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Devastating flood and Disaster management – A case study of Khanakul Block I & II; Arambag Subdivision, Hooghly, West Bengal, India

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ABSTRACT: The flood in lower Gangetic region is a very common phenomenon in every year. In the study area Khanakul Block I & II, the devastating floods occur due to mainly release of huge amount of water from upper catchment river's barrage D.V.C and as a result destroying embankment of local rivers, in monsoon and late monsoon period. Maximum areas in these blocks are under flood prone. River Mundeswari and Darakeswar are main dominant for flood of these regions. Lack of proper management of channels, lack of consciousness and poor condition of embankments make disasters in this vulnerable zone. This paper has tried to show the condition of flood and its effect and how it can be managed properly. For the surveying work, this study has followed so many primary and secondary data from different kinds of sectors. Besides, this paper has also tried to evaluate the general effect of flood, identification of the flood affected region and process proper management.

KEYWORDS: Flood, Phenomenon, Management, Mundeswari, Embankment, Devastating, Disaster

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I. INTRODUCTION

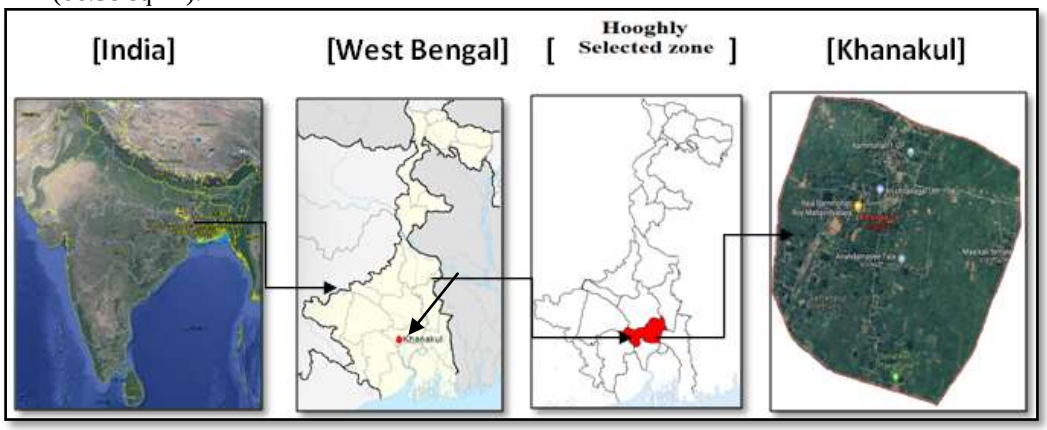
River flood is a natural phenomenon. Flood occurs, when a river carries an extreme volume of water and when water cannot drain properly. River is very important for environment especially physical environment. With the exchange of energy and matters; erosion, transportation and deposition are continuous process of river system (Bera, S., & Mistry, B.2014). The natural hazard flood is very dangerous for societies and societies' normal way of life. Hazard is a physical phenomenon and it has devastating impacts on the environment, economic and socio-cultural fronts especially in the developing countries like India. The study area Khanakul locates in Subdivision of Arambagh, district of Hooghly. This region is mainly interring fluvial region of the Damodar–Dwarkeswar Rivers, one of the flood prone regions in West Bengal. Flood is a common phenomenon of this region in every year. In recent time, flood frequency level has increased from previous and the Recurrence interval of floods is very low in this region (Das, B., Pal, S. C., & Malik, S. 2018). Actually with the change of time a dynamic change is showed in the lower Damodar and lower Mundeswari Rivers. It is also showed that these lower Damodar and Mundeswari channels are affecting through man-made flood and dying through continuous effects of humans (Ghosh, S. 2011). Actually the main factors of flood susceptibility are drainage density, slope, land use, geology, surface runoff, type of soil, flow accumulation etc. (Mahmoud, S. H., & Gan, T. Y. 2018). Hazard is one kinds of disaster which occurs due to sudden disruption in human life especially in their socio-cultural-economic life (Mandal, S. 2015). Actually due to vulnerability of the humans and the system, the impact of disasters are in multiplies. In present time there have a change in process of 'disaster management'. All kinds of management department as like PRI bodies, NGOs and other stakeholders are very responsible to handle hazards, preparing a plan of disaster management in various sectors. Stakeholders are also benefitted through these guidelines to prepare a risk management plan in any situation. Actually the main objectives of Disaster Management is controlling, minimizing and reducing of the impacts of hazards in one hand and preparedness arrangement for humanitarian response in another hands. As the region Khanakul I & II Blocks are in face to face of flood hazards in every year, Government and local region members should take a proper action, so that common people can live with safety.

1.1 Drainage system scenario of the study area

In study area the drainage system is totally controlled by River Mundeswari, embranchment of River Damodar and River Rupnarayan, embranchment of River Darakeswar. Those rivers flow towards southerly and joined near of Marokhana Panchyet, Khanakul-II block, Hooghly. This place is the combined zone of three different districts as like Howrah, Midnapur and Hooghly. Mundeswari is the most important river and it is the main causes of flood in study area. In every year due to heavy monsoon rainfall, this river is overflows and makes devastating floods in each and every year. Actually at the lost of main river, new channels have increased gradually and that is why a cut was made and linked with old and new channels and the name of this cut is Muchi Hana. As a result of this, the River Damodar flows on Muchi Hana. During past it flows on Kaiti-Chakbhura and in present near Pansuli it flows as River Mundeswari (Bhattacharyya, 2011).Darakeswar and Damodar are major rivers in Western part of West Bengal. The River Darakeswar has originated at Tilboni Hill in Purulia District. It has flowed on south eastern part of Brddhaman district and after that it has entered in Hooghly district. The River Silai has joined with it near of Ghatal and known also as Rupnarayan River (Chattopadhyay, 2011). Surroundings of the study area has so many canals as like Aurora Khal, Hurhura khal, Katakhal; Chhabis Bigha khal, Bara Khal etc.

II. LOCATION

Khanakul I&II Blocks are under of Subdivision Arambagh, district of Hooghly, West Bengal, India. The geographical coordinates of Khanakul is 22.7279° N, 87.8673° E. Total area of the study region is 171.92 km^2 (66.38 sq mi).



[Pic-1: Location map, Extracted from Google Earth Pro]

III. OBJECTIVES

(I) Identify flood vulnerable region surroundings of Khanakul I & II Blocks.
(ll) Analyzing causes of floods.
(III) Identify Important Rivers and Canals surroundings of the study area.
(IV) Consideration flood effected panchayet, moujas of the study area.
(V) Output a general overview of flood effect.
(VI) Management procedure of flood in the study area.
(VI) Suggest appropriate measures to mitigate hazards and future development planning in this block.
(VII) Assess the impact of flood in all around of human life.
(VIII) Find out flood shelter zone in red alert condition.

IV. METHODOLOGY

In this research, various kinds of Primary and secondary data has been collected from different kinds of sectors. Local administrative as well as Block of Khanakul I & II and different local monitoring body have randomly identified through sampling method to complete the paper. As a secondary data sources, information have collected through different Magazines, Newspapers, Books, Published Papers, Internet services etc.

V. A CASE STUDY OF FLOODS IN ARAMBAGH SUBDIVISION, ESPECIALLY KHANAKUL I & II BLOCKS; AND ITS EFFECTS

Flood is the overflow of expanse water that submerged a huge amount of land surroundings the channel of river. Generally flood is a natural and extreme geophysical event which threats to human life and human properties. There have so many reason of flood as like decrease of river width, massive downpour, sudden release of water from upper catchment river's barrage (D.V.C, Mithon, Panchet, Kansabati), short period massive rainfall, poor

natural drainage or poor siltation, limited storage capacity of dams etc. Mondal, P. (2016). In thesis of "A study in landform and soil in Bishnupur-Arambagh region", Santomoy Chattopadhyay has showed in 1985 about the condition of soil, landforms as well as physical body of environments and Socio-Economic condition of flood prone regions of River Mundeswari. In all over West Bengal, flood is a common problem and also in Arambagh Subdivision especially in Khanakul Block. The Khanakul I & II Block are very vulnerable than surroundings. The elevation of this region is 15mt only, from sea level. The main slop of catchment basin of rivers Darakeswar and Damodar is towards Khanakul block, Arambagh subdivision, Hooghly. So, devastating hazard of flood easily occurs in this block in every year.

5.1 A general overview of flood affected area of Khanakul Block:

Name of block	No. of G.Ps affected	No. of mouza affected	% of mouza affected	Area affected In Km.	% of area Affected
Khanakul-I	13	94	100	172.41	100
Khanakul-II	11	53	100	121.74	100

[Table -1: flood affected area; Source: Disaster Management Department, Arambag Sub-Division**]**

5.2 General causes of Flood in study area:

There have some general causes of flood in this region as like follows;

1. Climatic change and abnormal behavior of Monsoon.
2. The most important cause of the flood of this region is high level of discharge from DVC.
3. Heavy siltation in channel of different river in study area.
4. A huge deforestation in upper, middle and lower catchments surroundings.
5. Various kinds of construction and across of natural drainage line by embankment on the floodplain.
7. Huge sedimentation of river bed and decrease of river carrying capacity.
8. Overflow condition of water of Rivers Mundeswari, Darakeswar and Rupnarayan.
9. A very gentle slope of channel of River Darakeswar and Mundeswari.
10. In some area, due to agricultural encroachment, channel width has become narrow.
11. Lack of awareness about repairing of Dams during of that period.
12. Worst condition of natural levees of the Rivers Mundeswari, Darakeswar and associated channels likes Hurhurh Khal, Arora Khal, Karakdha- Panjhula Khal, Kata Khal, Deb Khal etc.
13. Less stable condition of soil due to use of chemical fertilizer at riverside agricultural field.
14. Drilling various 'Khal' or 'Nala' for irrigation purpose, in an unconditional manner.
15. Less awareness of administration.

5.3 Name of important Rivers and Cannels, causes of flood - in study area:

Name of Block	River	Cannel
Khanakul I	1. Munderswari 2. Darakeswar 3.Kana-Darakeswar4. Harinakhola.	1.Rampur Canel 2.Arura Canel 3.Panjola Canel
Khanakul-II	1.Munderswari 2.Kana-Darakeswar 3. Rupnarayan	1. Hurhurh Khal 2.Arore Khal 3. Karakdha-Panjhulakhal 4. Kata Khal 5. Dev Khal

[Table - 2: Important Rivers and Cannels in study area; Source: District profile of Hooghly]

VI. EFFECTS OF FLOOD

6.1 General Effects:

Flood in surroundings of study area have some general effects as follows:

1. A huge number property of agricultural becomes damage and loss.
2. Impacts on human health and all kinds of living organism.
3. Educational problem of poor child are also so much important problem because due to their loss of property they cannot run their study in a normal way.
4. Common people loss their settlements due to devastating flood in this region.
5. Livestocks are also so much affected due to this flood in every year.
6. Due to this flood people migrate from one place to another place and for this condition, a block wise demographic structural problem occurs.
7. The price level of market becomes high due to damage of vegetables and so many losses of properties.
8. Besides of these; Road damage problem, Plantation problems, accommodation problems occur due to this flood of the study area.

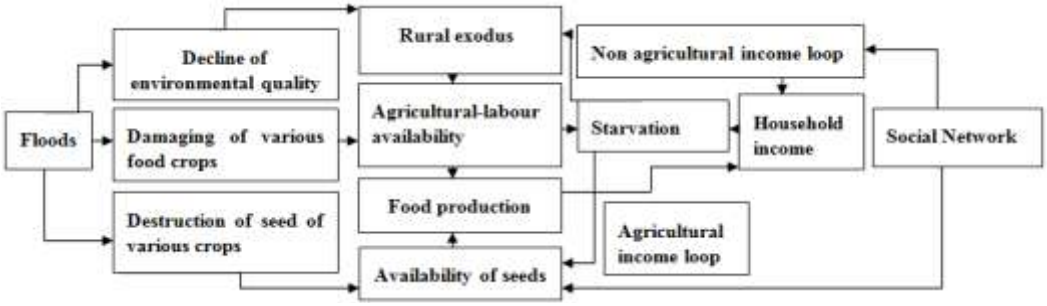


Diagram – 1: Impact of floods on livelihoods and vulnerability of natural resource**, (**Armah, F. A., et al. 2010)

6.2 A general case study about affected agricultural region at the time of flood, Khanakul Block I & II:
Flood of Mundeswari and Rupnarayan Rivers affect the region of Khanakul I & II in every year. These areas are very lower than surroundings. The elevation of these regions is 15m (49ft) from sea level. Each and every year the flood and destroying embankment is a common phenomenon of these regions. A huge number of property have damaged by flood in 2007. It must be mitigated as soon as possible. So, as an example, overview of effects of floods in that year is in below:

An overview of affected agricultural	**Total areas**	**Affected area**	**In percentage**	**Total production loss**	**estimated monetary value of production loss**
Total Area of agricultural land	36,843 hector	29,310 hector	79.6 %	69,490.2 Metric Tones	6514.39 lakhs
Aush paddy	2074 hector	1834 hector	88.4%	31387.4 M.T.	282.45 lakhs
Amon paddy	33,533 hector	26,389 hector	78.7 %	55,481.8 M.T.	4,993.37 lakhs
Vegetables	1236 hector	1087 hector	87.9 %	10,870 M.T.	1238.57 lakhs

[**Table - 3**: Flood effected agricultural area; Source: Department of Disaster Management, Khanakul Block]

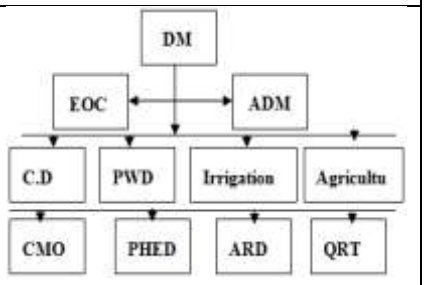
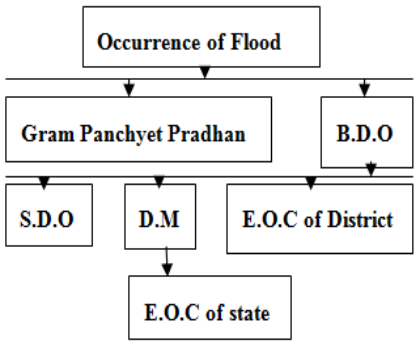
Actually, Khanakul-II Block is most vulnerable area than Khanakul-I, Pursurah and surroundings blocks. Amount of damaged vegetables is around 99% and the percentage of affected cultivated area is more than 60% of total area. In last devastating flood; agricultural regions, human properties, livestocks of Khanakul II Block have very much damaged than Khanakul I Block.

VII. MANAGEMENTS

7.1 General Flood Management Programmed:-
It is very unfortunate that, there have a little improvement on flood managements in these Blocks. Local common residence and its surroundings of these blocks are so much affected due to this disaster. So, it should be maintained properly so that common people can live in safety and with free from anxiety. A proper management can only solve this problems and rescue affected peoples from this hazards as like follows:
1. Different kinds of local bodies, Panchyet Samity and Zilla Parishad can construct 'Boro Bundhs' or high embankment at two sides of rivers, for passing flood discharge easily.
2. Block and Sub-Division level Disaster Management Group should be totally aware about this condition and they should visit in all blocks periodically and verify the conditions of embankments, river banks, Hydraulic Structures etc. so that restorative works can be started before the monsoon period and before these disasters.
3. Department of "Disaster Management" should ready at the time of flood with necessary preparatory works and necessary materials as like poly bags, sand, nylon, dry foods, and drinking water at any time and any situation.
4. At the time of crisis, verities of empty Poly bags should be issued to the BDOs at that Block or side Blocks.
5. Channel of different rivers and Khals should be properly managed.
6. Control of reservoir with proper and scientific methods.
7. Proper maintenance of all the embankments surroundings of these blocks.
8. Proper soil conservation and protect sheet erosion.
9. Proper channelization of stream.
10. Diversion and bypass of channel for passing water.
11. Early Warning to common people and give a forecast about flood.
12. Identification of flood vulnerability zones and proper management.
13. Insurance should be given to all affected people or may be affected.
14. Should grow the awareness of public.
15. Set up various Control Rooms and work actively at the flood time.

16. Need of proper maintenance, responsibility and accountability.
17. Boats and other equipments should be ready at any time and any moments at the flood time.
18. A sustainable management of flood.

7.2 Structural action plan of management, Khanakul-I and II, Hooghly district during the year 2018-19:

Base camp stations & officer in-charge	**Departments wise structural linkage for flood management**	
Khanakul: (Stationed at Khanakul) In charge, BLDO. And other officers and staffs. Besides, so many members and 'Pradhan' are also grows their helping hands for the managements of this disasters.		

[Base camp Station – In charge, in study area & Diagram-2: Flow chart of structure of management of flood disaster;
Sources: Office of the district magistrate and collector Hooghly, Disaster Management Department and ARD Department].

7.3 Action process, during Natural calamities in different phases:
As this is totally a flood prone region, it should need a long term managements. These natural calamities cannot be avoided. These hazards can be minimized by appropriate management practices and active prevention. In-fact, for proper managements of flood, emphasis should be given not only on post-disaster but also on pre-disaster preventive/mitigation. There have a Standard Operating Procedures (SOP) for Disaster Management as like DM, SDO and BDO. In this SOP managements have three phases for proper action on floods:

7.3.1 Pre-flood phase
In this pre-flood management phase there are some special works, which are so much important for controlling flood phase hazardable condition:
(a) Identification and demarcation of flood prone regions.
(b) Observation and properly repair of all embankments.
(c) Assessments of vulnerability.
(d) Stockings of necessary materials as like drinking water, animal feed, medicine etc.
(e) Prepare a list of boat holder's name and address.
(f) Activate to all control rooms.
(g) Development of all kinds of infrastructure.
(h) Awareness of common people and give a forecast and warning.

7.3.2 During Flood Phase
In the flood phase situation Local Government and all management members should be active in full time.
(a) Rescue flood affected peoples as soon as possible.
(b) Rescue all the Livestocks.
(c) Proper supply of dry food, drinking water, medicine to affected people and Livestocks.
(d) Provide life jackets to all flood affected people.
(e) Diverge them from flood affected area to a safe shelter.
(f) Disposal of carcass and dead bodies as soon as possible.

7.3.3 Post-Flood Phases
There have also some work in post-flood situation as like:
(a) Properly assess the damages.

(b) Verify all loss lives.
(c) Proper care on animals.
(d) Physical, economical and Social Rehabilitation.
(e) Documentation of all the incidents for future.

7.4 Name of some Government flood shelters in Hooghly Kahanakul 1 and 2 Blocks:

Name of Block	Name of village
Khanakul-I	Purba Radhanagar
Khanakul-I	Sankarpur
Khanakul-I	Hirachak
Khanakul-II	Harma
Khanakul-II	Kaknan

[Table - 4: Flood shelter zone; Source: http://www.hooghly.gov.in/disaster/main_disaster.htm]

7.5 Major Findings at Khanakul Blocks:

In 1978 at Horinkhola station, the maximum gauge height was recorded 14.49 meter against the discharge 6208.7 cusec.	In 2010 at Horinkhola station, the minimum gauge height was observed 7.42 meter against the discharge 120.2 cusec.	In the years 1978, 1980, 1984, 1985, 1986, 1987, 1990, 1993, 1994, 1995, 1996, 1998, 1999, 2000, 2006, 2007 and 2009 crossed the extreme danger level (EDL).	In almost every flood during the month of September, the peak flood level was normal which was unexceptional during year of 1932.	Due to breaching of embankment, sudden falling in recession limb occurs from one upstream station to another downstream station.
The correlation coefficient between the river discharge and gauge height is 0.804.	There have a variety of aerial extension of flood from year to year and block to block.	Khanakul-I and II Blocks are represents as a common victim of destruction in every flood.	There have a positive and strong correlation between the variables river discharge and gauge height.	A study shows that there is no chance of such devastating flood within 35 years.

[**Table - 5:** Major findings at a glance; Source: Civil Defense Department and Department of Disaster Management]

Due to climatic change and unfavourable behavior of Monsoon, there have irregularity of rainfall in every year. If the year wise rainfall variation studies, it is noticed that in 2009 the average amount of rainfall in that year was very low. From 2010 to 2017, there have a balance of rainfall. But in 2018, the average amount of rainfall is high than previous 10 years. In 2019, a devastating rainfall have occurred which is definitely an abnormal situation. In months of July, August and September in 2019, the amount of rainfall is more than 200 mm and number of rainfall days is 30. So, this erratic behavior of Monsoon rainfall grows the chance of devastating flood.

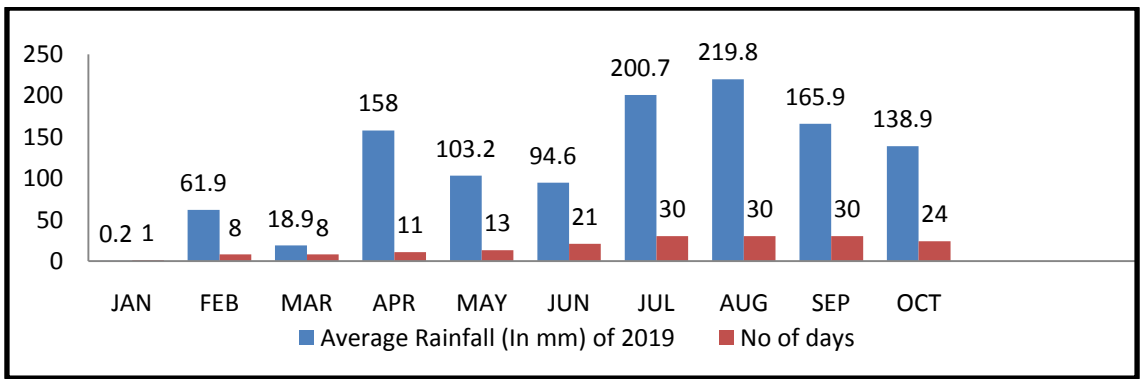


Diagram 3: Monthly Rainfall data of Hooghly district (2019)
[Source: https://www.worldweatheronline.com/lang/en-in/hooghly-weather-averages/west-bengal/in.aspx]

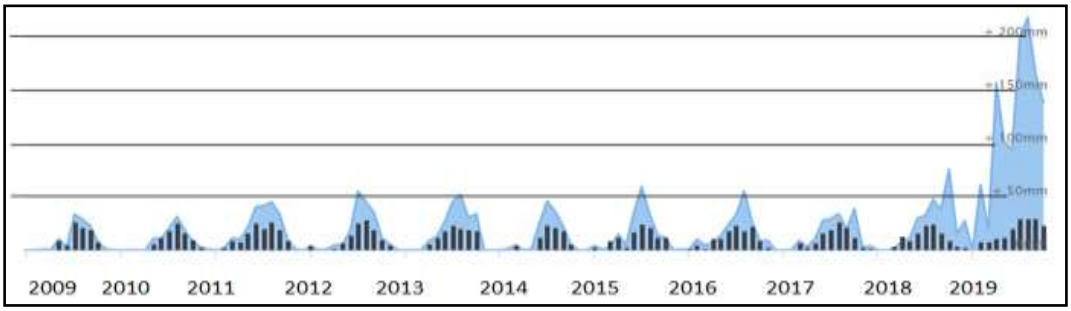
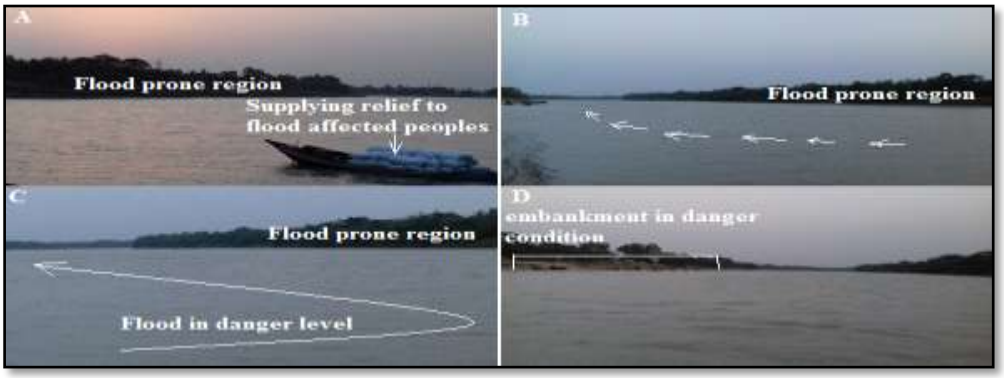


Diagram 4: Average rainfall data of Hooghly district (2009 2019)
[Source: https://www.worldweatheronline.com/lang/en-in/hooghly-weather-averages/west-bengal/in.aspx]

VIII. CONCLUSIONS

Actually proper and scientific management of flood and floodplains of Hooghly District, especially Khanakul I &II Blocks can reduce the damage and give stable relief for human civilization. This paper is mainly showing the flood effected regions of Khanakul I and II blocks, during monsoon and late monsoon period in every year and how this disaster can be controlled.



(Pic-2: A, B, C, D – A general scenario of Rivers Mundeswari and Rupnarayan at Khanakul Block, during flood condition)

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