Water Level

Field trip photos at Kalay on 9 Dec 2016.

9. Status of ODA for Water Related Disasters for last decades.

No.	Projects	Purpose	Donor	Organization	Year	Amount	Type
1	PROJECT FOR RURAL DRINKING WATER SUPPLY IN SHAN STATE	Basic drinking water supply and basic sanitation	Japan	MOFA	2002	4,488,818 USD	ODA Grants
2	The Provision of Equipment for Rural Water Supply Project In the Central Dry Zone	Basic drinking water supply	Japan	MOFA	2013	3,814,604 USD	ODA Grants
3		River basins' development	Japan	JICA	2008	2,564,773 USD	ODA Grants
4	UNOPS, Livelihood & food Trust Fund	Water resources policy/admin. mgmt	Switzerland	SDC	2012	2,026,667 USD	ODA Grants
5		Water supply & sanit. - large systems	Japan	JICA	2003	1,908,887 USD	ODA Grants
6	TC AGGREGATED ACTIVITIES	River basins' development	Japan	JICA	2012	1,782,278 USD	ODA Grants
7	TC AGGREGATED ACTIVITIES	Water resources	Japan	JICA	2013	1,726,122 USD	ODA Grants

No.	Projects	Purpose	Donor	Organization	Year	Amount	Type
8	Save the Children - Cyclone Nargis WASH Activities	Basic drinking water supply and basic sanitation	Australia	AusAID	2010	1,717,366 USD	ODA Grants
9	UNICEF- Cyclone Nargis WASH Activities	Basic drinking water supply and basic sanitation	Australia	AusAID	2010	1,375,894 USD	ODA Grants
10	World Vision - Cyclone Nargis WASH Activities	Basic drinking water supply and basic sanitation	Australia	AusAID	2010	1,326,051 USD	ODA Grants
11		River basins' development	Japan	JICA	2007	1,157,691 USD	ODA Grants
12	TC AGGREGATED ACTIVITIES	Water resources protection	Japan	JICA	2012	1,112,455 USD	ODA Grants
13	UNICEF WASH Activities in Burma	Basic drinking water supply and basic sanitation	Australia	AusAID	2010	1,091,543 USD	ODA Grants
14	Supporting the Sustainable Recovery of Livelihoods through Water and Sanitation-Hygiene, Food Security and Care Practices Programme	Basic drinking water supply and basic sanitation	EU Institutions	EDF	2011	924,638 USD	ODA Grants

No.	Projects	Purpose	Donor	Organization	Year	Amount	Type
15	SUPPORTING THE SUSTAINABLE RECOVERY OF LIVELIHOODS THROUGH WATER AND SANITATION-HYGIENE, FOOD SECURITY AND CARE PRACTICES PROGRAMME	Basic drinking water supply and basic sanitation	EU Institutions	EDF	2012	854,756 USD	ODA Grants
16	TC AGGREGATED ACTIVITIES	River basins' development	Japan	JICA	2009	843,854 USD	ODA Grants
17	Care - Cyclone Nargis WASH Activities	Basic drinking water supply and basic sanitation	Australia	AusAID	2010	826,005 USD	ODA Grants
18	11255. Water supply (excluding schools)	Basic drinking water supply and basic sanitation	UNICEF	UNICEF	2009	810,420 USD	ODA Grants
19	Integrated Wash and Food Security Project for Uprooted Communities in Kayah State, Myanmar	Water supply & sanit. - large systems	EU Institutions	CEC	2013	796,136 USD	ODA Grants

10. Future Agenda to Mitigate and Adapt to Water Related Disasters.

10.1. Implements and maintenance of River system

a. Maintenance to River bed and Banks by regular and master plan.

b. Set up good river flood monitoring, analyzing and forecasting and warning disseminating System in Myanmar.

c. Re-locate Housing system.

d. National Level Plan for Water security for hole country.

e. Fill up in maintenance of Dams, Reservoirs and Re- forestation on Catchment

f. Building to a system of Flash Flood monitoring and Warning purposes urgently.

10.2.Technical Supports

a. **Instrumentation, Installation, Technical transfer from developed countries.**

b. **Technical cooperation, coordination in these water related disaster issue with partner countries.**

10.3. Sustainable development in Myanmar.

a. Each master plan in related official agencies of Myanmar for their capacity development.

b. Individual capacity development programs.

11. Proposals for Regional cooperation

A. **Technical and advisories cooperation with regional level and global status.**
B. **Experience and Knowledge sharing .**
C. **Technical sharing and financial (ODA, GRANT aid, and LOAN) Assist or support.**
D. **Medium and Large Project on "Water Related Disaster Reduction" with regional and global cooperation.**

For Example:-
Project on Water resources protection
Project on Water supply and sanitation
Project on River development
Project on River Monitoring System.
Project on Grate Ayeyarwady River Management System.

Myanmar hope this cooperation Forum out comes can be solve our problems of Water Related Disaster for better future.

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Thank

U Chit Kyaw

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