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DECAY OF SARASWATI RIVER WITH SPECIAL EMPHASIS ON ITS ENVIRONMENTAL ISSUES HOOGHLY & HOWRAH DISTRICT, WEST BENGAL

Basanta Mandal

*M.Sc. in Department of Geography, Presidency University, Kolkata
basantais08@gmail.com*

Abstract: *These days each study is giving emphasis in its applied aspect. In this respect the application of fluvial geomorphology in resource management is essential. Dying river and flood prone areas are common features present in deltaic tracts of river; the changing nature of decaying rivers has important effect upon the cultural landscape. Land utilization changes and population dynamics accompany. Changes happen in floodplains and in deltas. Such areas have greater concentration of population. Therefore, any change in the natural aspect will have important effects on human activities. Rivers, which were once large and navigable, undergo silting up and decay. With time, they degenerate into insignificant streams. Ports may have developed along them in the past. River water may have been utilized for agriculture. Hence population may have concentrated along them. But, with the decay of such rivers, ports disappeared, agriculture declined in importance and the tendency to attract population decrease. The inter riverine tracts are not build up. So they decay to form low-lying flood prone tracts. Water logging becomes constant problem. Considering all these facts the present research has been organized on Sara Swati River, West Bengal*

Keywords: *River system, Micro level analysis of Devanandapur mouza, change in river morphology, Problem aspect, Management aspect.*

I INTRODUCTION

Saraswati River was a distributary of the Bhagirathi. It was vigorous till around the 16th century AD but now it is no more there actively. The course and condition of the Saraswati has acted major role in the development and decline of river port towns in Bengal. Originally, the major port town was Tamralipta, after the decline of which Saptagram rose and declined, and finally Kolkata came up. In the 16th century, the main waters of the Bhagirathi, which earlier used to flow through the Saraswati, had started flowing through the Hooghly channel. In the course of time, the upper Saraswati dried up, but the Bhagirathi or Hooghly has abandoned the old Adi Ganga channel and flows through the lower course of the Saraswati below Sankrail, Howrah.

II OBJECTIVE

The main objective of this study is to highlight the present condition of the Saraswati River. The river is undergoing silting up due to natural and man-made causes.

Pollution from various sources is entering the river. The research has tried to identify these problems, along selected points. The work will form a base for future planning of the river.

III METHODOLOGY

The work is divided into three phases: Pre field, Field and Post Field.

Pre field phase: This involves collection of theoretical information and secondary data from office like National Atlas and Thematic Mapping Organization (NATMO), Survey of India, Bansberia Municipality, Downloading of Google images has also been done.

Field phase: In this phase, field measurements of selected sites were taken. River depths, widths, bank slopes and water levels were taken. Besides the source and types of pollutants were noted each site. About 8 sites were taken for the analysis. Mouza level mapping of flood prone area was done. Photographs were taken.

Post field phase: The data collected was subjected to statistical analysis. Graphs were plotted. GIS Mapping of the

river overlays has been done. Finally, the work was completed through analytically scientific approach.

IV LITERATURE REVIEW

1. According to Kalyan Rudra (2012),

“The most effective causes for dying a river are dam making and growing pisciculture on the river bed. The construction of brick kiln industry causes stagnation of water.”

2. According to Yash Vardhan Jain and Chetan Singh (2014),

“Increasing pollution of the Yamuna has now become an international issue and cause of concern for environmentalist. Big industries, factories, people living in colonies, slums and rural areas everyone pollute this holy river. In addition the water in this river remains stagnant for almost nine months in a year, aggravating the situation. Agricultural residues, insecticides and pesticides also contribute to the pollution of the river. Also people wash their clothes, utensils and defecate in the river and pollute it.”

3. Marimuthu K.N*, Ruby Thomas, B. Yamini, S. Bharathi and K. Murugavel, (2015)

“The central pollution control board in coordinating with state board is planning to dump all dying effluents into deep sea through pipe line from Tripur and working out the cost analysis. Our state government may possibly involve in feasible studies and may allot funds for the proposal which may a permanent solution for both the people of Tripur area and manufacturers of garments.”

4. Himanshu Thakkar (2012) discovered that,

“Narmada movement has been a watershed in Gujarat’s history. There are many more movements even now going on, to name a few: recently a movement could stop Nirma from encroaching a water body in Bhavnagar, there is a movement against thermal power plants in Kutch and Nuclear Power plant in Bhavnagar, against water pollution in central and south Gujarat, against sand mining in Ambika river in South Gujarat, against river linking proposals in Dangs and Valsad, among many others. Hopefully, rivers will also benefit from these.”

General setting of study area: Topography:

Hemmed in between the Hooghly (Bhagirathi) on the east and Rupnarayana on the west and intersected by the Damodar, the Howrah district consists of a flat alluvial plain, with a gradual, almost imperceptible, rise towards the north and the north west, the general flow of drainage being consequently to the south and the south east. The product of these rivers and their branches, it comprises two main divisions, viz, the raised riverbanks and the large marshes or lowlands that separate them. In this way ,three districts tracts are formed each with a depression in the center bounded by their high banks in the rivers.viz, an eastern tract stretching away from the Hooghly(Bhagirathi); and in the intervening

country and numerous watercourses’ or creeks,called “Khaals” which run dry or very shallow in the hot weather . The characteristic feature of this riverine landscape is the levee formations along all the rivers in between which there are extensive swamps (jheels) or depression (jalas) forming vast sheets of water during the rains.

The eastern parts of Howrah city , for instance is situated on the levee formed by the Bhagirathi while its western part occupies a portion of the Dankuni and Howrah swamps extending from north and south between the Bhagirathi and Swaraswati. The Rajapur lies between the Saraswati and the Kana Damodar and while the Amta Swamp stretches between the Kana Damodar and Damodar. The average height of the riverside areas for which Bench Marks are available, varies from 15 to 20 feet above sea level, while the Botanic Gardens area with an elevation of about 15 feet in the lowest. The drainage of the riverside areas flow into the low lying marshes, which drained into the river partly through the channel further west. A larger amount, however, remains stagnant due to unplanned construction of railways, roads and buildings and forms a conspicuous feature of the city’s landscape.

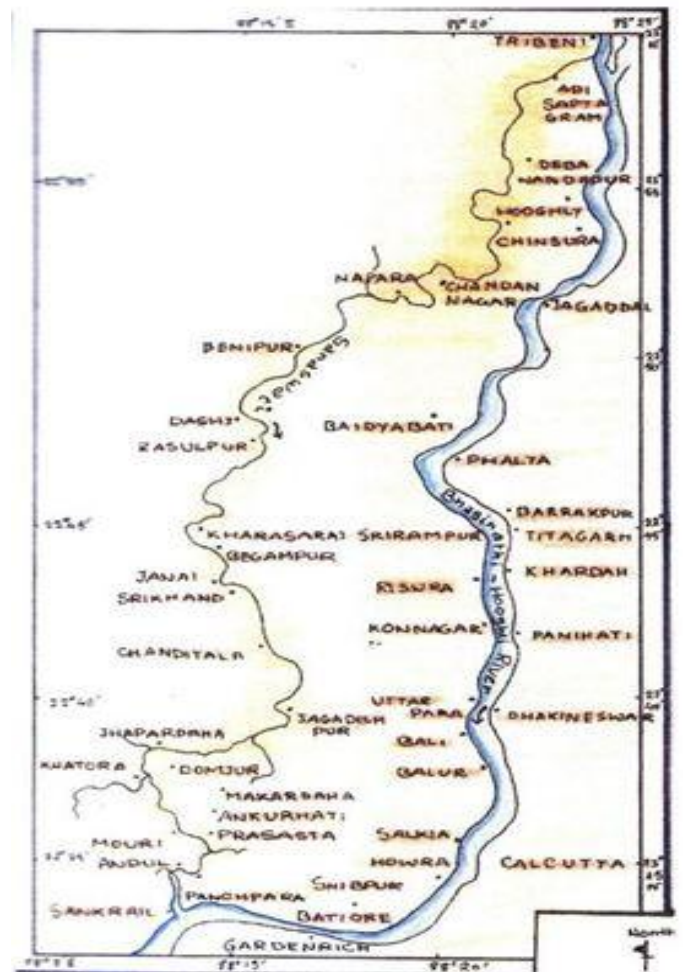


Figure 1 (a) Map of the selected area

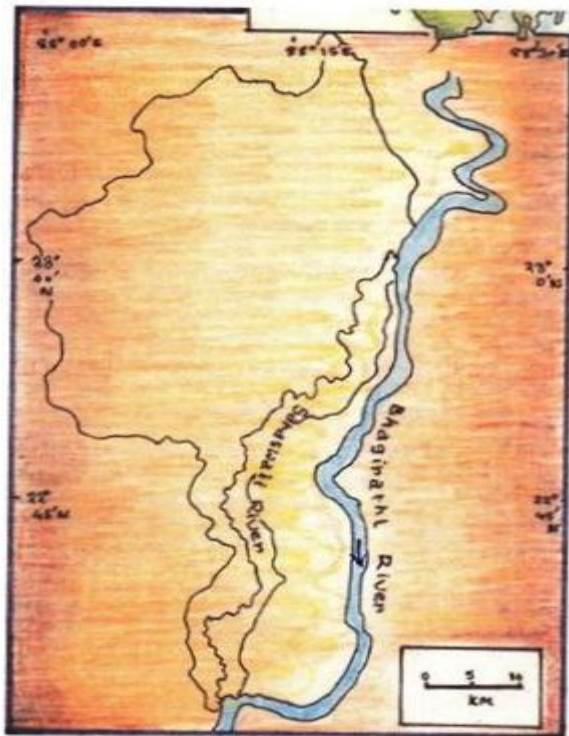


Figure 1 (b) Map of the selected area

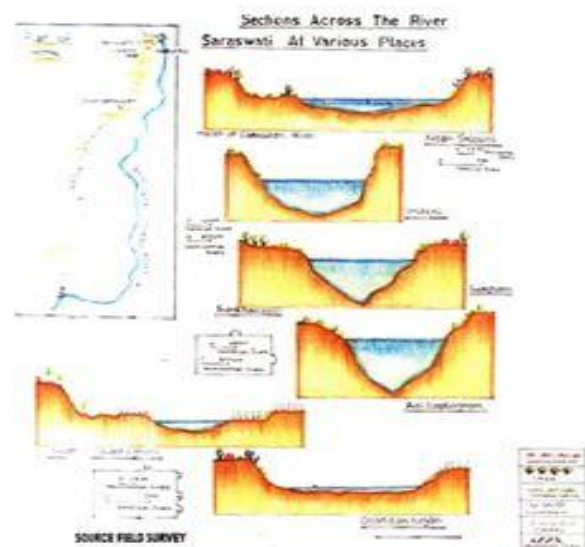
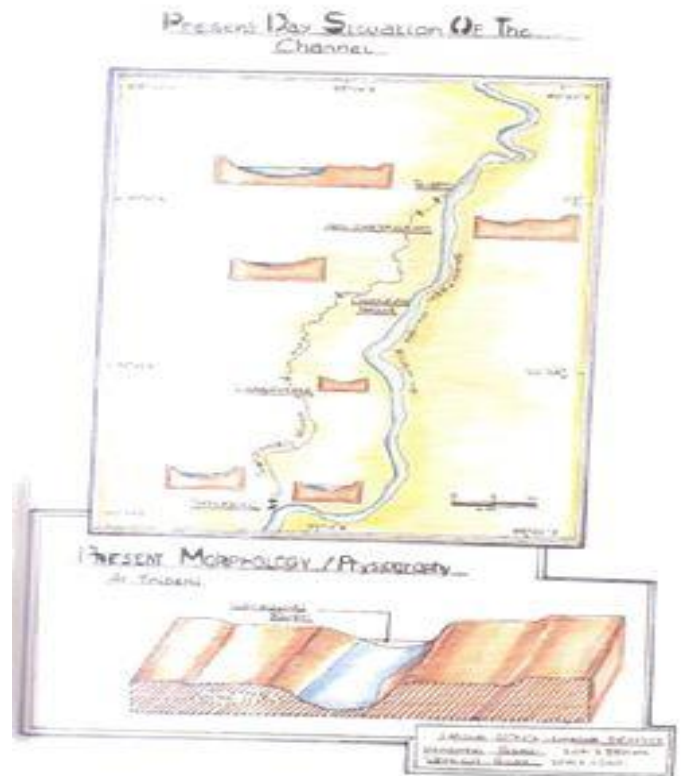
River System: The Principle Rivers of the district are the Bhagirathi and its tributary Saraswati, the Damodar and its two branches, the Kana Damodar and the Old Damodar and the Rupnarayan. Numerous Khaals or Creeks also intersects the districts. The tributaries of the Bhagirathi are mostly tidal offshoots navigable by small country boats for short distances inland. The sankrail and sijberia khaal are the lower reaches of the Saraswati and Kana Damodar respectively. The Bhagirathi is the main westerly channel by which the water Ganges enters the Bay of Bengal. The main and ancient course of Bhagirathi was further west of Saraswati according to Rennell.

These abrupt bends were most probably the debouching points of the Chotanagpur Rivers into the ancient channel of the Bhagirathi or Epicontinental Sea. As the delta face advanced southwards, the braided channels of the Bhagirathi vanished. The deep channel alternates from left to right and vice versa according to the windings of the river except where deflected by the large tributaries that debouch into it at the southern limit of the district. The lower Bhagirathi is under the influence of strong tidal forces.

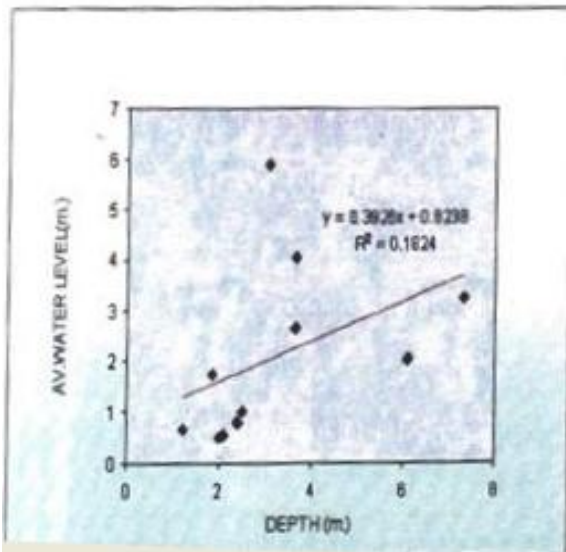
The banks are durable and the river therefore carries a heavier bed load and has a fixed regimen, the variations of which, in places, are oscillatory in accordance with the predominance of the opposing tidal currents, the Saraswati branches off from the Bhagirathi at Tribeni a few miles above Hooghly and enters the Howrah district at Baluhati (Baluti) as a very insignificant shallow stream. It then meanders south in tortuous course and keeping the Rajpur jhil to the west, flows past Domjur and Andul, falling into the Bhagirathi just above Sankrail. It was in Malley's time (1909) navigable up to Andul

by boat 5 tons burden or less its high banks and the remains of large boats occasionally dug up from its bed thus once it must have been larger river.

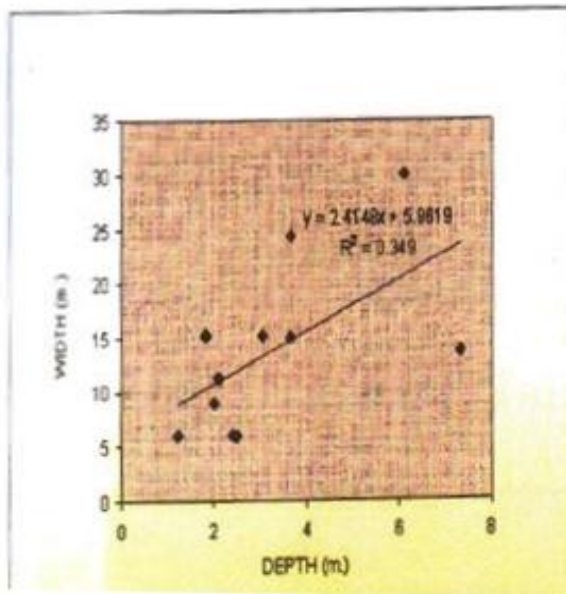
The inference is confirmed by numerous large pools commonly called "Dehas" found in its bed from which many riverside villages take their names e.g. Makardah, Jhapardah, Bhandarah etc. The dereliction of Saraswati seems too had been due to the division of the Damodar water from the upper reaches of the Bhagirathi. Even the lower portion of the Saraswati had decayed and the approach to Satgaon was along the Bhagirathi to Tribeni and down the Saraswati for about four miles. In its lower reaches, the Saraswati has at present, even lost its name known as the Sankrail Khaal.



RELATION BETWEEN RIVER DEPTHS & AVERAGE WATER LEVELS



RELATION BETWEEN RIVER DEPTHS & WIDTHS



Source: Field Survey 2016-2017

The History of Evolution of The Saraswati River Basin: the old Saraswati River has gone through a number to stage of drainage evolution e.g. **1. Pre Renell 2. Rennell 3. Pre DVC 4. Present or Post DVC.**

Stage I (PRE-RENELL PERIOD): From the sketch of the jao-de-barros (1550AD) it is evident that Saraswati was somehow lined with the Damodar. Most Probably it has more than one branch in the medieval period. One was probably towards Damodar and the other having received a branch of the then Bhagirathi River just a little below Batore certainly flowed towards the sea. The latter course has been prominent in the Sketch of Van Den Brouke (1600 AD). A few centuries back Saraswati and Bhagirathi ran almost parallel to each other. The lowest segment of the Bhagirathi was known as old Ganga and the Saraswati (Mkherjee, 1996) which is at present

in estuarine stage referred to as Hooghly. Although Saraswati is a distributor of Bhagirathi, the river had a tell link with the Bhagirathi through a Sundarban creek at about the Sankrail town. From the navigation point of view the Saraswati was more convenient channel than Bhagirathi channel (Ganga) because of the stronger tidal flow.

The upper reaches of the Saraswati and the Yamuna at Tribeni were originally Feebler than the upper sketch of Bhagirathi as those were mere distributaries of the main Bhagirathi. In course of time the upper sketch of Bhagirathi was silted up so much that it was letter completely detached from the main Ganga channel. It resulted in gradual decay of not only the Bhagirathi but also its continuation further south.

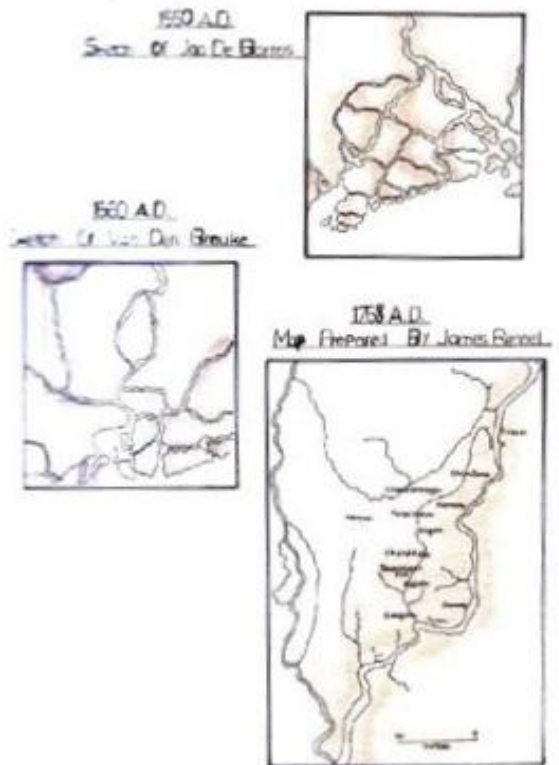
Stage II (RENELL PERIOD): Renell in his volume “ Memoir of a map of Hindoostan” showed that in early 18th century the Bhagirathi continuity (the old Ganga segment) was deteriorating faster than the old Saraswati segment so much that an alternative channel for navigation for the foreign centers on the Bhagirathi was felt a dire necessary .With the permission of the then ruler Nabab Alibardi Khan the Dutch traders of Oegli (Hugli) dredged and widened partly the link channel from Khidderpore to Sankrail, manually during low tides resulting in the main flow of the Bhagirathi from its decaying lower segment of to lower Saraswati naming this channel as Kaliganga (Mukhopadhyay ,1915/91,vide, Mukherjee 1996). From that time the entire course of this rejuvenated channel from Khidderpore to Bay of Bengal came to be known as Hooghly River. This is a glaring example of human aided river capture. Although the Saraswati river channel remained unnamed in Rennell’s map, he has also shown the full length of the river Kunti, its northern tributary and the third segment of the three pigtails (The Ymuna) but also not named.

Stage III (PRE-DVC PERIOD): J & C Walker in his map (Surveyed in 1867-71) shows the detail Pre-DVC condition of the Damodar-Bhagirathi region where we find amaze of minor streams were interlinking the Rupnarayana, the Dmodar, the Saraswati and Bhagirathi. All these streams and the main rivers were carrying down the monsoon deluge along with huge quantities of sediments from their upper catchments region causing massive floods in Damodar-Bhagirathi section. The flood havoc was so devastating mainly coming along the Damodar River that this river itself was nicknamed as “Sorrow of West Bengal”. To partially save this sector the old Damodar stream was dredged in sections and extended beyond the Sarawati River through to the Bhagirathi. This was at that time known as Eden Canal. Although a number of channels interlinking the Damodar and the Saraswati / Hooghly as marked in the post DVC period was either delinked from the Damodar or turned into Kana Nadi but in Walker’s map they are still being shown as fully

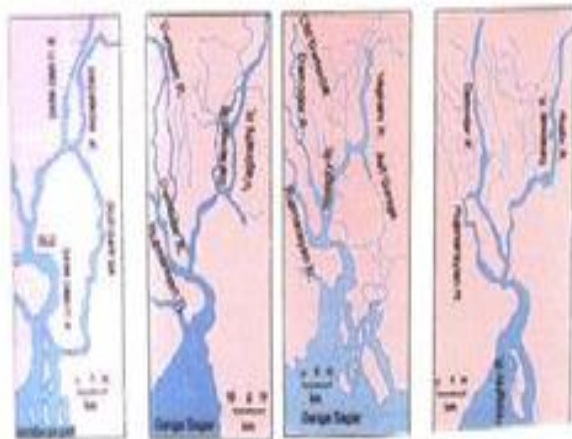
interlinking channel.

STAGE IV (POST DVC PERIOD): After independence, to make a radical cure of the Damodar flood problem, a Damodar valley Corporation (DVC) was created. This took up a multipurpose river valley project. The diversion of the major flow of the Damodar into diversion canals constructed from Durgapur Barrage to turn into a very lean flowing channel depriving almost all its distributaries became delinked from the Damodar and turned into non continuous inland drainage channels or KanaNadi. This is because of human interference and normal south easterly ground slopes some of the Damodar delinked channels in this heavy rainfall region, converted into tributaries of the Saraswati River e.g. Beulah, Kantul, Ghia, Julki etc. These are excellent examples of human aided river capture.

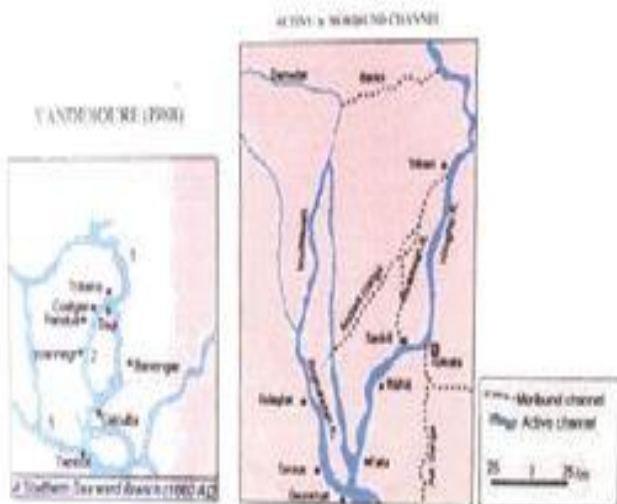
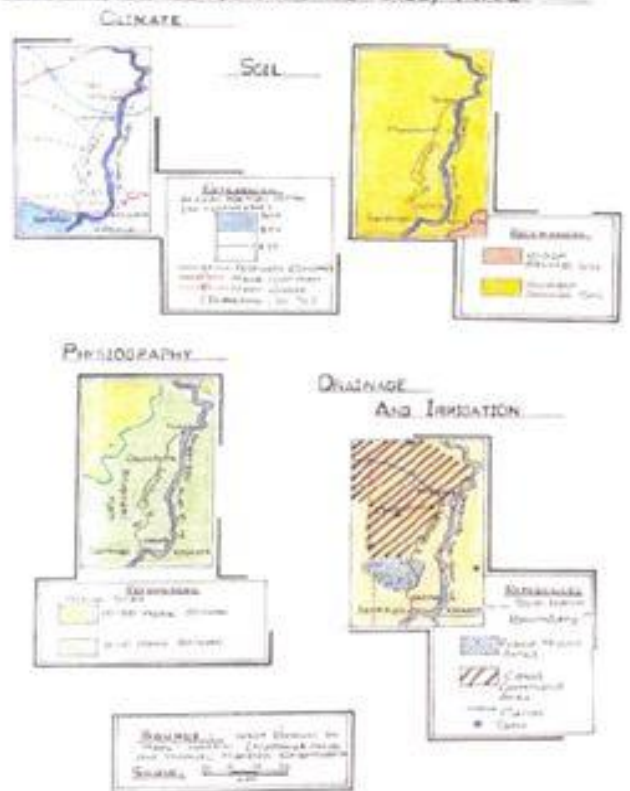
MENTION OF SARASWATI IN OLD LITERATURE
HISTORICAL COURSES OF SARASWATI RIVER



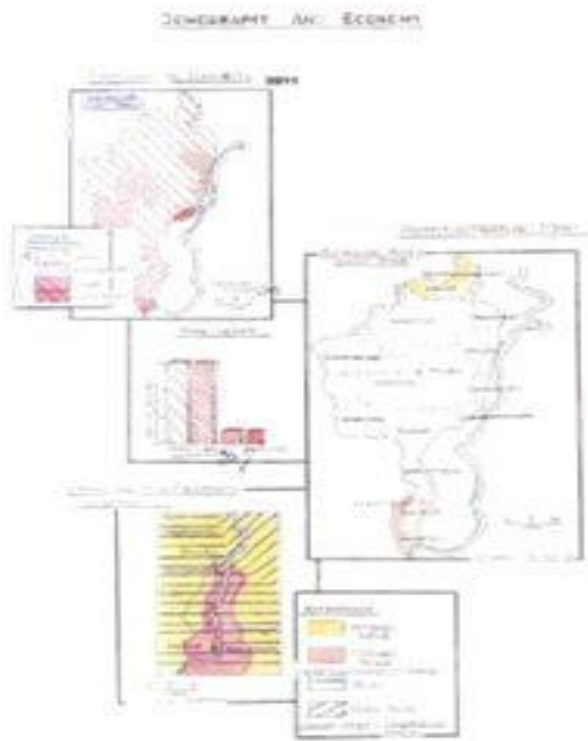
HISTORICAL PERSPECTIVE OF SARASWATI RIVER



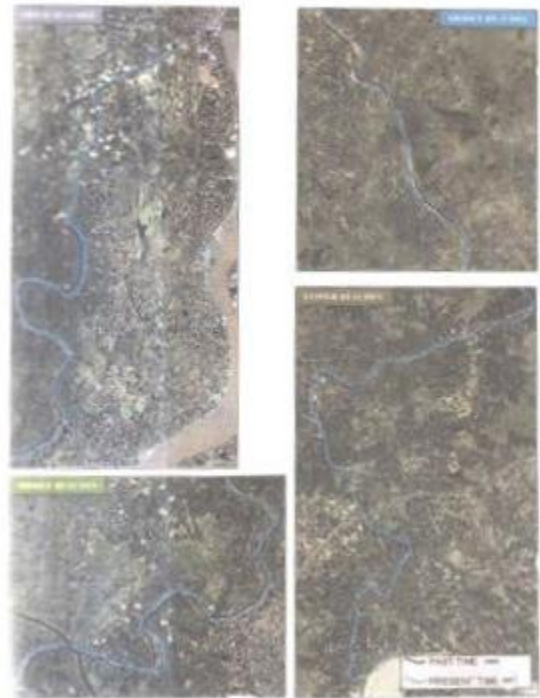
Some Physical Components Of The Study Area



REF: STATUS OF RIVERS IN WEST BENGAL: KALYAN KJORA



Overlays Shows Changes Of Saraswati River Course From 2008 To 2017



Source : Google Map

Geology and Physiography

Relief Map



Physiographic Units in Saraswati River basin



Geo Tectonic Setting of Bengal



Geology of the basin area

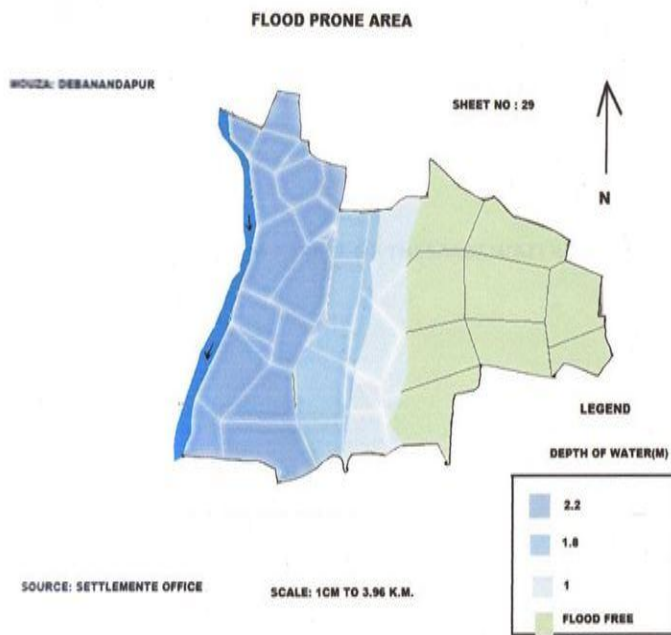


Source: K.G. Mukherjee 1976 Agricultural Land Capability Of Bengal

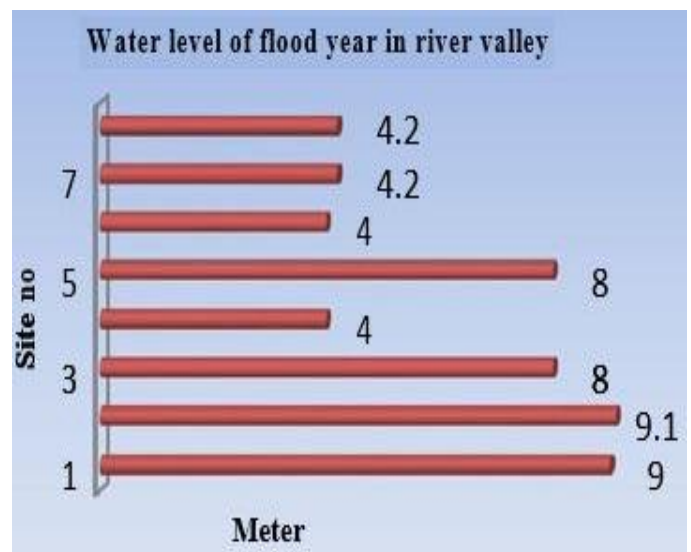
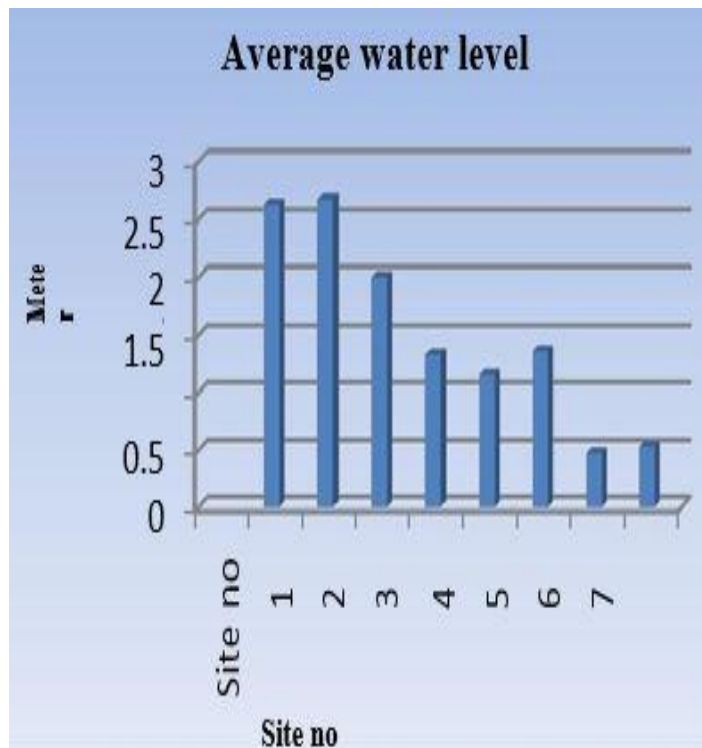
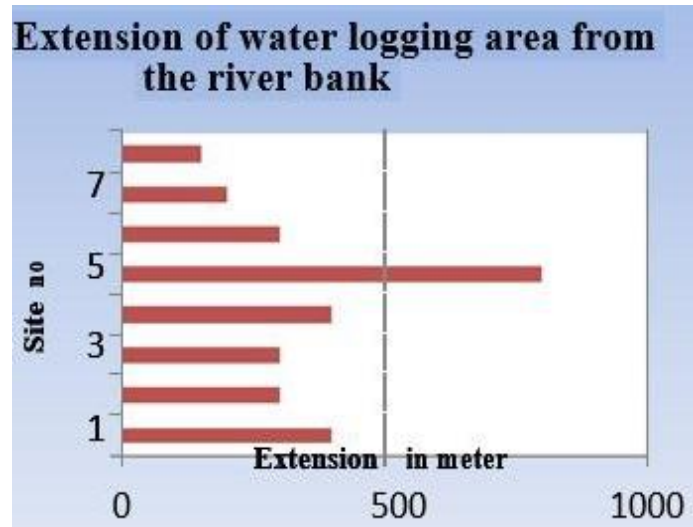
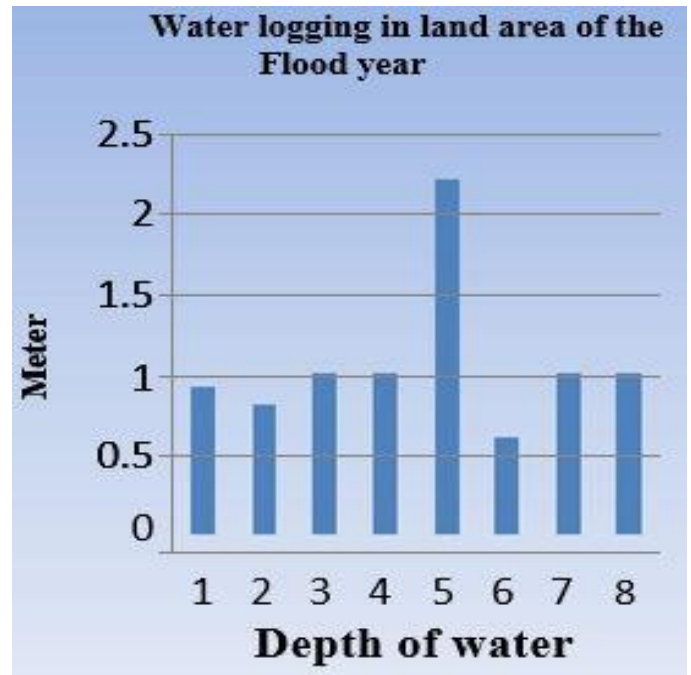
Micro Level Analysis of a Flood Prone Area: The higher tracts lie alongside of the decaying river levees. It is only along the larger river that land slopes towards the river. But in the present study area, one finds depressed tracts away from the river sides. In fact, these are depression in the alluvium. As the carrying capacity of the moribund rivers declined, they deposited silt in the beds. Embankment made the problem worse. The inter riverine tracts did not received this silt. Hence, away from these distributaries there was the presence of low lying tracts. The flood water deposited silt near the riverside. To highlight the situation, one micro level analysis of a flood prone area has been shown.

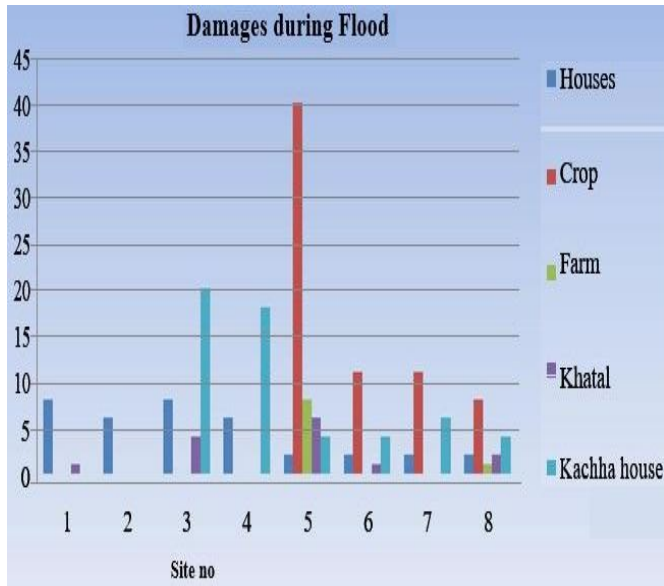
Debanandapur Mouza: This mouza is bounded by Saraswati River in the west and four kilometer away from river Hooghly in the east. Site five is located in this mouza. The information collected from the local people by conducting interview has shown that it is a highly water logged area in the time of rainy season. It also shows that low land tracts are lying in the eastern part of the river bank and the western part of the river bank land is much higher but flood effects these two parts almost in a same way. This mouza area's elevation is inclined from the west to east. Though the width of the riverbed became small from past to present so the older part of the bed is one of the part of water logged area. The water logging area is almost covering fifty percent of the mouza. It can be showed that though this area is very useful for crop cultivation, the flood damages all the crops in the time of

flood. The height of stagnant water level is above two meter and stagnancy remains for eight days. Government has already sanctioned fifty thousand rupees for recovering and cleaning this part of the river. During flood years the problem assumes serious proportions. As it is observed from the map, the high water logged areas are located at riversides and this lies under 2.4 meter of water or even more. The medium land bordering the high land remains under 1.8 meter of water.



Source: Field Survey 2017
Field Survey Report (2016-2017)





Problem aspect of Saraswati River: The problem aspects of Saraswati River are the main source to unearth the critical reasons of its decaying. The problems are generally of two times both man made and environmental degradation but it has been proved that human created mischievous acts have been propagating the decaying procedure. The River Saraswati is subjected to silting up and pollution from various sources. The information collected from various sites reveal a decrease in depth and width with respect to the past. As this data is based on people’s opinion no specific time is selected to collect the data of past time. But roughly the past data refers to conditions of 40 years ago. All the data are collected by field survey.

Change in river width: The site wise data of part, present and decrease range or changed in river widths are given in the following table.

River width at different sites			
Site no	River width (Meter)		
	Past time	Present time	Range
1.	90	68.58	21.42
2.	80	45	35
3.	80	45	35
4.	68	22.2	45.8
5.	68	22.32	45.68
6.	66	20	46
7.	58	22	36
8.	64	24	40

Source: Field Survey 2017

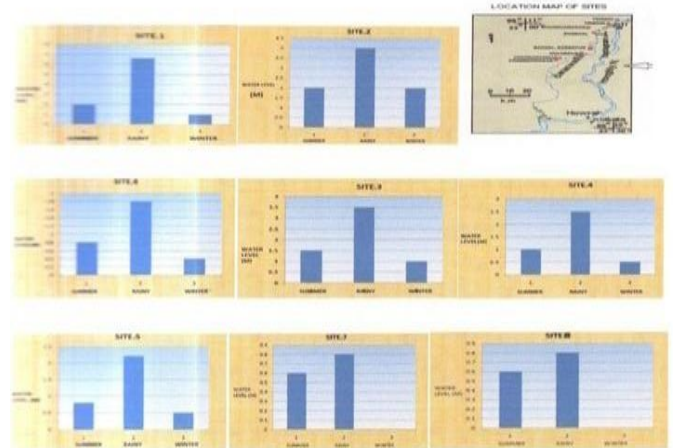
Interpretation: The table shows decrease in width ranged from 21.42 meter 47.5. The minimum decrease was recorded at site 1, which is located in the origin of the river in Tribeni. The maximum decrease was recorded in site no 3 at a range of 47.35 meter and it is situated in Mogra.

Change in river depth: As like river depth, site wise changeable data of rivers depth are given in the following table.

River depth at different sites			
Site no	River width (Meter)		
	Past time	Present time	Range
1.	14	7.8	6.2
2.	14	7.8	6.2
3.	12	6.8	5.2
4.	11	2.8	8.2
5.	10	2	8
6.	18	2.4	15.6
7.	14	2	12
8.	11	2	9

The table shows decrease in river depth. The range lies from 5.2 meter to 15.6 meter. The highest range is located in site 6, in this site the river bed is made of concrete and the lowest range value is 5.2 meter in site number 3 which is Mogra.

DIFFERENT WATER LEVEL OF DIFFERENT SEASON



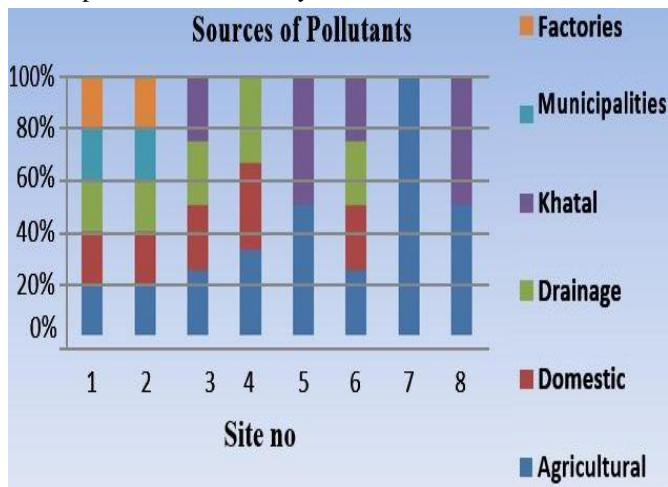
Source: Field survey 2016-17

Causes of siltation: The reason for this is reduced carrying capacity of the Bhagirathi-Hooghly River. This is a consequence off take of the Bhagirathi from Ganga. As a result, the Saraswati flow cannot be accommodated. No fresh water in flow takes place. In addition, drainage from surrounding lands is increasing the silt content of the river. The manually activities also create to siltation of the river. The construction of pillar on channel for bridge, by making cross bands for storage of water for pisciculture in the dry season, silt and water for brick kilns and construction of house, shops on river etc. help to siltation. An example at Tribeni to Adisaptagram bricklin development is very common. Some garbage near the channel causes pollution.

Problems of riverine pollution: The sources and nature of pollutants are varying from site to site. The percentage of pollutants of water hyacinth, cattle shed , straw

grass garbage , drainage water , chemical water are e) consequently 5.75, 9.2, 5.75, 5.75, 11.5, 5.75 and 9.2.

Causes of pollution: The construction of cattle shed along the river and even on the riverbed is distinctive feature of Saraswati. The cattle is more observed in Adisapta Gram f) and Mogra. Domestic garbage is very common natural pollution causes eutrophication as water hyacinths are sommon sight. Agricultural land and fishing also encroach on Saraswati. At Mogra, Adisapta gram and a large number area of agricultural land developed both side of the river. Near Adisapta gra Natun Bridge and Tribeni chemical water of factories make the water colour dark. The garbage in Tribeni of Bansberia Municipality and Municipality garbage of Bandel Causes pollution enormously.



Source: Field survey 2016-17

Management Aspect: The socio economic life of a huge number of surrounding area of Saraswati River in Hooghly district is related with it. So proper planning is needed to control the problems. Some measures are given below.

- a) **Administrative step:** It is the most important step because without help of government it is impossible to recover the river. The cattle shed, shops, brick kiln etc. constructed along both side of the river channel. In some places the river bed is made of concrete to use it as a path way. Hence administrative steps have to take against these constructions.
- b) **People’s consciousness:** To protect river bank and to minimize water pollution, public awareness is common thing. Effective consciousness has to be built among common people by the help of NGOs, environmental organization and government.
- c) **Dredging:** It is essential to improve dying situation and to improve the flow of the river as it has never been done to rejuvenate.
- d) **Drainage scheme:** Some drainage schemes from local administrative unit can control flood problem and water logging. This leads to excess water away from the affected area.

Morphometric study: To recover this river government has to make a plan after detail study of the whole channel area. One must know its evolution history and make a morphometric analysis.

Restriction and cooperation: Restriction to throw garbage from municipality or domestic source is important and certainly cooperation between different government units e.g. irrigation, agriculture, fishing, B.D.O, pollution control department, panchayet and municipality is indispensable.

Objective of the Saraswati river management:

- 1) To recover the river from dying.
- 2) Irrigation and fishing industry development.
- 3) To control flood.
- 4) To control pollution.
- 5) Starting navigability.
- 6) Conservation of water.

V CONCLUSION

From the historical perspective, it is evident that Saraswati was once a large river. Reference has been made of the flourishing part of Saptagram. Large barges as well as sail boats pile along the Saraswati. Thus, this river sustained the economy of the region by facility trade. It was responsible for the prosperity of the region. Iban Batuta came to Bengal through this part. The Portuguese controlled this part for some time. Commodities like rice, cotton goods, sugar, dry fruits etc. we’re being exported through this part. Different trading classes and fisherman lived along this river as the Saraswati was a source of their livelihood. According to the local people, even fifty to sixty years ago it was very salient locally. The water of this river sustained cultivation and fishing. Small boats carried out local trade. But at present the Saraswati is a defunct, narrow silted up channel. Even locally, it has lost its importance particularly on fishing and agriculture. By detail study we discovered that the depth, width, water level has been decreasing exceedingly. As a consequence problems like flood, pollution and silting up are also increasing.

REFERENCES

- [1] Bagchi.K.G, (1944): The Ganges Delta, Calcutta University press.pp-1-157
- [2] Bagchi.K.G,edited, (December, 1972), The Bhagirathi-Hooghly Basin, Kolkata,pp-3-8,59-100,143-197.
- [3] Bangiyo Bhugol Mancha (2009), Barnamay nadnadi, (first publication),Kolkata,pp-22-57.
- [4] Biswas.K.R, (2001) Rivers of Bengal, a compilation, volume II, Part I report on the Hooghly River and Its head waters, Stevenson committee report With Addendum C.Addams-Williams,Reprint., Published by K.R.Biswas,IAS, State Editor.West Bengal District Gazetteers, Higher Educational Department, Government of West Bengal, Bikash Bhawan, North Block: 8th Floor, Salt Lake City, Kolkata-091.
- [5] ChitraSivasankarA, JaisarSpintex Private Limited,

Sankarankovil, TirunelveliDist, Tamil Nadu 627 756. Textile articles, 2011. 3. Rajan MC, Water of infertility: Polluted Noyyalriver in Tamil Nadu is turning land and people barren, Mail online India, January 28th2015.

[6] Majumdar, Dr. R.C., History of Ancient Bengal, First published 1971, Reprint 2005, pp. 2-3, Tulshi Prakashani, Kolkata, ISBN 81-89118-01-3.

[7] Outputs from Indo (Anna University, Centre for Environmental science) - German joint collaborative project.

[8] Outputs from volunteer organization, "SIRUTHULI" functioning in Coimbatore

[9] Ray, Aniruddha (2012). "Satgaon". In Islam, Sirajul; Jamal, Ahmed A. Banglapedia: National Encyclopedia of Bangladesh (Second Ed.). Asiatic Society of Bangladesh.

[10] Roy.K.P, (2007), Uttar Chabbish Parganar Sekal Ekal-vol-4, Prava prakashani, Kolkata, pp-80

[11] Rudra.K, Banglar nadikatha, (2nd edition) January 2010, ISBN: 978-81-7955-141-5, published by: Sishu Sahitya Sangsad.Kolkata. Pp-45-51.

[12] The Noyyalriver, Rain water harvesting.org, 2007.