

STUDY ON PROLONGED FLOOD IN THABAUNG TOWNSHIP, AYEYARWADY REGION*

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Abstract

Except the western part of the township, the remaining area is situated on the deltaic region. Therefore, 58.96% of the township is a hilly and 41.04% is flood plain region. The main river is Ngawun. It is the first distributary and divert from the western side of the Ayeyarwady River. The main tributaries of Ngawun River are Tabu Creek, Shwenyaungbin Creek and Daga River from the east and Kyeintali Creek and Kanyin Creek from the west. The critical water level of Ngawun River in Thabaung Township is 5.152 meter (17 feet), and the danger water level is 6.897 meter (22.75 feet) above sea level. According to the highest water level statistics from the year 2004 to 2019, all of the years were above the critical water level. In order to cultivate paddy commercially, the British government had constructed an embankment from Hinthada to Thabaung on the east bank of Ngawun River in (1871-1876). The embankment was 122.109 km (75 miles 7 furlong) long. In the rainy season, when the level of water rises it overflows to the lowlands, and with the fall of the water level, it was mainly drained through Ngawun River, Daga River, Tabu Creek, Htanzinhla Creek, Shwenyaungbin Creek, Udo Creek and Hngetpauk Creek. The overflowed water flowed through Daga River to Kangyidaunt Township, so flooding in Thabaung Township was not very serious. But now embankment have been built along the south of Daga River, which is the main drainage of the region, in order that Kangyidaunt Township can cultivate paddy. As the main drainage has been blocked by the embankments, flooding period within the embankment became longer. Although canalization of the poor drain creeks in the flood plain area leading to the Irrigation and Water Utilization Management Department since 2013-2014, no reduce to the annually prolonged flood.

Keywords: Thabaung Township, Ngawun River, critical water level, embankment, canalization, prolonged flood

Introduction

River flood have been defined as events of such magnitude that the channels cannot accommodate the peak discharge; in other words, a flood is a flow in excess of the channel capacity, and results in inundation of low-lying flat land adjacent to the channel. Another factor is the modification of river catchments by man in deforestation, agriculture, and drainage, urbanization etc., which may considerably alter the probability of floods of a particular size (John Small and Michael Witherick, 1989).

Thabaung Township is not only situated on the delta region but it is also on the Ngawun River (See figure 1 (a) and (b)). Ngawun River is a tidal river. High tide and low tide conditions are found along the Ngawun River course. There are three tidal zones along the river course. (1) Just downstream below the point where Ngawun River and its tributary Daga River merge together, a current moves up and down and this area is affected by salt water due to tidal action. (2) From the confluence of Ngawun and Daga Rivers to the south of Thabaung, although there is a current flowing up and down, this part is not affected by salt water. (3) From the north of Thabaung at the upper Ngawun River, although there is no current moving up and down, but changes in velocity is caused by tidal action (Aung Swe, 2007).

Major causes of flooding on the Ngawun riverine area are experienced high tide water level from the Andaman Sea, downstream discharge from the Ayeyarwady River and successive rain during the peak monsoon period in the study area. The factor causing annually prolonged flood in

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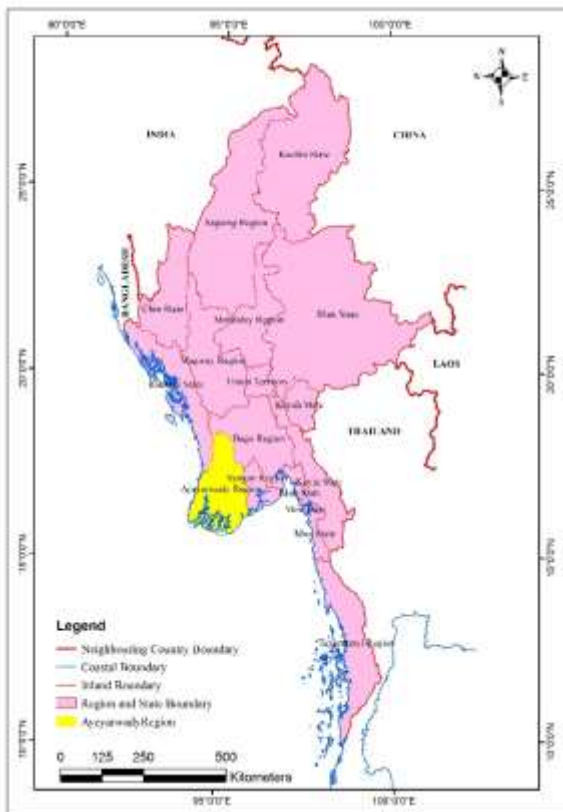
* Best Paper Award Winning Paper in Geography (2020)

the study area are included the physical features, weather conditions, the construction of Ngawun and Daga embankments and over exploitation of forest resources in Rakhine mountain ranges in Thabaung Township.

The eastern part of the Thabaung Township is under 5.152 meter (17 feet) above sea level and suffers the consequences of the tidal effect. At the time of high tide, the water level rises and the velocity of the river slows down which causes of the prolonged flood.

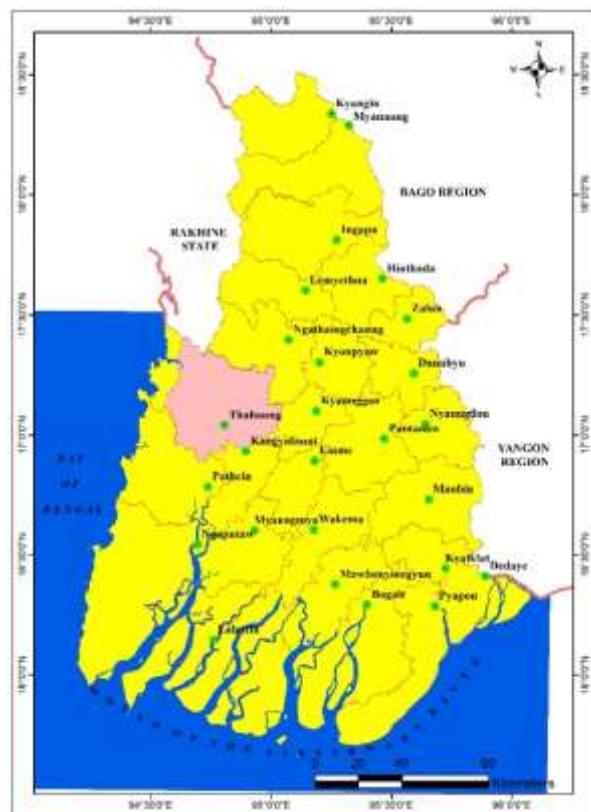
Aim and Objectives

The main aim of this research is to find out the way to reduce annually prolonged flood in the study area. The main objectives are to study major causes of annually prolonged flood, to analyze highest water level condition of Ngawun River in Thabaung Township, to extract flood affected area of the study area, and to assess relationship between the construction of embankment, block of natural water drainage system, canalization, and prolonged flood in the study area.



Source: Myanmar Survey Department, Yangon

Figure 1(a) Location of Ayeyarwady Region in Myanmar



Source: Myanmar Survey Department, Yangon

Figure 1(b) Location of Thabaung Township in Ayeyarwady Region

Materials and Methods

UTM topographic maps (1:50000 scale, 2002, Myanmar Survey Department, Yangon) are used to obtain length measurement of Ngawun River. Highest water level data and canalization data are derived from Irrigation and Water Utilization Management Department, Patheingyi. Elevation class and flood affected area are extracted from the 30 meter resolution DEM (Digital Elevation Model).

Results and Discussion

Major Causes of Annually Prolonged Flood in Thabaung Township

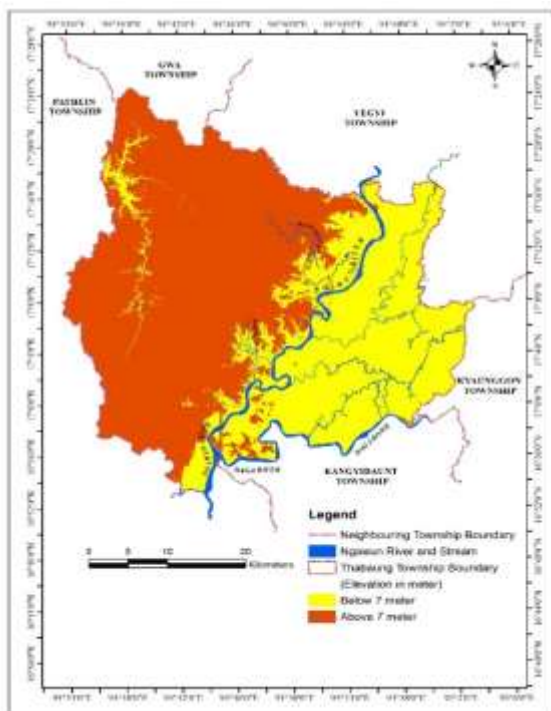
1. Relief and drainage condition

Relief

Except the western part of the township, the remaining area is situated on the deltaic region. Therefore, 58.96% of the township is hilly region and 41.04% is flood plain region.

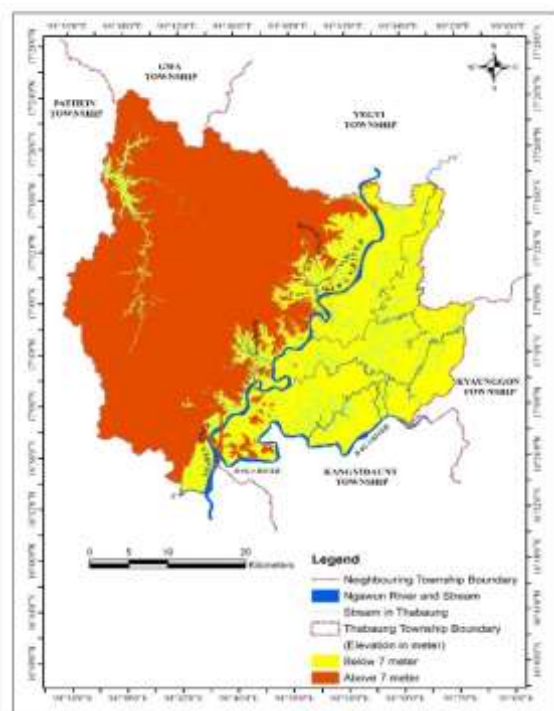
Western hills are situated in the western part of the Thabaung Township which is composed of Rakhine mountain ranges and hills. Most of the hills in this part run from north to south and it is found that the northern part is higher. These hills, slope down eastwards to the Ngawun River. The western hills are composed of the major reserved forest, such as Kyeintali, Sitsayan, Khayu, Kyaukchaunggyi unreserved forest. The western hill region covering 58.96% of the township and being a water reached of the tributaries entering into the Ngawun River, water level rises when there is heavy rain.

The alluvial plain composed of alluvial deposited by Ngawun River and its tributaries is in the eastern side of Thabaung Township and is a very flat plain. Ngawun River passes through meandering alluvial plain with northeast and southwest alignment. Except the very few places, the whole plain is below 7 meters (22.96 feet) above sea level. In the western side of the Ngawun River the alluvial plain gently slopes down from the foothills of the Rakhine mountain ranges to the eastern side. In some areas, spur stretching from the Rakhine mountain ranges form as ridges. In the eastern side of the Ngawun River, the alluvial plain is more flat than that of the western side. It is also the lowest part in Thabaung Township. The extent of the whole alluvial plain is about 41.04%. (Figure 2)



Source: Myanmar Survey Department, Yangon : 30 meter resolution DEM

Figure 2 Relief of Thabaung Township



Source: Myanmar Survey Department, Yangon : 30 meter resolution DEM

Figure 3 Drainage of Thabaung Township

Drainage

Thabaung Township is a part of Ayeyarwady deltaic region. The Ngawun River flows across the Thabaung Township from north to south. The main river is Ngawun. It is the first distributary and divert from the western side of Ayeyarwady River at about 14.48 km (9 miles) above Hinthada, near Nyaunggyo village, Ingapu Township. It flows in a northeast-southeast direction. There are many bends along its course within the township. Ngawun River enters Thabaung Township near Thayetkone Village Tract and flows from northwest to southeast until Setdaunggyi Village Tract. Then it turn to the southwest. From Thinganpinseik Village Tract, the river bends to the west and east repeatedly until Pathein-Thabaung boundary which is near Theaphyu Village Tract. The bending of the river reduces the river velocity enhancing the duration of river flood. As Ngawun River is a yearly flooded one, the deposition of sediments are found along the river banks as natural levees especially in the western bank.

The main tributaries of Ngawun River are Tabu Creek, Shwenyaungbin Creek and Daga River from the east and Kyeintali Creek and Kanyin Creek from the west.

Tabu Creek flows from Yekyi Township and is known as Htanzinhlhla Creek in Yekyi Township and when it flows through Thabaung Township, it is known as Tabu Creek. Flowing from northeast to southwest, it turns to the west in Thayettaw Village Tract and flows into the Ngawun River near Dekone Village Tract. There are many small creeks flowing into Tabu Creek.

Shwenyaungbin Creek is also one of the creeks flowing into the Ngawun River from the east. It enters Thabaung Township from Kyaunggone Township and passes through the eastern alluvial plain and joins the Ngawun River near Shwenyaungbin Village Tract. Udo Creek is connected with Daga River and Shwenyaungbin Creek.

Daga River is the largest tributary and it is flowing into the Ngawun River within Thabaung Township. It starts in Kyaunggon Township and then flows to the west as the boundary between Thabaung and Kangyidaunt townships. It enters Ngawun River near Kintat Village Tract.

The tributaries of Ngawun River in the eastern side are connected with each other by small streams like a network. This is one of the characteristics of deltaic region and is one of the reason causing the most serious flood especially in the eastern side of the Ngawun River.

Kyeintali Creek takes it source from the Rakhine Mountain Range in the northernmost part of the township. From it source, it flows in a northwest and southeast direction into the Ngawun River from the west near Hpayakone Village Tract.

Kanyin Creek also takes it source from Rakhine Mountain Range in the west of Thabaung Township. It flows from north to south and turns to the southeast and flows into the Ngawun River near Thabaung Township.

The tributaries of Ngawun River from the west which take their source from the Rakhine Mountain Range can carry much sediments into the Ngawun River. Ngawun River and all its tributaries within Thabaung Township are tidal in nature. (Figure 3)

2. Channel pattern of Ngawun River in Thabaung Township

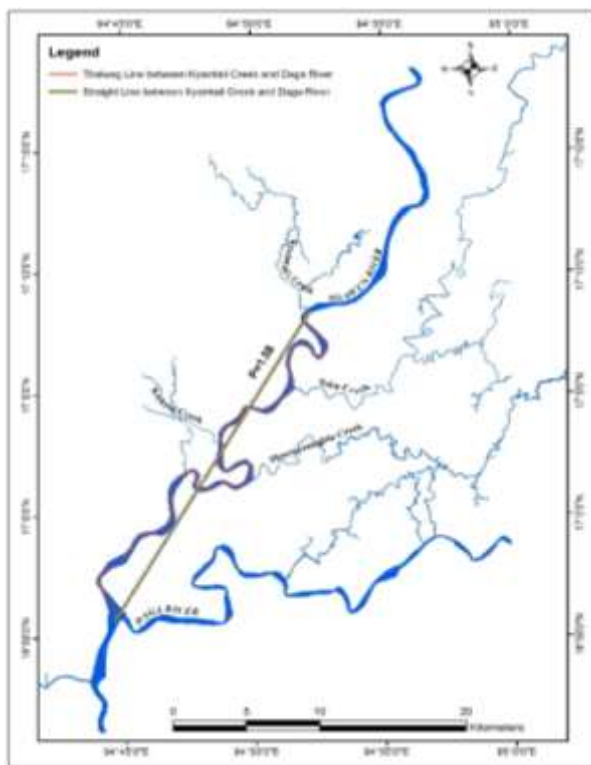
Channel pattern is related to the sinuosity ratio. The ratio between the measured length of a stream channel and that of the thalweg of its valley is measured by its sinuosity. Sinuosity ratio P is 1.0 for straight channel, 1.2 for transitional between straight and regular, 1.5 for regular channel, 1.7 for irregular channel and 2.1 for tortuous (Chorley, R.J., 1984).

In this paper sinuosity ratio is calculated based on the confluence of Ngawun River and its tributaries. There are five main tributaries entering into the Ngawun River from western and eastern

banks. Kyeintali Creek and Kanyin Creek from the west and Tabu Creek, Shwenyaungbin Creek, and Daga River from the east. Between the confluence of Ngawun River-Kyeintali Creek and Ngawun River-Daga River, thalweg line length of Ngawun River is 42.94 km and straight line length is 27.16 km respectively. Therefore, sinuosity ratio is 1.58 and channel pattern is nearly irregular channel. (Figure 4)

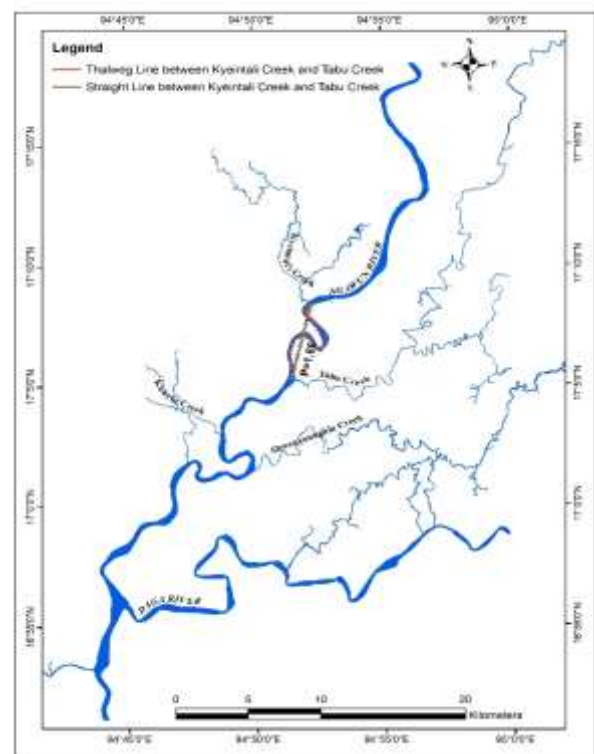
For more detail study, between the confluence of Ngawun River-Kyeintali Creek and Ngawun River-Daga River segment is subdivided into four segments from north to south, namely such as between the confluence of Ngawun River-Kyeintali Creek and Ngawun River-Tabu Creek, between the confluence of Ngawun River-Tabu Creek and Ngawun River-Kanyin Creek, between the confluence of Ngawun River-Kanyin Creek and Ngawun River-Shwenyaungbin Creek, and between the confluence of Ngawun River-Shwenyaungbin Creek and Ngawun River-Daga River.

Straight line length and thalweg line length between the confluence of Ngawun River-Kyeintali Creek and Ngawun River-Tabu Creek are 5.94 km and 9.88 km respectively. Therefore sinuosity ratio is 1.66 and channel pattern is nearly irregular. In this portion, Ngawun River is likely to be meandering channel as shown in figure 5.



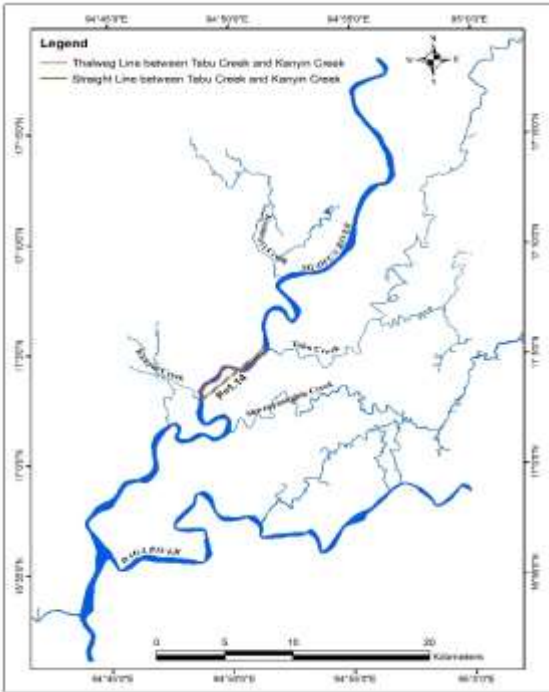
Source: Myanmar Survey Department, Yangon (2002)

Figure 4 Channel pattern between the confluence of Ngawun River-Kyeintali Creek and Ngawun River-Daga River



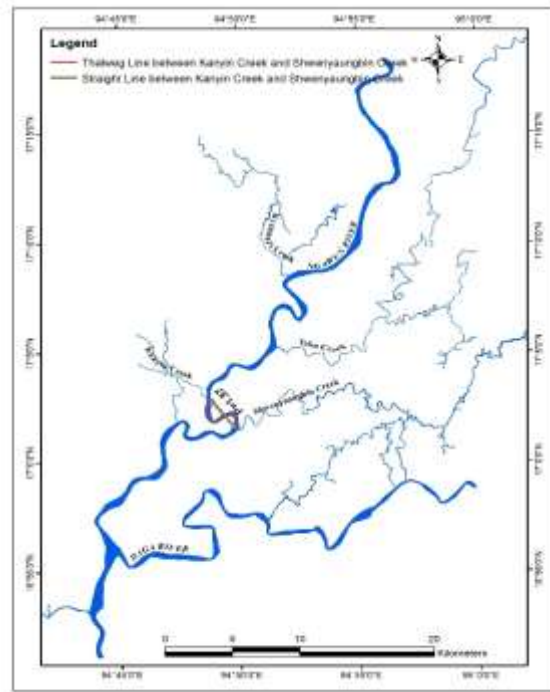
Source: Myanmar Survey Department, Yangon (2002)

Figure 5 Channel pattern between the confluence of Ngawun River-Kyeintali Creek and Ngawun River-Tabu Creek



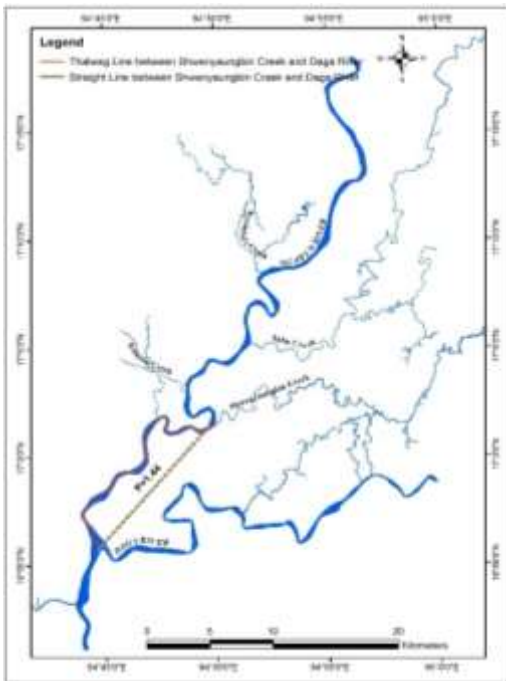
Source: Myanmar Survey Department, Yangon (2002)

Figure 6 Channel pattern between the confluence of Ngawun River-Tabu Creek and Ngawun River-Kanyin Creek



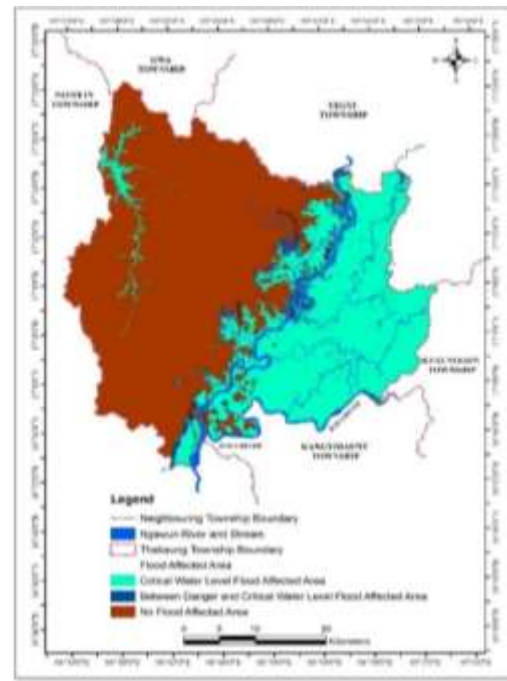
Source: Myanmar Survey Department, Yangon (2002)

Figure 7 Channel pattern between the confluence of Ngawun River-Kanyin Creek and Ngawun River-Shwenyaungbin Creek



Source: Myanmar Survey Department, Yangon (2002)

Figure 8 Channel pattern between the confluence of Ngawun River-Shwenyaungbin Creek and Ngawun River-Daga Ri



Source: Myanmar Survey Department, Yangon : 30 meter resolution DEM

Figure 9 Flood affected area of Thabaung Township

Straight line length and thalweg line length between the confluence of Ngawun River-Tabu Creek and Ngawun River-Kanyin Creek are 6.42 km and 7.36 km respectively. Therefore, sinuosity ratio is 1.14 and channel pattern is nearly transitional between straight and regular as shown in figure 6. Between the confluence of Ngawun River-Kanyin Creek and Ngawun River-Shwenyaungbin Creek, length of straight line and thalweg line are 3.19 km and 5.03 km respectively. Therefore, sinuosity ratio is 1.57 and channel pattern is regular as shown in figure 7. Between the confluence of Ngawun River-Shwenyaungbin Creek and Ngawun River-Daga River, length of straight line and thalweg line are 14.31 km and 20.67 km respectively. Therefore, sinuosity ratio is 1.44 and channel pattern is also regular. (Figure 8)

3. Water level condition of Ngawun River in Thabaung Township

According to the Thabaung Township Irrigation Department's norm, the critical water level of Ngawun River in Thabaung Township is 5.152 meter (17 feet), and the danger water level is 6.897 meter (22.75 feet) above sea level. The annual highest water level of Thabaung Township collected from Zeepinkwin gauging station for the period from 2004 to 2019 is given in table 1. According to the highest water level statistics, all of the years were above the critical water level.

4. Simulation of flood affected area based on critical and danger water level employing the surface model

Calculation of flood affected area is based on the critical and danger water level of the Zeepinkwin gauging station in Thabaung Township. Flood affected area under critical water level (5.152 meter) of Thabaung Township is about 674.22 square kilometer (37%) of the total and flood affected area under danger water level (6.897 meter) of Thabaung Township is about 744.19 square kilometer (40.88%) of the total as shown in figure 9.

Table 1 Highest water level of Zeepinkwin gauging station, Thabaung Township

Year	Highest Water Level		Year	Highest Water Level	
	Meter	Feet		Meter	Feet
2004	6.93	22.75	2012	6.4	21
2005	5.64	18.5	2013	6.17	20.25
2006	5.67	18.6	2014	5.84	19.15
2007	6.71	22	2015	6.78	22.25
2008	6.19	20.3	2016	6.83	22.4
2009	5.78	18.95	2017	6.49	21.3
2010	5.61	18.4	2018	5.79	19
2011	6	19.7	2019	5.67	18.6

Source: Irrigation and Water Utilization Management Department, Patheingyi

5. Construction of Embankment along the Ngawun River and Daga River

Ngawun River is the first river that branched off from the Ayeyarwady on the right side. It is the most important of the distributaries of the Ayeyarwady, and at that time there is heavy rainfall in the Deltaic region and streams and rivulets from the mountain and uplands bring down large volume of water into Ngawun River. In the southern part of the Ngawun River tidal effect is also

experienced. So the delta region of Myanmar has very good alluvial soil which are very suitable for paddy cultivation. In order to cultivate paddy commercially, the British government had constructed an embankment from Hinthada to Thabaung on the east bank of Ngawun River in (1871-1876). The embankment was 122.109 km (75 miles 7 furlong) long (ဦးအုန်းမြင့်၊ ၁၉၇၆).

The embankment was constructed on the eastern part of Ngawun River because the cultivated acreage of paddy is greater on the east than on the west side, and the deltaic characteristic are more pronounced. Due to the protection of the embankment, the east side of Ngawun River is quite free from danger of flooding. But as there are no embankment in the west side, it is liable to annual flooding and sometimes even the east side experiences flooding. There are no embankment on the west side in order to avoid double embankment system. If both side of the river have embankment, the flow volume of the river will be very strong. The embankment will not be able to retain such great volume of water for long, and sooner or later, there will be breaches which will cause sudden flooding. So embankments are constructed only on the east side of the river where the cultivable acreages are greater and the west side are left as a flooded area.

During the British period in order to promote paddy cultivation, Ngawun embankment was constructed starting from Hinthada passing through Laymyethna and Ngathaingyaung to the north of Tabu Creek in Thabaung Township. If the embankment was continued southwards, the volume of water brought down from the upper course in the rainy season was very great, the great volume of water brought down from the mountain streams of the west, the rise of tide from the south that reached Thabaung, all these factor would cause great flood especially to Pathein, Kangyidaunt and Kyaunggon townships. Moreover, rail road and motor roads would be flooded and suffered damage. So the embankment was not continued southwards but ended at Tabu Creek. By construction this embankment, the water that flowed from the Ngawun River in the rainy season was diverted to the eastern lowlands Thabaung, acting as a break for the water flow. Although there was flooding, the water rose gradually, which was not harmful to either roads or motor roads.

In the rainy season, when the level of water rises it overflows to the lowlands, and with the fall of the water level, it was mainly drained through Ngawun River, Daga River, Tabu Creek, Htanzinhla Creek, Shwenyaungbin Creek, Udo Creek and Hngetpauk Creek.

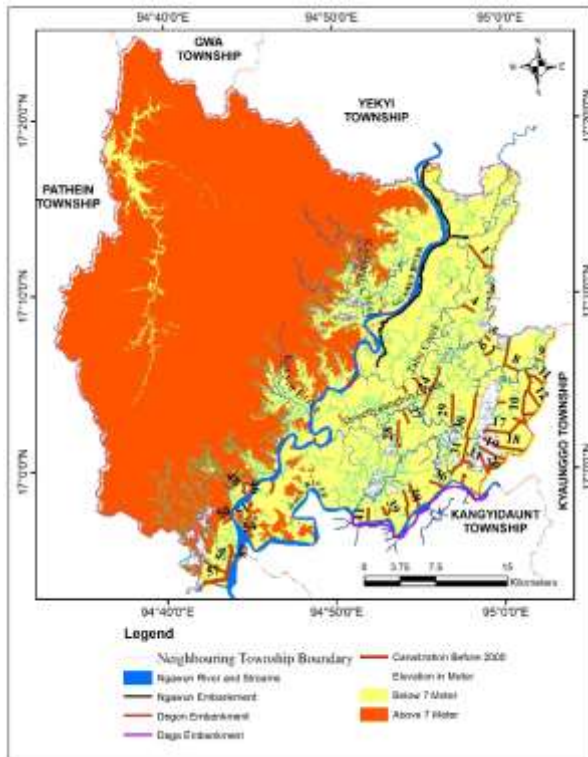
The overflowed water flowed through Daga River to Kangyidaunt Township, so flooding in Thabaung Township was not very serious. But now embankment have been built along the south of Daga River, which is the main drainage of the region, in order that Kangyidaunt Township can cultivate paddy. As the main drainage has been blocked by the embankments, flooding period within the embankments became longer, especially in Thabaung and Yegyí townships. With the construction of a new embankment in the southern side of Tabu Creek from Magyigone to Daegon Village in Thabaung Township, villages in the lower section are more in danger of flooding. Although there is an embankment on the east side of Ngawun River, the area between the embankments and the river experience flooding every year.

Irrigation and Water Utilization Management Department constructed 46 new canal and canalization in the flood plain area with the length of 112.08 km since before year 2000, 128 new canal and canalization in the flood plain area with the length of 425.59 km between 2013-2018, 26 new canal and canalization with the length of 87.88 km in 2019, and 13 new canal and canalization with the length of 53.61 km in 2020 respectively. Total length of the stream in flood plain area of Thabaung Township is about 1324 km and length of constructed new canal and canalization is about 679.16 km. Therefore, percentage of the length of constructed new canal and canalization is about 51% of the total stream length of the flood plain area as shown in table 2, 3, 4, 5 and figure 10, 11, 12, 13, 14.

Table 2 Site of canalization in Thabaung Township (before 2000)

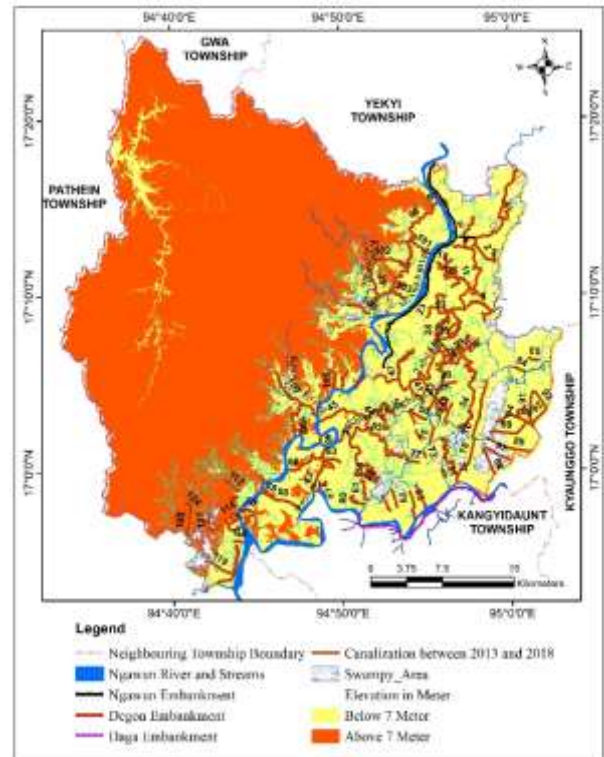
No.	Length (km)	No.	Length (km)	No.	Length (km)	No.	Length (km)
1	2.94	16	0.06	31	4.51	47	0.65
2	1.18	17	4.63	32	0.30	48	1.19
3	0.37	18	4.75	33	1.35	49	1.18
4	1.55	19	3.19	34	1.12	50	1.06
5	0.78	20	2.31	35	0.33	51	0.84
6	1.05	21	1.52	36	1.64	52	0.51
7	3.11	22	0.44	37	2.78	53	0.44
8	1.40	23	1.83	38	3.24	54	0.59
9	0.40	24	4.94	39	1.23	55	0.23
10	6.08	25	2.23	40	0.84	56	1.61
11	1.84	26	0.80	41	1.50	57	4.42
12	2.19	27	1.50	42	0.44	58	1.66
13	1.23	28	2.91	43	0.38	59	2.06
14	0.86	29	3.33	44	1.42	60	2.63
15	1.54	30	4.89	45	1.05	61	0.45
				46	1.82	62	2.76

Source: Irrigation and Water Utilization Management Department, Patheingyi



Source : Myanmar Survey Department, Yangon
 : 30 meter resolution DEM
 : Irrigation and Water Utilization Management Department, Patheingyi

Figure 10 Canalization in Thabaung Township (before 2000)



Source : Myanmar Survey Department, Yangon
 : 30 meter resolution DEM
 : Irrigation and Water Utilization Management Department, Patheingyi

Figure 11 Canalization in Thabaung Township (between 2013 and 2018)

Table 3 Site of canalization in Thabaung Township (between 2013 and 2018)

No.	Site of Canalization	Length (km)	No.	Site of Canalization	Length (km)
1	Ngabat Creek (Akeyo)	1.96	33	No.23 canal (Htanzinhla, Kyaye, Magyigone)	7.49
2	Kyibinyo Creek	1.97	34	No.22 Lahata Creek (Htangyogone, Kyaye)	18.42
3	Aleyo Creek	2.38	35	Yayosin	0.59
4	Akegyi Creek	2.07	36	Byetkawgyi Creek	0.62
5	Thantada Creek	1.14	37	Umaungdaing Creek (Magyigone)	2.61
6	Kywebyu Creek	3.15	38	Kanyingone Canal (Magyigone)	0.38
7	Kanyin Creek	1.11	39	Kyaye Creek	3.69
8	Chinphaya Creek	4.20	40	Kwinlezu Creek	2.00
9	Sakhangyi Creek	2.14	41	Utinnyunt Creek	2.84
10	Akegyi Creek (1)	1.63	42	Kadetyo Creek (Kanyingon)	3.11
11	Akegyi Creek (2)	1.96	43	Cross Kanyingon Canal	1.50
12	Akegyi Creek (3)	1.70	44	Shingyibyauk Canal	2.83
13	Akegyi Creek (4)	0.93	45	Pyidawthar Canal (Thayetgon, Sison)	3.64
14	Akegyi Creek (5)	1.04	46	Yonchaung (Kanyinbin)	0.77
15	Akegyi Creek (6)	1.97	47	Lahabaing Creek (Pyidawthar, Thayettaw)	6.61
16	Akegyi Creek (7)	0.26	48	Ward No. 3 Canal	0.71
17	Denanyo Creek	1.43	49	Shwenyaungbin Creek	2.53
18	Dawpantinyo Creek	1.42	50	Lindagya Canal	2.99
19	Nyaunggone Creek	0.81	51	Mithwedaik Canal	6.70
20	Akegyi Creek (8)	1.60	52	Hlayswae Canal	4.76
21	Innmagyi	1.23	53	Alegyun (Yegyo)	2.14
22	Ledi Creek	4.33	54	Yedwington Canal	1.59
23	Migyaunggaung Creek	1.92	55	Ngamangyaung-Ngamyetsanni Creek	8.63
24	Hlayswae Creek	1.54	56	Nwenikyaung Creek	7.65
25	Shwesan Creek	0.21	57	Kywelan Creek	1.14
26	Hninsan Creek	0.12	58	Bwettaw Creek	3.36
27	Htanzinhla Creek	0.60	59	Thidatkalay Creek (Shwenyaungbin)	2.41
28	Htantabin (Pyinmagauk)	6.50	60	Ngu Creek (Daga-Nyaunggon)	2.96
29	Kyaikpi (Htanzinhla)	4.99	61	Khwethe Creek (Daga-Nyaunggon)	3.10
30	Laychaung Creek	2.46	62	Thayetkon-Satthwa Creek	5.28
31	Thayetchaung Creek	1.49	63	Shwenyaungbin-Kywelanyo Creek	2.08
32	Hngetchaung Creek	2.14	64	Thamingon-Kywelan Creek	1.57

Source: Irrigation and Water Utilization Management Department, Patheingyi

Table 3 Site of canalization in Thabaung Township (between 2013 and 2018) continued

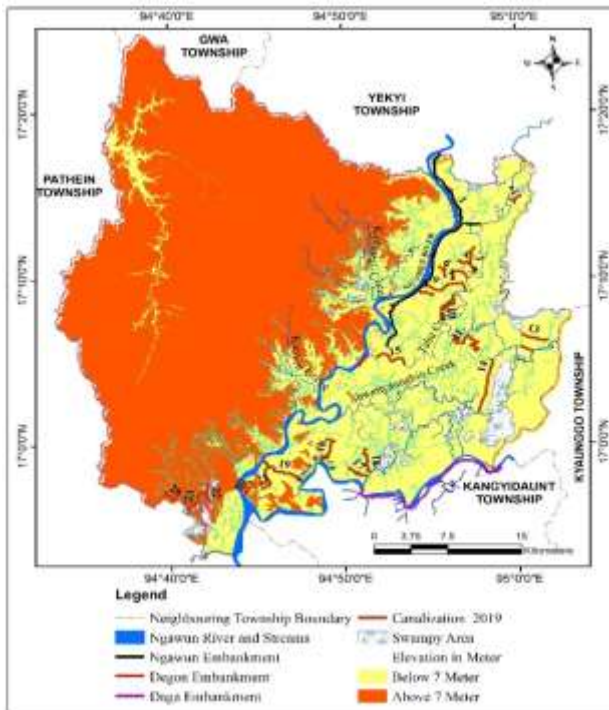
No.	Site of Canalization	Length (km)	No.	Site of Canalization	Length (km)
65	Kyauksayitkon Canal	1.11	97	Thayetkon-Paukhlut	0.59
66	Khathtiya-Nyaunggonlay Canal	5.34	98	Sinchaung	20.01
67	Pauktan Canal	1.87	99	Lahargamon-Myayniaing	7.21
68	Ngawun-Dauntgyi Canal	5.66	100	Udo	3.67
69	Peinnechaung Canal	1.58	101	Kyaynan-Maunghnamagon-Wunloke	3.41
70	Taungthayetkon (Kindat)	1.28	102	Kwaygok	5.35
71	Ngugyaung (Kindat)	2.13	103	Kalarhpan	2.56
72	Layeindan Canal	1.31	104	Pazundaung	2.52
73	Leingon Canal	0.83	105	Kyigangyun	0.94
74	Okshit (Htado Canal)	1.35	106	Wayachaung	3.50
75	Gonnyindan Canal	1.99	107	Kanyin Chaung	8.42
76	No.9 Canal (Kyaye-Mandaing)	6.34	108	Myaukngu Chaung (Gayatkyi Chaung)	4.73
77	Panbinseik Creek	8.97	109	Hpauk Chaung	0.69
78	No. 7 Canal	4.51	110	Nannanbingon	3.48
79	Tagundaing Canal	2.08	111	Kungyungon	1.14
80	Kalawe Canal	2.15	112	Obo	2.61
81	Gyongyongya Canal (Sinlan)	1.13	113	Kyauksalikkon	1.68
82	No.38 Canal	2.77	114	Kunthigyan	1.16
83	No.39 Canal (Mewin Canal)	3.25	115	Ayeyarwady	1.97
84	Volunteer Canal (Sitpingyi)	1.40	116	Zibyugwin	2.08
85	Kyudawyo Canal	1.33	117	Kangon	0.90
86	Byaikgyi Canal (Phayani)	3.12	118	Htanbingyaung	1.26
87	Gomin Canal No.1	3.19	119	Aungdat	3.28
88	Ohnpinzu Canal No.2	5.03	120	Aungdat	3.08
89	Gomin Canal No.12	4.62	121	Aungdat	3.16
90	Gonmin-Natsin-Dedok Canal	5.57	122	Thebyu	2.09
91	Gomin Canal No.13	3.81	123	Ngakywetkon	3.74
92	Gomin Canal No.14	2.31	124	Pwegyaw	1.71
93	Gomin Canal No.15	2.23	125	Kyaukaing	3.23
94	Pauktaw Canal	2.25	126	Kyungon	2.40
95	Tabu Chaung	45.98	127	Kanyinmyaung	3.64
96	Ngabat Creek-Shauk Creek	1.08	128	Hpongyi Chaung	2.72

Source: Irrigation and Water Utilization Management Department, Pathein

Table 4 Site of canalization in Thabaung Township (2019)

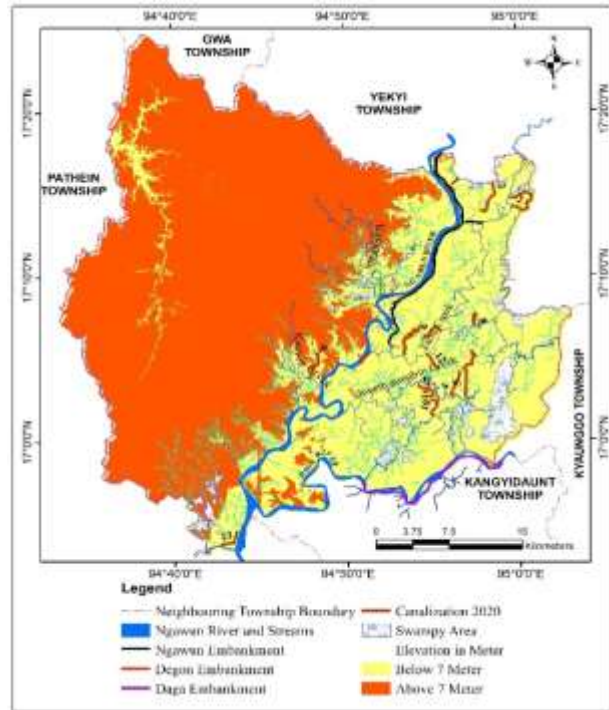
No.	Site of Canalization	Length (km)	No.	Site of Canalization	Length (km)
1	Ngawun Embankment 64/4-67 mile	4.30	14	Number (9) Canal	6.27
2	Upper Akegyi Number (8) Canal	2.01	15	Tabu Chaung Canal	4.11
3	Upper Akegyi Number (7) Canal	2.33	16	Kyauksayitkon Kywelan Canal	4.28
4	Upper Akegyi Number (1) Canal	2.87	17	Ngu Chaung	3.00
5	Upper Akegyi Number (2) Canal	3.44	18	Khwethe Chaung	3.73
6	Upper Akegyi Number (4) Canal	2.35	19	Ngawun Dauntgyi-Shwedaungkyun Canal	5.51
7	Upper Akegyi Number (3) Canal	3.60	20	Kindat-Ngu Chaung	3.92
8	Upper Akegyi Number (5) Canal	1.77	21	Kindat-Daunggyi Canal	3.44
9	Upper Akegyi Number (6) Canal	1.64	22	Letkok Chaung	2.33
10	From Pynmagauk to Htanbingyi Canal	6.44	23	Yekyi Chaung	4.24
11	Number (22) Canal	7.15	24	Nyaung Chaung	0.87
12	Sitpingyi Canal	1.41	25	Umoe Chaung	0.92
13	Kyidawyo Canal	2.94	26	Kayu Chaung	3.03

Source: Irrigation and Water Utilization Management Department, Pathein



Source : Myanmar Survey Department, Yangon
 : 30 meter resolution DEM
 : Irrigation and Water Utilization Management Department, Pathein

Figure 12 Canalization in Thabaung Township (2019)



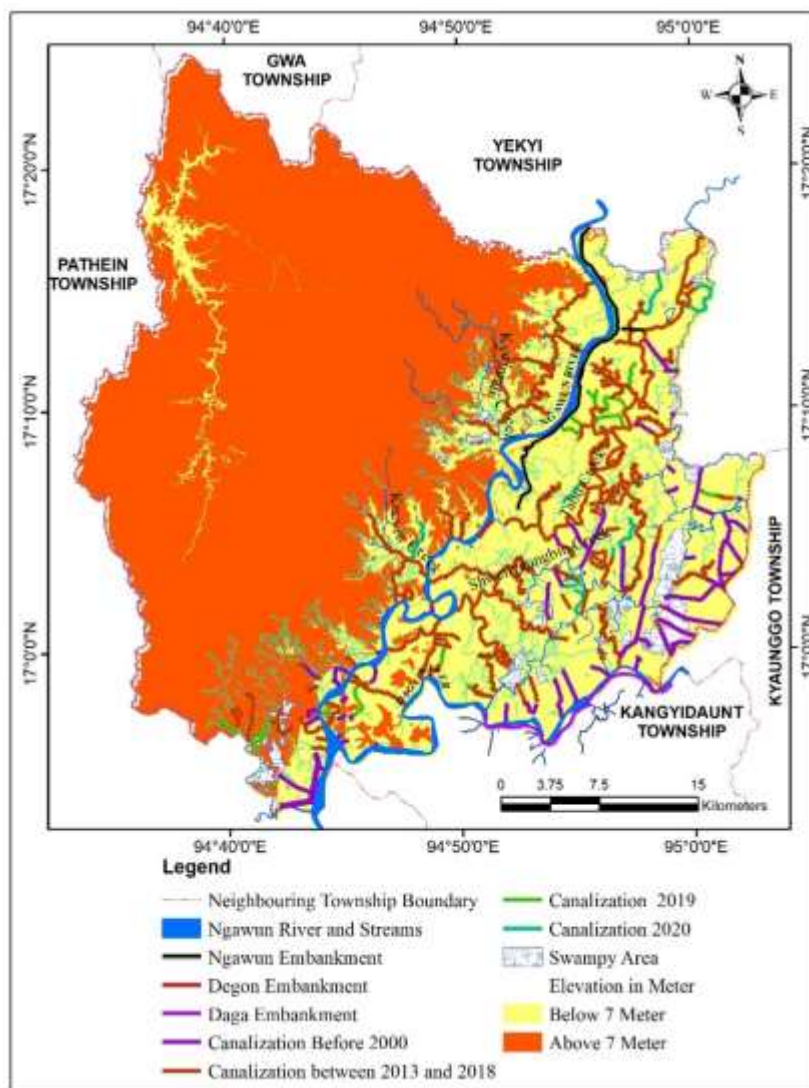
Source : Myanmar Survey Department, Yangon
 : 30 meter resolution DEM
 : Irrigation and Water Utilization Management Department, Pathein

Figure 13 Canalization in Thabaung Township (2020)

Table 5 Site of canalization in Thabaung Township (2020)

No.	Site of Canalization	Length (km)	No.	Site of Canalization	Length (km)
1	Ngawun Embankment	4.67	7	Pyidawthar Chaung	6.51
2	Mayangon Creek-Shaukchaung Creek	6.28	8	Hngetyo Chaung	2.48
3	Ake Creek	4.27	9	Mayin Chaung	4.07
4	Kyaye-Kadatyu Canal	3.34	10	Kwinya Canal	3.20
5	Lahata Canal (Number 22)	6.69	11	Popon Chaung	4.23
6	Yon Chaung	2.87	12	Umaungdaing Chaung	2.23
			13	Thaephyu	2.76

Source: Irrigation and Water Utilization Management Department, Pathein



Source : Myanmar Survey Department, Yangon
 : 30 meter resolution DEM
 : Irrigation and Water Utilization Management Department, Pathein

Figure 14 Canalization in prolonged flood area

Although construction of new canals and canalization of the poor drain creeks in the flood plain area lead by the Irrigation and Water Utilization Management Department since 2013-2014 are found no reduction of the annual prolonged flood is seen.

Conclusion

The factor causing prolonged flood in the study area are due to the physical features (relief, drainage), channel pattern, water level condition of Ngawun River, the construction of embankments, poor drainage condition of the flood plain area and unsystematic canalization. In the rainy season, when the level of water rises it overflows to the lowlands, and with the fall of the water level, it was mainly drained through Ngawun River, Daga River, Tabu Creek, Htanzinhla Creek, Shwenyaungbin Creek, Udo Creek and Hngetpauk Creek. But now embankment have been built along the south of Daga River. As the main drainage has been blocked by the embankments, flooding period within the embankments became prolong. Moreover, monsoon paddy cultivation of the flood plain area is gradually decreasing and harmful to the local people's socio-economic development. Local authority urgently perform river training of Ngawun River and systematic canalization of small streams and creeks over prolonged flood area.

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ဦးအုန်းမြင့်၊ (၁၉၇၆) ဧရာဝတီမြစ်ဝကျွန်းပေါ်အတွင်းရေကြီးမှုအစီရင်ခံစာ (၁+၃)၊ ဆည်မြောင်းဦးစီးဌာန၊ လယ်ယာနှင့် သစ်တော ဝန်ကြီးဌာန။