

CHAPTER 3

DRAINAGE SYSTEM

3.1 DRAINAGE TYPES

3.1.1 RIVER SYSTEM OF KOCH BIHAR DISTRICT

3.2 NATURE OF DRAINAGE SYSTEM

3.2.1 CHARACTERISTICS OF THE RIVER

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3.4 SILTATION PROBLEM

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18 DEC 2012

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3.1. Drainage types

The main rivers of the District are Sankosh, Raidak I, Raidak II, Kaljani, Torsa, Jaldhaka and Tista (Table 3.1). They are all flow from north-west to south-east. They are running almost parallel to each other and flowing towards Bangladesh. Mostly they are dendritic in pattern. The drainage map has been prepared using the Satellite Imageries of IRS 1C and 1D, LISS III and LISS IV, Survey of India Toposheet No.78 B/14, 78 B/15, 78 F/7 78 F/11 78 F/15 and 78 F/16. It is observed from the drainage map that the study area has dendritic drainage pattern. The rivers of this District flow in a slanting course from north-west to south-east (Fig. 3.8). Most of the river take their origin in the Himalaya, and enter the District from the District of Jalpaiguri and after passing through the District, flow into Bangladesh to join the Brahmaputra. Sometimes they are branching into different channels.

3.1.1 River System of Koch Bihar District

The District of Koch Bihar is the land of rivers. There are many large and small rivers flowing over the District. The major rivers which are flowing over different Blocks of the District are given below:

Table 3.1 Major River in Koch Bihar District.

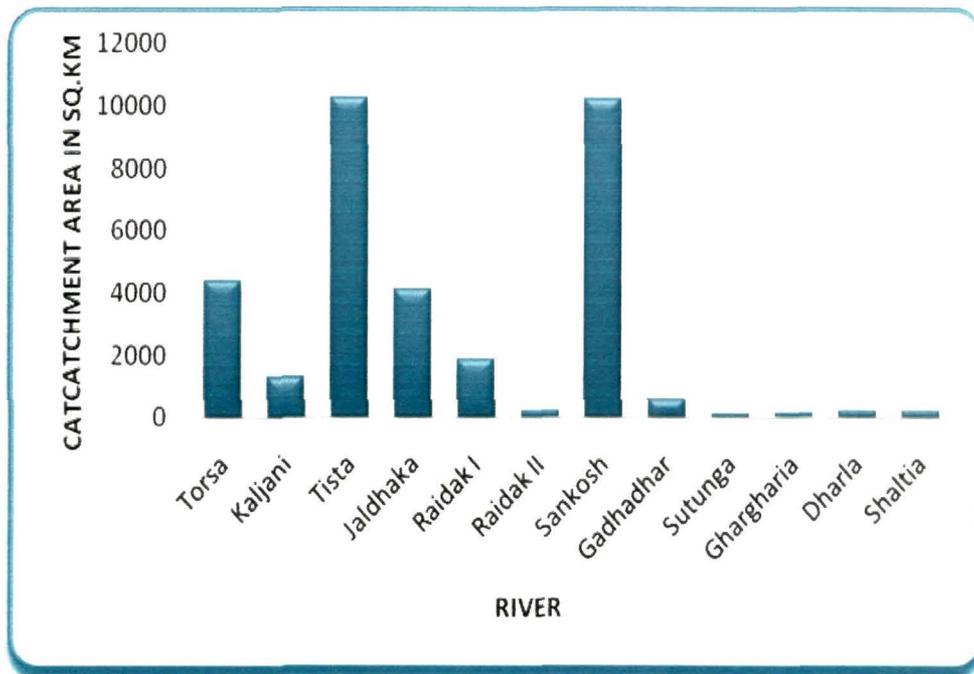
Sl. No.	Major River in Koch Bihar District	Block over which flowing
1	Tista	Mekhliganj and Haldibari
2	Jaldhaka/ Mansai	Mathabhanga I&II, Dihata I and Sitai
3	Torsa	Koch Bihar I & II, Tufanganj I and Dinhata I
4	Kaljani	Koch Bihar II, Tufanganj I and Dinhata I
5	Raidak I	Tufanganj I & II
6	Raidak II	Tufanganj II
7	Sankosh	Tufanganj II

The main rivers and their length, catchment area, peak discharge and highest flood level of different Blocks of the District are given in the table 3.2.

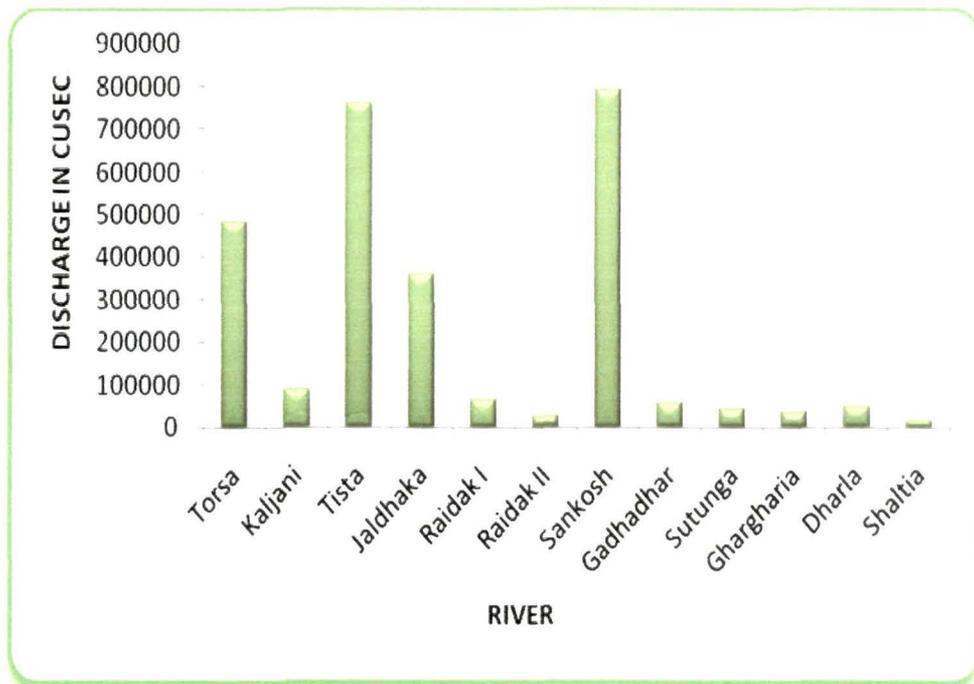
Table 3.2 Hydrological parameters of major rivers of Koch Bihar District.

Sl. No.	Name of the River	Name of the Block	Length in km	Total catchments area in sq. km.	Peak Discharge in cusec.	Highest Flood level in m
1	Torsa	Koch Bihar I & II	340	4350	4,82,200	41.45
2	Kaljani	Tufanganj I, Koch Bihar I & II	95	1250	87,364	N.A.
3	Tista	Mekhliganj & Haldibari	232	10205	7,61,180	66.45
4	Jaldhaka	Sitai, Mathabhanga I & II,	192	4092	3,57,600	49.60
5	Raidak I	Tufanganj I	90	1820	64,190	36.36
6	Raidak II	Tufanganj I & II	55	175	26,048	
7	Sankosh	Tufanganj II	280	10159	7,92,000	30.91
8	Gadhadhar	Tufanganj I & II	85	550	54,826	N.A.
9	Sutunga	Mathabhanga I	65	110	42,868	N.A.
10	Ghargharia	Koch Bihar I & Tufanganj I	60	120	33,601	N.A.
11	Dharla	Mekhliganj & Mathabhanga I	120	200	48,699	N.A.
12	Shaltia	Mathabhanga II, Koch Bihar I & Dinhata II	60	180	15,917	N.A.

Source: CWC, Jalpaiguri.



(A)



(B)

Fig. 3.1 Total catchments area in sq. km (A) and discharge in cusec (B) of main rivers of Koch Bihar, (Ref. Table 3.2).

Table 3.3 Different location of river site and their length and catchments area from the origin.

Sl. No.	River	Site	Location	Length of the River up to the site in km.	Catchments area in sq.km.
1	Tista	Sankalan	88°32'E,27°30'N	70	4200
2	Tista	Khanitar	88°30'E,27°20'30"N	114	5100
3	Tista	Tista Bazar	88°25'E,27°3'N	134	7714
4	Tista	Coronation bridge	88°27'35"E,26°54'20"N	158	8147
5	Tista	Sevok	88°28'7"E,26°53'N	160	8179
6	Tista	Gajoldoba	88°36'30"E,26°45'5"N	177	8503
7	Tista	Domohoni	88°45'45"E,26°32'N	206	9432
8	Tista	Mekhliganj	88°55'43"E,26°19'17"N	249	10205
9	Jaldhaka	Nagrakata	88°51'40"E,26°52'30"N	68	804
10	Jaldhaka	NH 31	88°58'30"E,26°32'8"N	103	1590
11	Jaldhaka	Mathabhanga	89°13'27"E,26°20'25"N	149	3039
12	Torsa	Hasimara	89°21'E,26°48'48"N	64	3920
13	Torsa	Ghugumari	89°27'30"E,26°16'45"N	122	4530
14	Raidak I	Chepan	89°44'30"E,26°32'7"N	14	124
15	Raidak I	Tufanganj	89°38'45"E,26°18'50"N	108	520
16	Raidak II	Barobisha	89°40'E,26°31'N	110	4573
17	Sankosh	LRP	89°52'E,26°31'N	140	8230
18	Sankosh	Golokganj	89°52'E,26°31'N	176	8521

Source: CWC, Jalpaiguri.

Tista

This is the most important river in the western part of the District. The Tista originates in the lake Chalamu in Tibet (Barman 2007). After flowing through Sikkim, Darjeeling and Jalpaiguri District, it enters from the north-west to the District at Buxiganj of Mekhliganj Block and is flowing nearly 35 km over the villages of Boxiganj, Khasbhas, Par Mekhliganj, Daripattani, Jharsingeswar, Kharkharia, Andaran Devottar and Kuchlibari of Mekhliganj Subdivision of the District (Fig. 3.9). Then it enters to Bangladesh and meets with Brahmaputra in Bangladesh. It separates Haldibari and Mekhliganj Block. The river bed is wide about 1–2 km in the District. The bed is sandy. Within the District it has no tributary or distributaries. During the monsoon period this river distends its bank; both in size and turbulence. The length of the river from its origin up to Bangladesh border is 232 km and having

a total catchments area of about 10,205 sq. km. The Tista receives heavy monsoonal rainfall from its catchments area and causing very rapid rise in water level within a short time. The calculated peak discharge of the river during flood near Bangladesh border is 761,180 cusec. The highest flood level at Mekhliganj was 66.45m in 1996.

The floods of the river are extremely flash in nature. The catchment area generally gets rainfall of high intensity. The total rainfall recorded in these catchments during flood season is 30,575 mm. The river is highly prone to flood from Tista Bazar to Mekhliganj. The velocity of the river is high due to steepness of its bed slope.

Table 3.4 The approximate slope in various reaches of the river is tabulated below for ready references.

Sl. No.	Description of the Reach	Length of River (km.)	Slope	Normal travel time
1	Sankalan to Khanitar	44	6m / km.(167:1)	Around 4 hrs
2	Khanitar to Tista Bazar	20	4m/km.(250: 1)	1 to 2 hrs
3	Tista Bazar to Coronation bridge	24	2.5m/km(400:1)	1 to 2 hrs.
4	Coronation bridge to Domohoni bridge	48	1m/km(1000: 1)	5 to 6 hrs.
5	Domohoni bridge to Mekhliganj	43	0.5m/km.(2000:1)	5 to 6 hrs.

Source: CWC, Jalpaiguri.

Jaldhaka

The River Jaldhaka originates from the Bedang Lake in Sikkim. After flowing through Sikkim, Bhutan, Darjeeling and Jalpaiguri District it enters into the District from north-west in Dhulia Baldiahati of Mekhliganj Subdivision. It is flowing over Mekhliganj, Mathabhanga I & II, Sitalkhuchi, Koch Bihar II, Dinhata I and Sitai Blocks. It enters Bangladesh at Barabangla of Dinhata Subdivision and meets with Bhrahmaputra in Bangladesh. The Jaldhaka is known as Mansai at Mathabhanga and Singimari at Dinhata. It has many tributary in this District (Fig. 3.2 , 3.3 & 3.4). They are Mujnai, Diana, Dudua, Sutunga, Dolong, Rangati, Khutamara, Bura Dharla etc.

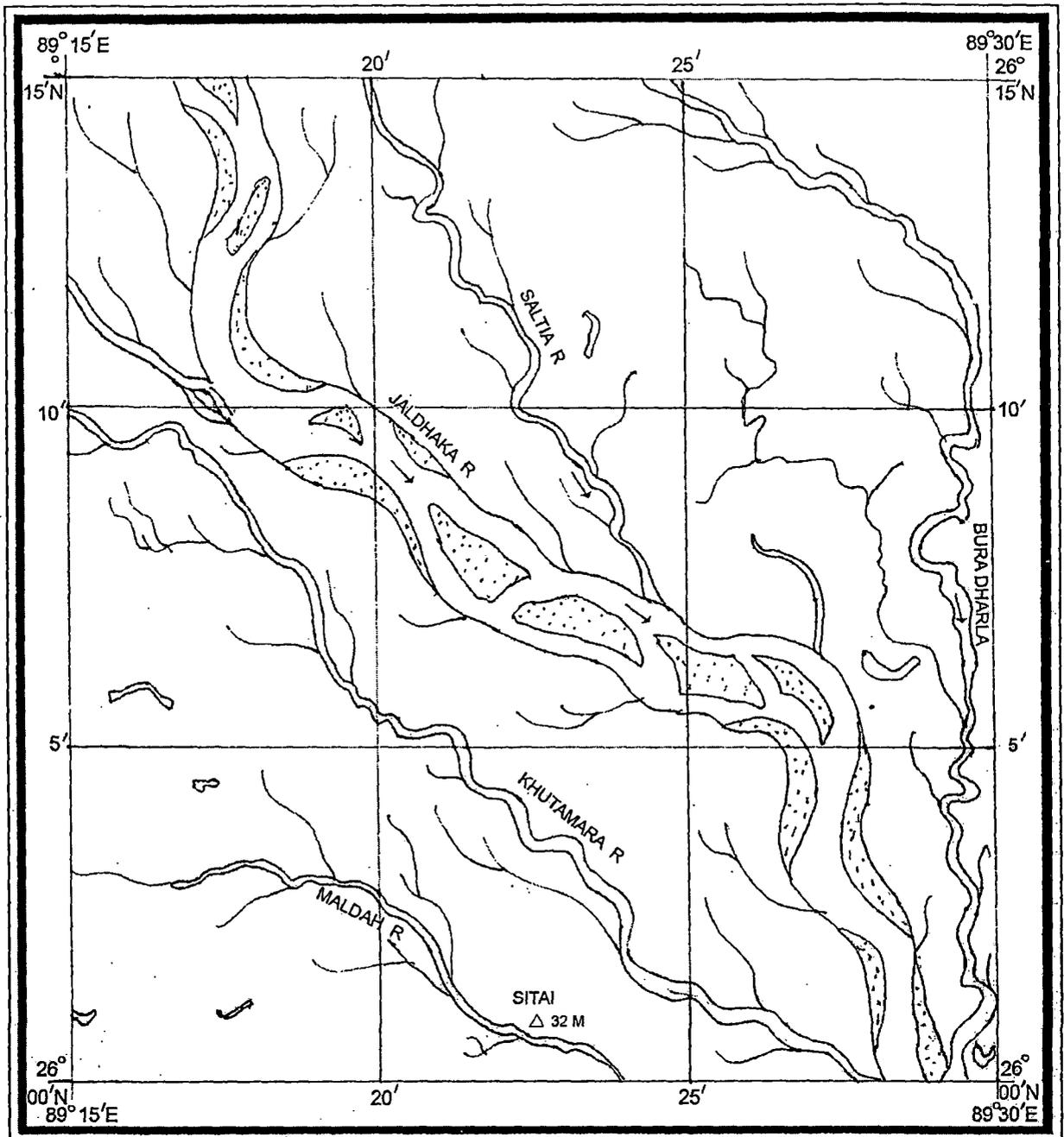


Fig. 3.2 Formation of braided channel pattern of the River Jaldhaka-Mansai based on Satellite Imageries of IRS 1C and 1D, LISS III and LISS IV and SOI Topographical map No. 78F/8, R.F. = 1:178125.

Total length of the river is 192 km, among which 98 km is in the District. The length of Jaldhaka from its origin upto Mathabhangha is 175 km and total catchments area is 4,092 sq. km upto Mathabhangha. The river has 1-2 km wide bed. The river is much prone to flood. It frequently changes course and makes water logged areas. The river is faded by heavy monsoonal rainfall. The Peak discharge of the river at Mathabhangha is 357,600 cusec. The highest flood level at Mathabhangha is 49.60m in 1972.

Torsa

Torsa means angry river. It rises from Chumbi Valley in Tibet (Pal 2000). Then it is flowing through Bhutan and Jalpaiguri District and enters the District from the north in Lafabari of Mathabhanga and Buxibas Putimari of Koch Bihar Subdivision. Then it flows over Koch Bihar I, Mathabhanga II, Koch Bihar II, Tufanganj I, and Dinhata II Blocks. It has a tributary known as Buri Torsa in the District and meets with Jaldhaka. Ghargharia River meets with Torsa in the Tufanganj Subdivision. Near Deocharai and Balarampur Torsa meets with Kaljani and then it flows to Bangladesh and merges with Brahmaputra (Fig. 3.3 & 3.5). It is the main river of the District. Nearly every year Torsa experiences flood in the district. The bed is about 3 km broad in the District and sandy. The bank is very high on one side and shelving on the other (Plate 3.1). The water is cool, limpid and sweet. In Ghugumari, the peak discharge of the river is 482,200 cusec. The total length of the river from the origin upto Ghugumari is 340 km. and having a total catchments area is about 4,350 sq. km. The highest flood level at Ghugumari is 41.45m in 1993. The Torsa catchments also receive heavy monsoon rainfalls which fierce on river flow causing very rapid rise in water level within a short period.

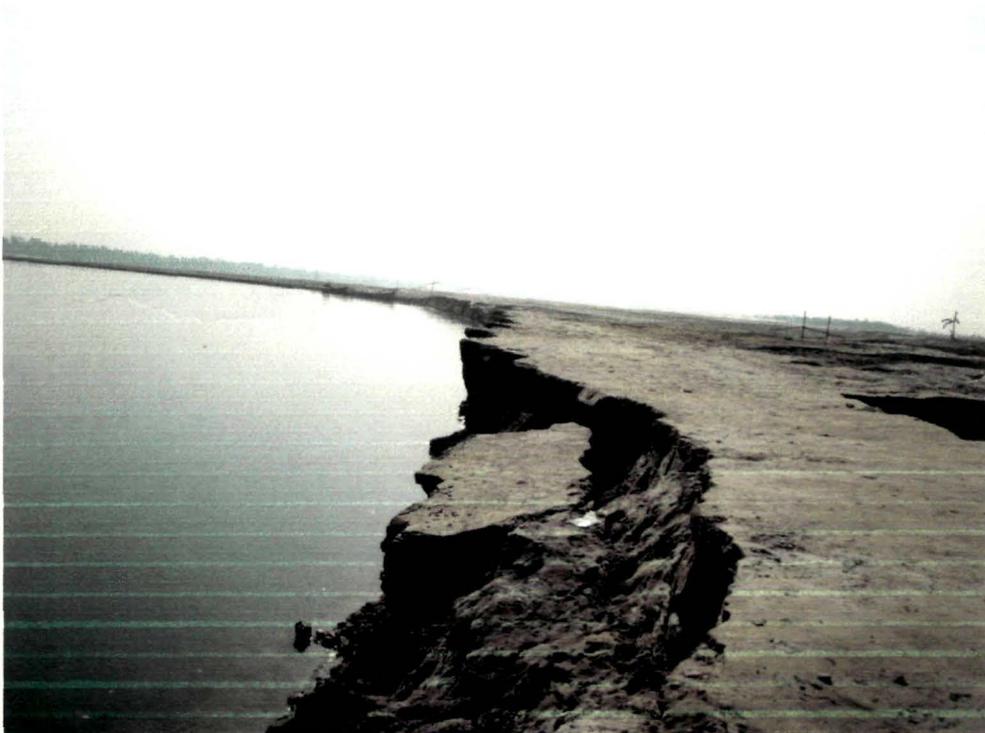


Plate 3.1 Highly erodible banks along the Torsa River at Satmile.

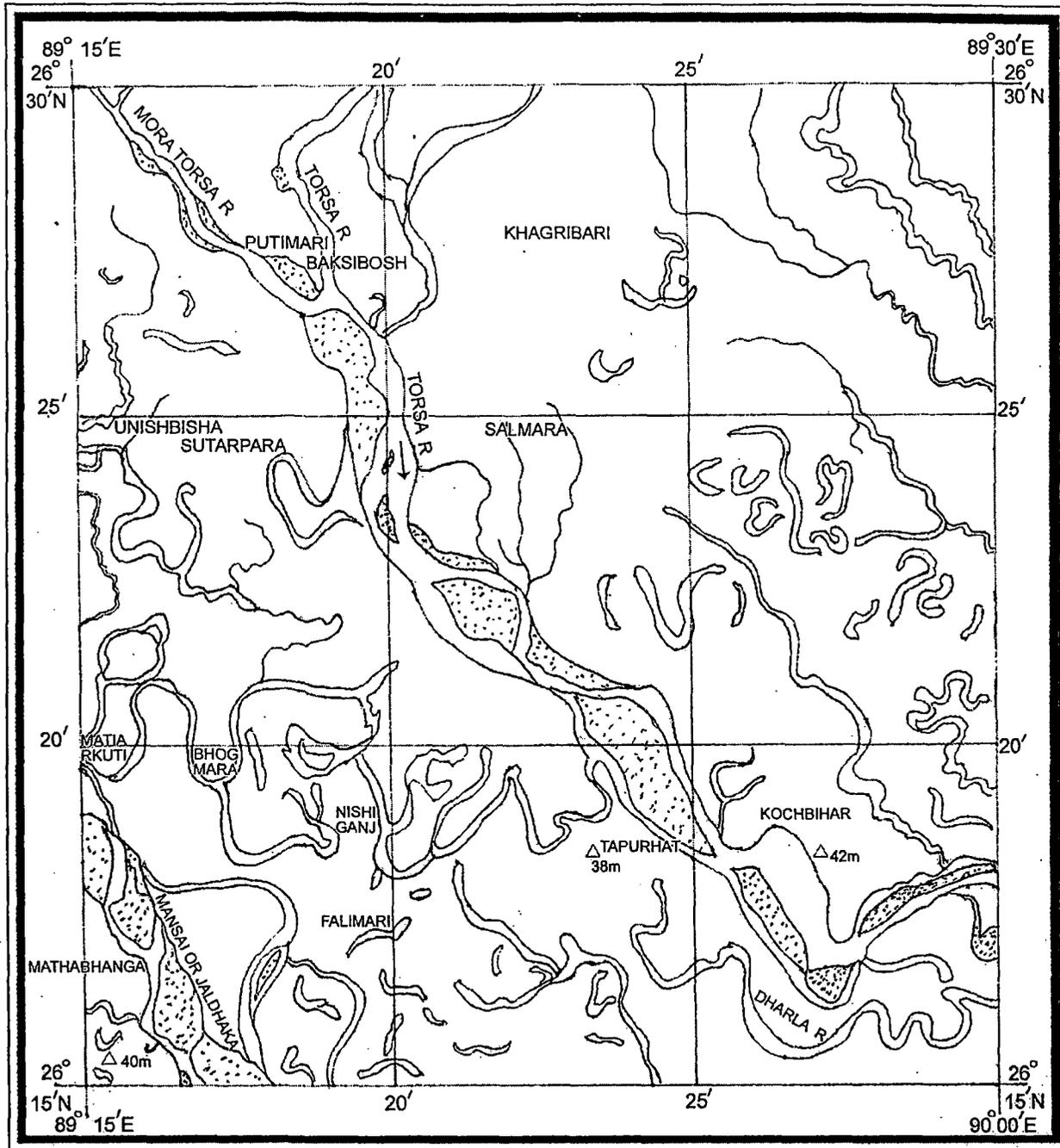


Fig. 3.3 Formation of braided as well as anastomosing channel pattern of the River Torsha and Jaldhaka based on Satellite Imageries of IRS 1C and 1D, LISSIII and LISS IV and SOI Topographical map No. 78 F77, R.F. = 1:178125.

Kaljani

River Kaljani is formed by the combined waters of the Alaikuri and Dima at Western Duars of Alipurduar Subdivision. Both the rivers originate in Bhutan hills (Majumdar 1977). It enters the District from Jalpaiguri District in the north in Kholta of Koch Bihar Block I and passes through Koch Bihar I and Tufanganj-I Blocks and ultimately meets with Torsa near Deocharai and Balarampur of Tufanganj

Subdivision (Fig. 3.5). Ghargharia is a tributary of Kaljani which merge with it in Maruganj of Tufanganj Subdivision. It is a quick flowing river with a formed bed and shelving banks. It has a good depth and is about one km wide. It created devastating flood in 1993 in the District. The peak discharge of the river at Maruganj is 87,364 cusec.

Raidak I

Raidak I or Dipa Raidak is a branch of Raidak. It enters the District from Jalpaiguri District in the north at Sikdarerkata of Tufanganj Subdivision. It is flowing fully in Tufanganj Block I. It is flowing through Bansraja, Dhalpal, Shalbari, Andaranfulbari, Kamatfulbari, Chamta, Nakkatigachh, Dwiparpar, Rajarkuthi, Debogram Balabhut villages of Tufanganj Block I and enters to Bangladesh to meet with Dudkumar (Fig. 3.5 & 3.6). The total catchments area upto Tufanganj is about 635 sq. km and length is 90 km. The river catchments area also gets rainfall of high intensity. The peak discharge of the river at Balabhut is 64,190 cusec. The highest flood level at Tufanganj is 36.36 m in 1993.

Raidak II

River Raidak II originates from the mount Chumatarhi in Tibet. It flows through the Western Duars of Jalpaiguri District and enters the District from the north in between Khagribari and Rampur. Then it flows through Rampur, Madhurbhasha, Takoamari, Jaldhoa and Mahishkuchi villages of Tufanganj Block II and meets with the river Sankosh or Gangadhar in the south of Jaldhoa of Tufanganj Subdivision (Fig. 3.7). The peak discharge of the river in Tufanganj is 26,048 cusec. The total catchments area from Bhutanghat to Sankosh is 175 sq. km and length is 55 km.

Sankosh or Gangadhar

Sankosh or Gangadhar is flowing through the eastern part of the District in between Assam and West Bengal. It enters the District from north in Rampur I and flowing through Rampur I & Rampur II, Falimari, Mahishkuchi I & II GPs of Tufanganj Block II. At Garbhanga of Rampur II GP, a small tributary meets with it. Then the river enters to Assam and lastly it meets with Brahmaputra in Bangladesh (Fig. 3.7). The total catchments area upto Golokganj (Assam) is 10,159 sq. km and length is 280 km. The catchments also experience very heavy rainfall during the flood season. The peak discharge of the river in Tufanganj is 792,000 cusec. The river has large

sand banks in Bhanukumari and Falimari. The highest flood level at Golokganj is 30.91m in 1993.

Dharla

River Dharla originates from Ramsai in Mainaguri, District Jalpaiguri and when it is flowing in the downstream in the Mainaguri town it is known as river Zarda. The river enters in the District of Koch Bihar in the Panisala G.P. of Mekhliganj Subdivision, and finding its way without any change of direction or about 9 km through Mekhliganj Subdivision and, leaving Changrabandha on its right bank, enters into Bangladesh and again enters into the Indian territory near Kurshamari of Mathabhanga Subdivision covering and ultimately outfalls into the river Mansai (Jaldhaka) near Panaguri village in Koch Bihar (Fig. 3.4 & 3.9). The total catchments area of the river Dharla is nearly 120 sq. km. The peak discharge of the river at Kodaldhowa, Mathabhanga is 48,699 cusec.

Sutunga

The river Sutunga originates from Dharaiguri area at Mainaguri, District Jalpaiguri. The river is flowing close to the river Jaldhaka (Mansai) for a length of 102 km. The river enters into the District near Kamat Changrabandha of Mekhliganj Subdivision and ultimately outfalls in the river Mansai just below the Mathabhanga Town (Fig. 3.4). The river Sutunga is mainly fed by rain water and discharge an area of about 250 sq. km. The discharge is also supplemented by the discharge of underground springs. Discharge is much lower and is nearly 2000 cusec in dry season. But the rain water flow coming from catchments area of 200 sq. km carries a considerable discharge of 42,868 cusecs during the monsoon period. The rainfall precipitation in the catchments area of the river is 3000 mm to 4000 mm per year. The fluctuation of discharge of the river is mainly responsible for active erosion along the bank of the river. The right bank of the river at West Khaterbari is being severally affected by the active erosion of the river for total length of 325m. The erosion is engulfing the valuable homestead lands, houses etc.

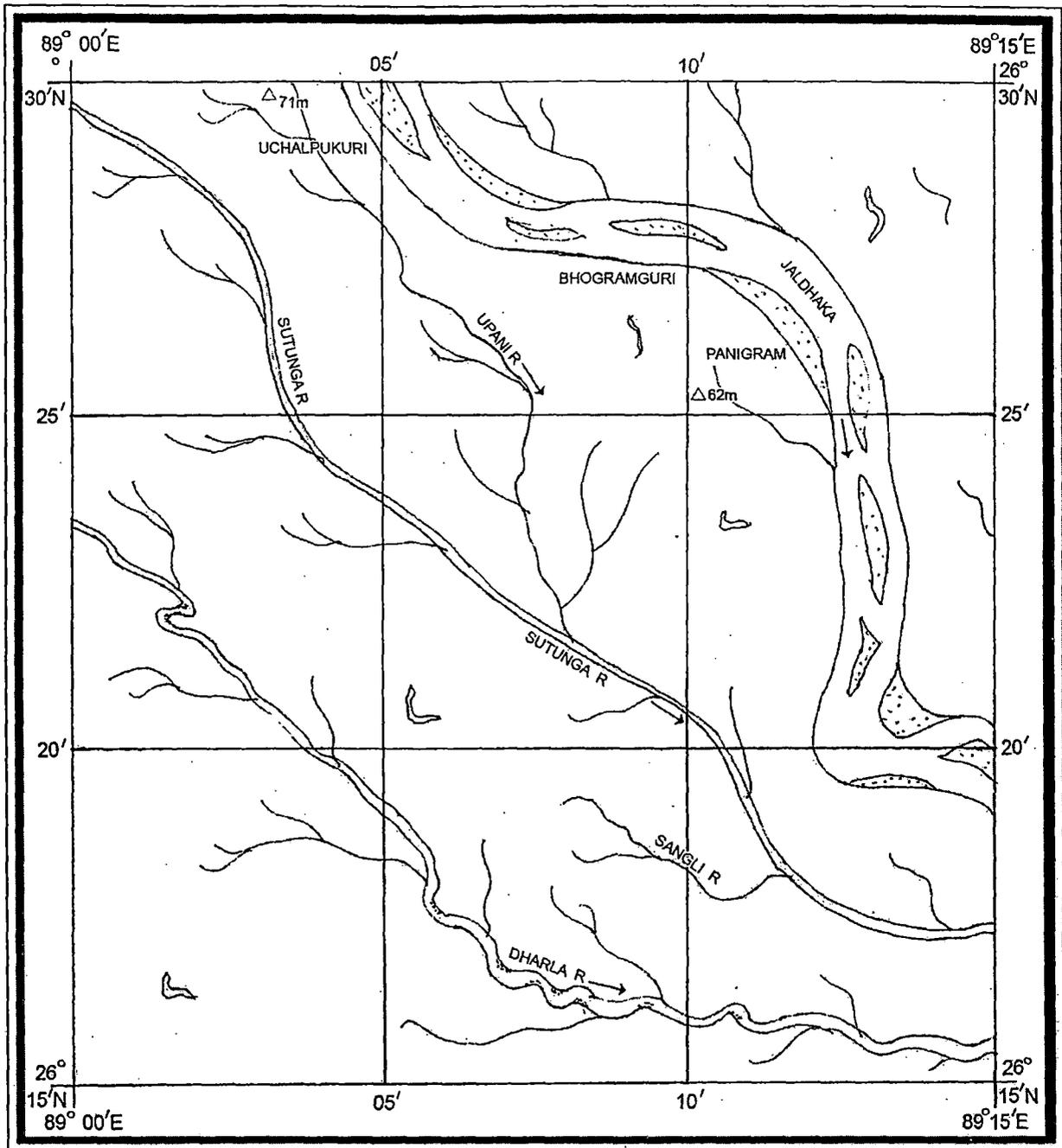


Fig. 3.4 Formation of braided channel pattern of the River Jaldhaka-Mansai, Sutunga and Dharla based on Satellite Imageries of IRS 1C and 1D, LISSIII and LISS IV and SOI Topographical map No. 78F/3, R.F. = 1:178125.

Khutamara or Giridari or Maldah

It is a small river and flowing through Sitalkuchi and Sitai Block of the District. The upper course is known as Khutamara and the lower course is known as Giridari. It is an eastward offshoot of small river known as the Maldah. This river is flowing parallel to the Bura Dharla and falls into the Singimari in Mahishmuri near Bangladesh border (Fig. 3.2). This River is not flood prone.

Kumlai

It is a branch of the river Diana, used to meet the Jaldhaka on its left bank in Jalpaiguri District but it is flowing through the old bed of the Jaldhaka, until it falls into the big river through Ksheti village of Fulbari Grampanchayet of Mathabhanga Subdivision. It becomes dangerous during flood.

Gilandi

It is a branch of river Diana. It is only the southern section of a small stream called the Rangit which is a branch of the river Diana. It enters the District from north-west in Tengnamari and after flowing about 4 km it turns south-easterly direction through Fulbari and falls into the Jaldhaka at Giladanga. It becomes fordable during dry season but swells into a turbulent little rivulet during the rains, over flooding the banks and sometimes causing much loss of cultivators. It is a dangerous river during flood as the difference between the high flood and the normal level is very great, and as the floods rise and subside sometimes within 24 hours.

Dudua

It is a pretty big river of duars of West Bengal. It is formed by the combination of several small rivers like Kalua, Barabank, Dim Dima and Tasati, Nanai, Angrabasha. It enters the District from the north at Dekalikuba Hat of Fulbari GP and flow south-eastwards, forming the boundary between Mekhliganj and Mathabhanga Subdivision and meets the Jaldhaka at Inderkhuti. Flash floods are frequent and sometimes destructive.

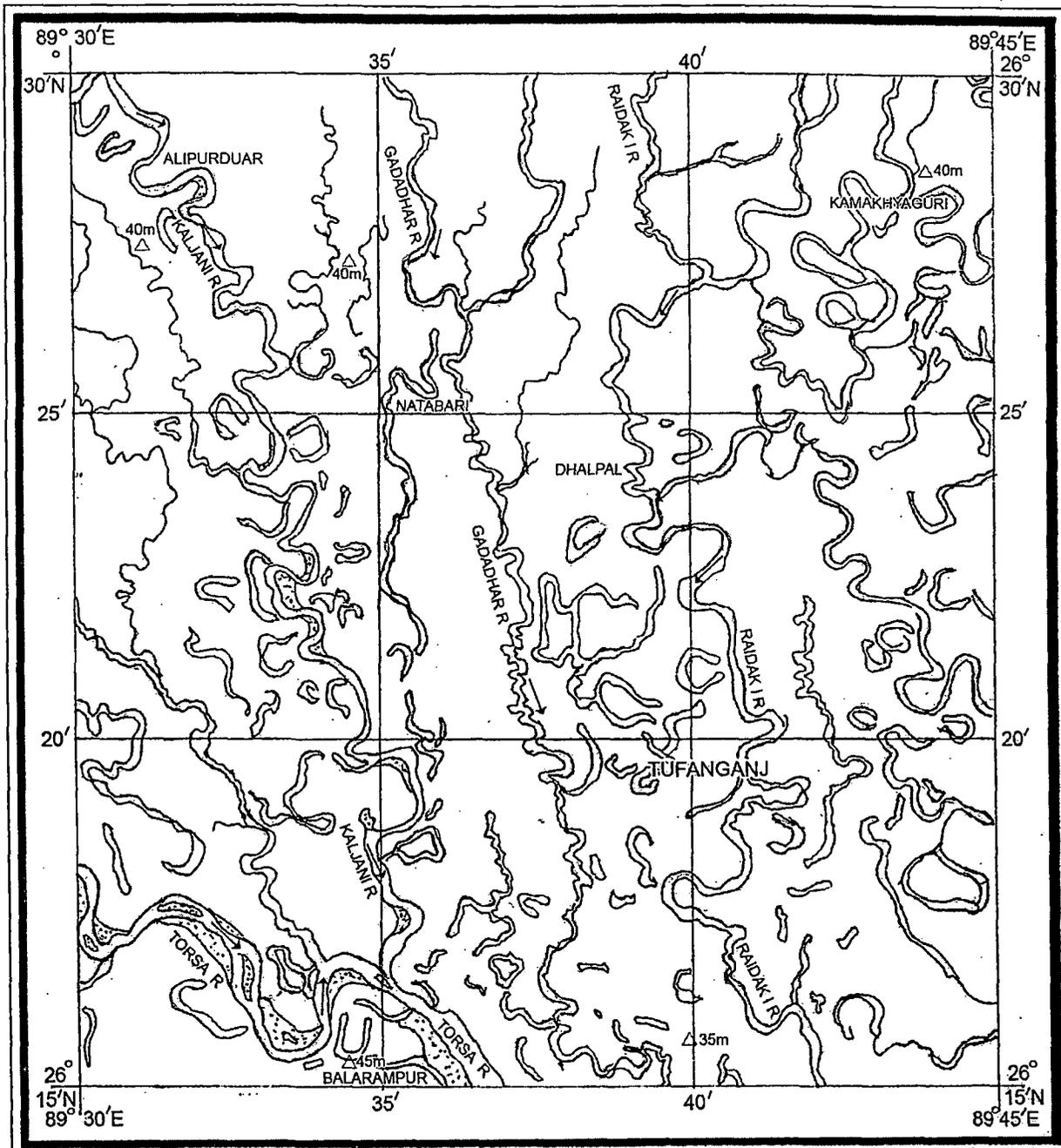


Fig. 3.5 A correlation between the relief and drainage condition based on Satellite Imageries of IRS 1C and 1D, LISS III and LISS IV and SOI Topographical Map No. 78F/11, R.F. = 1:178125.

Dolong

It is a left bank tributary of Jaldhaka-Mansai. It rises in western duars and enters the District from north in Soulhari. It passes over Soulhari, Ramthenga, Dawaguri Ruidanga, Latapota, Angerkata Paradubi, Bhanurkuthi villages and it meets with Mansai at Dolongerkuthi (Fig. 3.8). Except rainy season the river remains shallow. In the rainy season sometimes occurs flood.

Mujnai

It is a small river of northern Koch Bihar. It rises in the southern slope of the Bhutan hills, and flows southerly over Jalpaiguri District and enters Koch Bihar District at Soulmari. It passes over the Soulmari, Singijani, Mukuldanga, Matiyarkuthi, Bhogmara, Dumniguri, Kalpani, Atharakotha, Ghegirghat, and Mawamari of Mathabhanga Subdivision. It is a left bank tributary of Jaldhaka and meets with the Jaldhaka in Chokherkata. Yearly water flow of the river is 70,000 cusec.

Saniajan and Suti

It is a small stream of Mekhliganj Subdivision. It originates in Baikunthapur forest of Jalpaiguri District. It is formed by the union of two small rivers - Shaniajan and Khutamara and enters the District in Bhotbari of Mekhliganj Subdivision. It passes over Kuchlibari and flows about 33 km within the District. It meets with the Tista near the Bangladesh border. It has a branch called the Suti Nadi. This comes out in Phulkadabri of Mekhliganj Subdivision and is flowing south easterly direction about 15 km over the District and again meets with the main river of Saniajan in Kuchlibari near Bangladesh border (Fig. 3.9). The bed of the river is sandy and the river is usually tame. But at times it can be turbulent.

Gadadhar

The river Gadadhar originates from Pamuse peak of Sinchula hill in Baxaduar. There it is known as the Jainti River. And flows through Jayanti, Chunikjhora, Padangpara, Telchangrapara, Salsalabari, Khatapara, South para, Kajirpara of Jalpaiguri District and enters the District of Koch Bihar from the north between Khashbash and Chhat Rampur, and flows south over Natabari, Andaranfulbari, Ghogarkuthi, Shikarpur, Balaghat, Deocharai, Santoshpur, Jhaljhali, Nepalerkhata, Balabhut, Laukuthi and meets with Torsa-Kaljani in Bangladesh (Fig 3.5 & 3.6). It has a current all round the year. It becomes shallow in winter, and is then fordable in many parts of its course. The banks are steep and the bed is narrow. The river is much prone to flood and bank erosion is common along the river side. The river also changes its course.

Ghargharia

It is a left bank tributary of Torsa. It is a combination flow of three small rivers. They are Kurmi, Chapar and Sekhakhari and they originated from Chilapata forest of Jalpaiguri District. They meet at Sonapur of Jalpaiguri District near Koch Bihar border and name as Ghargharia. It is running about 60 km and merges with Torsa at Sholadanga village of Falimari GP. This river is very deep and furious at the period of monsoon and causes heavy flood in Koch Bihar I and Tufanganj I Blocks (Fig. 3.8). Almost all the feeders of the river are moribund now and the river itself has very little water except during the rains. But as it has a narrow steep channel, it may become turbulent at height of the monsoon.

Sanfola

It is a right bank small tributary of Raidak I in Tufanganj I Block. It is dry in dry season but furious in rainy season. During flood season it become danger for the inhabitant of Andaranfulbari, Chamta, Lohagari, Kamatfulbari and Kuthibari and meets with Raidak I in Kamatfulbari. In the flood period it connects Gadadhar and Raidak I and havoc water passes from Gadadhar to Raidak I (Fig. 3.8).

Bura Raidak/ Masan Kura Nadi

It is a small river of Tufanganj II Block. The Masan Kura Nadi originates from Rasik Bill near Takoamari forest and flows towards southern direction through Bakla. A small river Bura Raidak meets with it near Buri Bamnir Hat. The Masan Kura Nadi flows over Dhaldabri, Boxirhat, Taraganj, Balakuthi, Mansai and enters Bangladesh. Again it enters to this District after passing a few km in Bangladesh and merges with Raidak I at Debagram near Bangladesh border (Fig. 3.8). It is a very small river but it is perennial and during monsoon it becomes a large river. Sometimes it creates havoc flood with others large rivers of the Block.

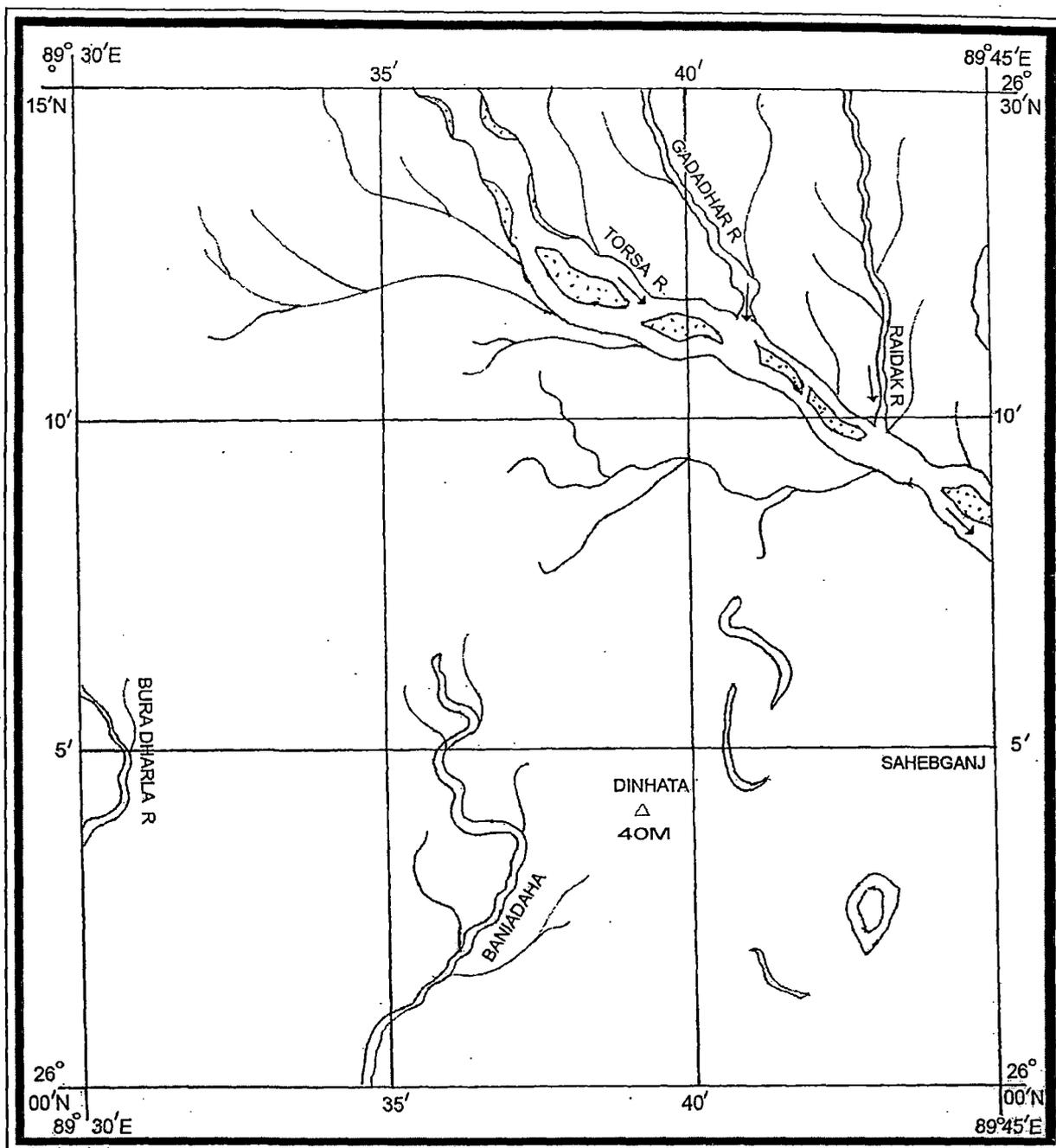


Fig. 3.6 Formation of braided channel pattern of the River Torsa and Baniadaha based on Satellite Imageries of IRS 1C and 1D, LISS III and LISS IV and SOI Topographical map No. 78F/12, R.F. = 1:178125.

Shaltia

Shaltia is a small river like a canal. Shaltia originates from Chheramari village under Unishbisha Grampanchayet of Mathabhanga Block II. It is flowing towards south over Mathabhanga II, Koch Bihar I and Dinjata I Blocks nearly 60 km and meets with Bura Dharla in Dinjata Subdivision (Fig. 3.8). Though the river is small but it created many troubles for the two lakh people of 12 Grampanchayets of three Blocks of the District. Already more than 17,000 hectare of lands become

unsuitable for cultivation due to sand cover, 1100 houses damaged and 110 people died. The main problems are bank erosion and lands are becoming dry as the river absorbing water from nearer lands and thus lands become barren. The peak discharge of the river is 15,917 cusec.

Bura Torsa/ Mora Torsa

Bura Torsa is an abandoning channel of river Torsa is flowing west, north and east of Nilkuthi of Koch Bihar town. It passes to the west of the Bhojanerpur, and ultimately joined the Torsa (Fig. 3.8).

Baniadaha

It is a small branch of river Torsa. It issues out of Shaktibas hat and flows over Panishala, Gosaiganj of Koch Bihar II Block and over Bhetaguri, Burirhat Kayalidha, Basantirhat Gitaldaha and meets with Singimari at Bangladesh (Fig. 3.6 & 3.8). During monsoon period the river become furious as excessive water of the river Torsa began to flow over this small river and creates flood adjacent areas of the river.

Upani

It is a small branch of Jaldhaka-Mansai, and tributary of Sutunga. It lays out at Boldirhati of Mekhliganj Subdivision and flows over Gopalpur, Kesabari, Nayarhat and merges with river Sutunga at Nayarhat (Fig. 3.8). At the monsoon period it becomes over flooded but others time it carries little water.

Chenakata or Nenda

It is a small branch of river Sutunga, issues out of in the south of Chat Jamaldah of Mekhliganj Subdivision and passing over Gopalpur, Nayarhat, Bairagirhat, Ashokbari, Chenakata, Shikarpur Kurshamari, Jorpatki and meets with Mansai at Shibpur of Mathabhanga Subdivision. It's bed becoming more and more irregular and bank erosion is common.

Bura Dharla or Dharla

It is an old bed of Dharla which lies south of present bed. And passes over Gangdhar, Vaorthana, Gadaikhora of Sitalkuchi Subdivision and meets with Mansai near Jalduar (Fig. 3.2 & 3.8). The entire beds are very irregular, being a series of

curves and abrupt bends all along the course. It becomes dry during the dry and winter season and during the rains the water does not raise high except after heavy rains.

Buri Tista

The Buri Tista is an erratic river and constant changes its course. There are now three different beds of the in existence. One flows outside the District, near western border of Bara Haldibari (Fig. 3.8). The second flows near Dewanganj. These two channels are now dead and are called Mara Tista and Bura Tista respectively. The third is the existing channel of the river flowing near Mekhliganj.

Banti

It is a small river of Koch Bihar Block I. It originates near the Doldali village of Thaneshwar GP. It meets with the river Ghargharia at Siddheswari. The basin areas of the river are nearly 200 sq. km and it carries nearly 2000 cusec water in a year. The river become furious during flood season and bank erosion is very common in Gopalpur GP of Koch Bihar Subdivision. It is a narrow river of only 28m wide in most places. So river cannot carry water if rains heavy pours.

Jorai

Jorai is a small tributary of river Raidak II. It is rising in the Bhalkaduar and flowing over Dewtikhata Naziran, Rampur, and at Garbhanga it meets with river Gangadhar or Sankosh (Fig. 3.8).

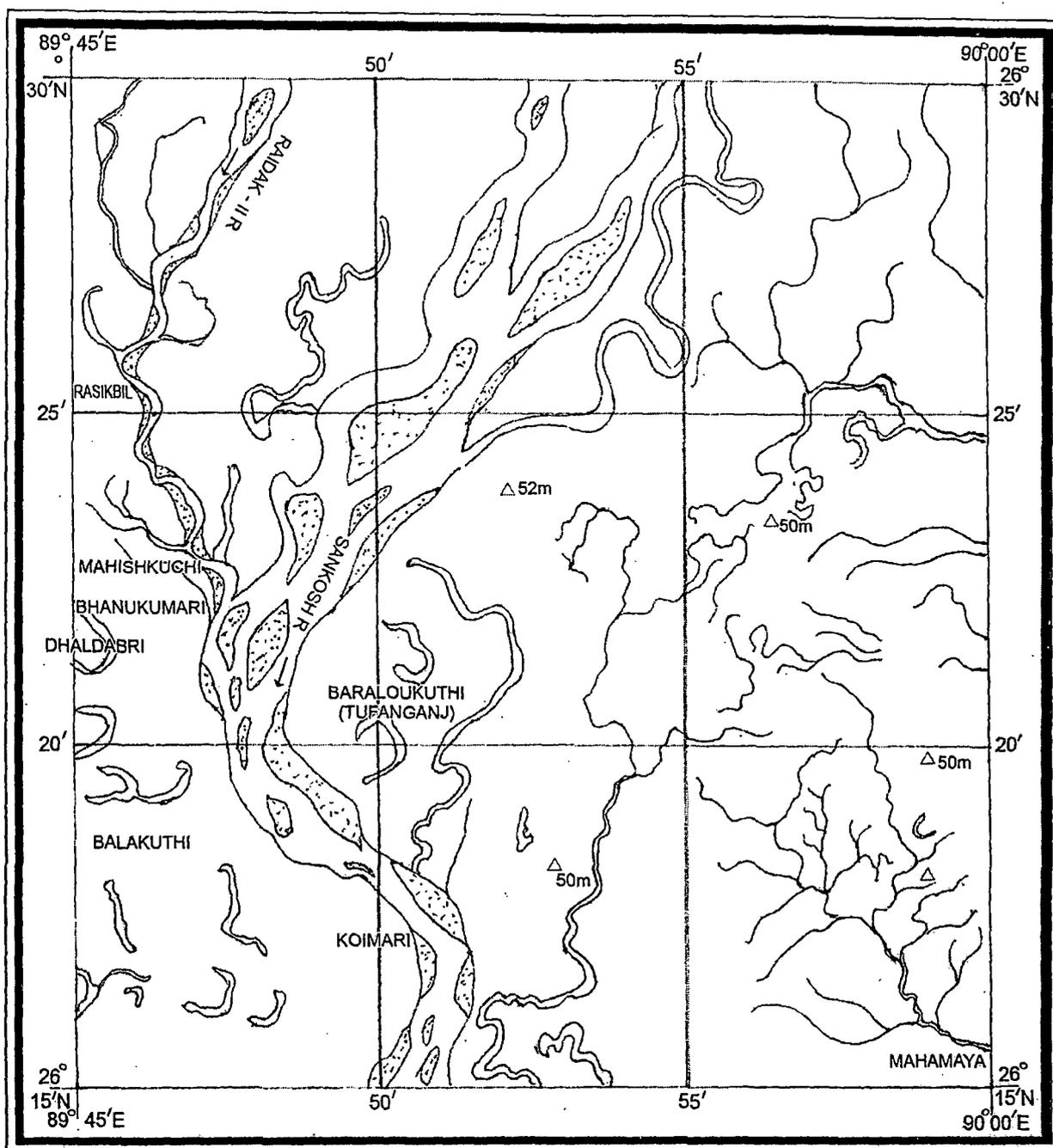


Fig. 3.7 Formation of braided channel pattern of the River Sankosh and Raidak II based on Satellite Imageries of IRS 1C and 1D, LISSIII and LISS IV and SOI Topographical map No. 78F/15, R.F. = 1:178125.

Takula

Takula is also a small tributary of river Raidak II and flows over Dewtikhata Naziran, and then Majherdabri of Jalpaiguri District and reenters the District at Garbhanga and meets with Sankosh at Jaldhoya.

over flooded and deposited successive super strata, of fertile silt upon the plains

3.2 Nature of drainage system

The main rivers of the District are perennial in nature. During the south-west monsoon they become very active and widen their channels. In dry period they are shallow and narrow due to less availability of water. Main rivers are originated from Darjeeling, Sikkim and Bhutan Himalaya and they are fed with melting water of mountainous ice. So they are perennial in nature. But due to south-west monsoon, heavy rainfall occur in July, August & September and heavy rain water comes down and over flow the rivers at the foothills. There are some small river channels in the District which are totally dry in dry season but very active in rainy season. Sankhola and Mara Gadadhar in Tufanganj Subdivision, Mara Torsa in Sadar Subdivion, Chenakata River and Dolong River in Mathabhanga Subdivision are such type of river channel. During flooding these rivers become much widen but in winter the volume of water is so small that the rivers appears misfit. The banks of the rivers are generally abrupt, and beds sandy, mostly with a beach on one side of stream, gravels are met with in higher latitudes and in some of the big rivers. The rivers are generally tame and shallow in dry season. They become very turbulent, vigorous and muddy and unwholesome during the rains. But in the dry season of March and April rivers is nothing but tame, narrow shallow and limpid streams, meandering through the innumerable and banks which come into existence after the rains. The water is cool, sweet, refreshing and the river carries a clear limpid streams in the dry season.

3.2.1 Characteristics of the rivers of Koch Bihar District

Koch Bihar is a network of rivers and small streams which appear to have been a great factor in the formation of its soil. Every year the rivers of the District over flooded and deposited successive super strata, of fertile silt upon the plains around. The hill streams which pass over the District change their beds, roaming right and left, cutting new courses, or rushing back into the old channels. No opposition to these fluvial vagaries can be offered by the land. The District of Koch Bihar is the land of large and small rivers. They are flowing through the District and responsible for flooding. The rivers in the District flow in a slanting course from north-west to south-east. The entire river rises in the Himalayas and enters the District from Jalpaiguri District. The banks of the river are abrupt and the beds are sandy. Generally there is a beach on one side and other side is abrupt of the rivers. Though in a few places both banks of the river are abrupt. The bed is sandy and sands shift during the monsoon when the rivers are in spate.

DRAINAGE MAP OF KOCH BIHAR DISTRICT

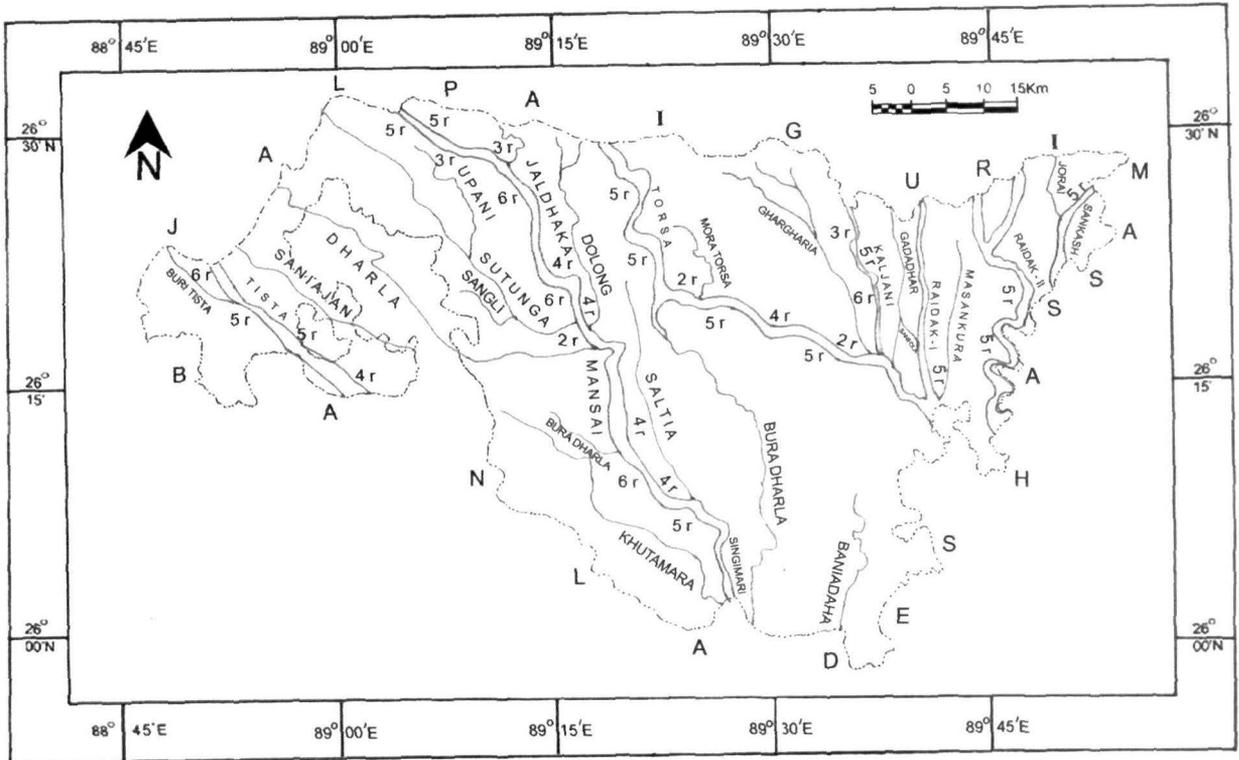


Fig. 3.8 Map showing major rivers of Koch Bihar District.

The larger rivers bring down gravel in large quantities. When the rivers are in spate, trees which fall down due to soil erosion are carried along the torrential current. The rivers in the dry season are tame and shallow. But due to the vicinity of the source area, Himalaya, even an ordinary rainfall on the hills causes a sudden rise of these rivers which overflow the banks and gushing waters destroy crops and properties. Though generally the rivers keep to their beds small oscillations and throwing out of the channel are almost annual features of these rivers. Just as the water of these rivers rise suddenly, so also the fall is quick. The flooding water hardly remains on the fields for more than one or two days in ordinary inundation. The rivers have flood spells 2-3 times in a year. The soil, of the District is alluvium of very recent origin and mixed with sand, is washed away by rushing flood water and deposited on the other side of the river on which velocity is less. Thus alluvion and diluvion are almost annual happenings with these rivers. The large sand banks are numerous near the rivers. By the end of October the water come down considerably and in March the rivers become slow currents. The morphological changes of very high magnitude are still very common phenomena. Huge quantity of bed and bank erosion is supplemented by sedimentation and slope changes are experienced in almost all the river system.

Northern part of the District lies in Terai region of West Bengal. The slope of the land is gentle, from north to south. The general height of the land is 30–80m. The entire region is made up of sands, gravel pebbles laid down by the Himalayan rivers like the Tista, Torsa, Raidak I, Raidak II, Jaldhaka, Sankosh and several small rivers,

Southern part of the District is a part of North Bengal plains and it is silt laden plain and is made of new alluvium deposited by numerous rivers like Tista, Torsa, Raidak I & II, Sankosh, Jaldhaka and of the small rivulets.

The predominant soil found here is alluvial of recent formation it is mostly sandy and loose. The surface soil is loam and good clay is found. Sand and loose soil erodes easily. Vertical corrosion almost stops but lateral corrosion goes on, and the river gradually widens its plain. Over the District the slope of the river is so gentle that any great increase in the volume of water will make it overflow its banks and cause floods.

The District is a part of Brahmaputra basin comprising with alluvium with diverse sand silt and clay. This plain is characteristic by abandoned channels ox-bow-lakes or bills.

The District has very little forest cover. Once it was rich in forest cover but due to population explosion after the merger with India forest has been cleared for cultivation and excessive activity with unscientific land management the loose soil has been eroded easily by the rivers. The District is much prone to flood. River bank erosion is common; shifting of river course is regular phenomenon, silting problems also common. Silting of the rivers is the main cause of flooding. But in 1993 the cause of havoc flood was heavy rainfall in the upper catchment areas as well as rainfall in the District. All the rivers of the District could not carry huge amount of rain water.

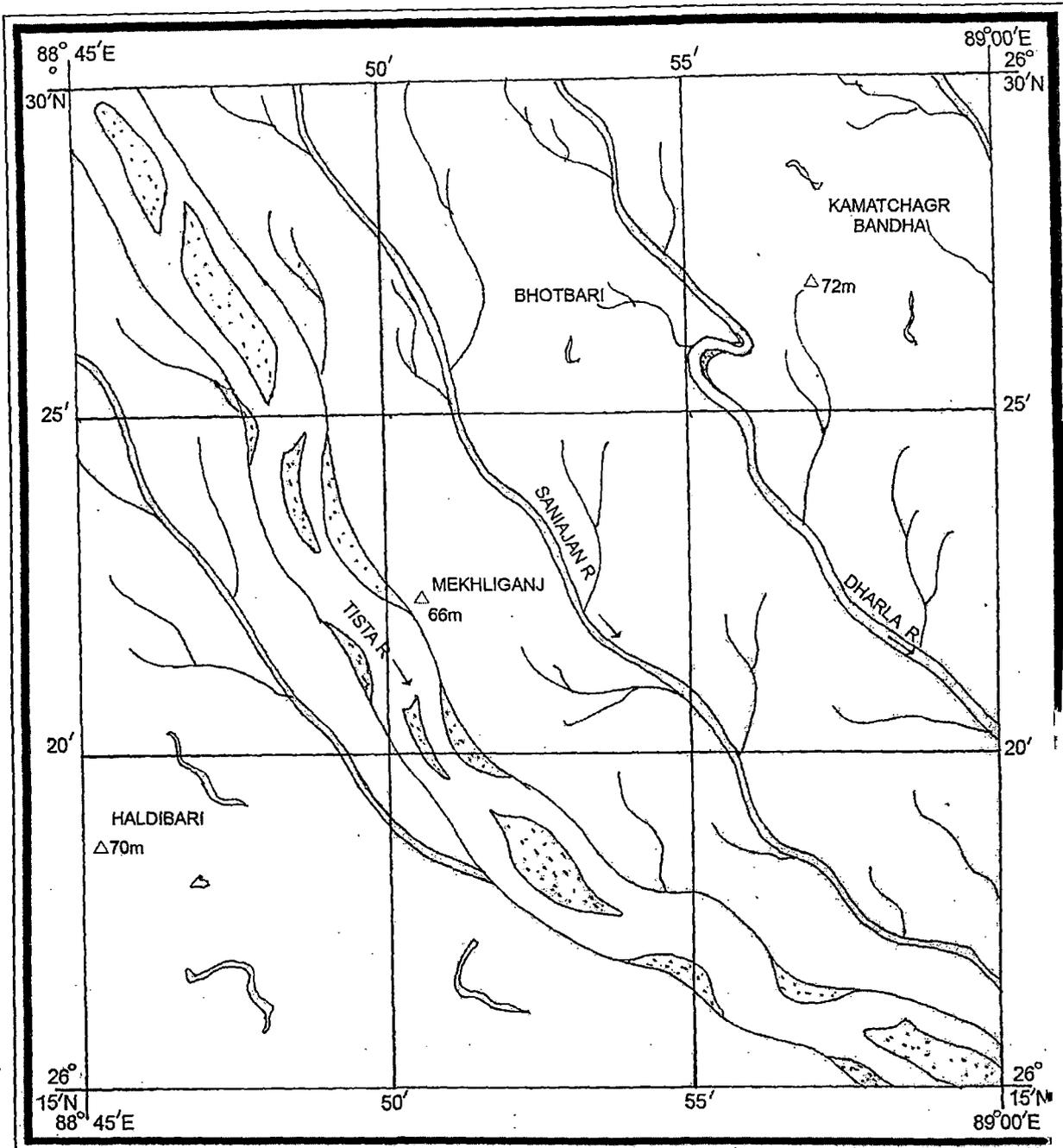


Fig. 3.9 Formation of braided channel pattern of the River Tista, Saniajan and Dharla based on Satellite Imageries of IRS 1C and 1D, LISSIII and LISS IV and SOI Topographical map No. 78B/15, R.F. = 1:178125.

3.3 Bank erosion

River bank erosion is common feature in this District. This type of erosion is active throughout the year. But during the flood period it becomes tremendously active. Rivers like the Torsa, the Tista, the Mansai, the Sankosh, the Gadadhar, the Sutunga, the Dharla, the Singijani, and others are responsible for widespread erosion in the District. The rivers have gobbled up vast areas of farmland, dwelling

houses and trees at Mahishmuri (Plate 3.3), Gitaldaha, Dawaguri, Kuchlibari, Khapaidanga, Jatrapur, Maruganj and other villages. Excessive bank erosion cause shifting of the river channel and agricultural land turn into barren or sometimes turn into river channel. This situation is found in most of the villages near the river of the District. Bank erosion is a great problem of Ghogarkuthi, Balaghat, Jhaljhali (Plate 3.2), Deochari, Shaladanga, Falimari, Natabari, Balabhut, Balarampur Santoshpur, and Lotafola villages of Tufanganj Subdivision; Kedarhat, Ghoksadanga, Nayarhat of Mathabhanga Subdivision; Salmara of Dinhat Subdivision.

In Mekhliganj, erosion of the Tista causes panic at Kuchlibari, Tista-payosthi, Hussener-tari and other villages. The Singijani grasped a large area of cultivable land at Gitaldaha in Dinhat. The Torsa plays a disastrous role in villages like Dawaguri, Jatrapur, Madhupur, Takagachh, Rajarhat, and Kaminirhat. The river erosion grabs a large area of cultivated lands in these villages. Erosion of the Kaljani and the Gadadhar at Bhuchungmari, Bhairaber-tari, Panisala, Balabhut, Balarampur, Nakkatigachh, Chilakhana and adjoining villages, create panic every year. The Sutunga and the Mansai River grabbed vast areas of farmland in Mathabhanga Subdivision. The river bank erosion due to meandering of rivers is the main problem of the District. The meandering causes the rivers to leave their original course, force them to flow along concave bank and thus devastating vast area of land, villages and affecting important and valuable nearby structures such as roads, building etc.



Plate 3.2 Erodible bank sites in the study area (View at Gadadhar River, Jhaljali, Tufanganj I).



Plate 3.3 Bank erosion gobbling adjacent settlement, farmlands and trees. (View at Mahishmuri village).

3.4 Siltation problem

Like bank erosion siltation is a great problem for the people of the District. Siltation problem is common for all Subdivision of this District. This problem is created during flood period but appeared after the fall of flood water. Many fertile agricultural lands due to siltation turn into barren sandy land (Plate 3.4). Sometimes *amon* paddy cover with sand due to over flood. Many roads become unsuitable for this problem. Many ponds and other water tanks become shallower and thus unsuitable for fishing. Low lying lands of Balaghat, Deocharai, Nepalerkhata, etc. are unsuitable for agriculture and even unsuitable for grazing also. In reality the rivers of the District have lost its heavy carrying capacity. This is the main cause of flooding. Because of silting, river beds are becoming shallower and shallower. When the water volume increases due to heavy rains in upper catchments area, the river cannot hold entire water in its channel and overflows its banks. The silt is laid by recurrent floods in the low and flat part of the river valley. Siltation is closely related with deforestation and soil erosion. Deforestation increases the risk of flooding and flooding increases siltation in the District. After the independence, in the District and neighbouring areas of Assam and Jalpaiguri District large number of population migrated from Bangladesh as refugee. They made settlement and tea plantation in this region also destroy large areas of forest though data is not available. Thus deforestation turn the soil looses and erosion which deprives the nutrition of an area and deteriorated the quality of land. Continue deposition of silt, elevates the river bed and thus the water level, and aggravate flood devastation.



Plate 3.4 Highly sandy agricultural land because of sand deposition during monsoon over-flow by the River Jaldhaka.

3.5 River channel migration

Highly sinuous and meandering river courses are prone to flooding because of their low but big hydraulic efficiency and the backwater effects of beds. Most of the rivers of this District change their channel to new ways breaking of river bank are common feature of the rivers. River Tista migrated towards Jalpaiguri town during 1968's flood. In recent past the rivers of the District have lost its carrying capacity of heavy silt due to frequently shifting its courses and overflowing its banks and causing heavy flood in the valley. Large amount of silt is deposited here by the main seven rivers and their tributaries which make the river channel shallower and its carrying capacity is reducing. This results in flooding of the vast areas in the District. The District suffers from floods due to large scale silting and consequence change in river course. Indiscriminate falling of tree in the catchments areas (Sikkim and Bhutan Himalaya) of major rivers has further complicated the present scenario. Being of an alluvial formation, the soil is very loose, and is easily washed away by the vigorous torrential flow which the hills pour down on one side of the channel which is less exposed to the furry of the current.