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Case Study on Diminishing the Flood Hazard in Gangetic Delta

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ABSTRACT

A few catastrophic events have happened from the times of scriptural Noah as of recently. These cataclysmic events have taken different structures like; floods, tremors, volcanic emission tidal waves, tornadoes, avalanches, typhoon, and among others. Inside the previous decades, flooding has become a worldwide pandemic which hampers economic and social improvement. This worldwide wonder has influenced 4 million individuals, loss of lives and economic harms of around US$ 780,500,000. It is thusly important to discover the reasons for flood. Floods are catastrophic events which can cause issues and antagonistic impacts on the populace. These occasions will likewise cause annihilation on a substantial scale. An incorporated flood management should assume a critical job in decreasing the effect of flooding among merchants, particularly as far as arrangements to confront floods later on. The paper talks about the current situation with flood at an intersection point between two waterways at Bandar of Ghatal block in Gangetic delta and proposed an innovative answer for diminished weakness of flood. While yearly floods can possibly unleash devastation on ill-equipped networks, ruin crops and jeopardize sustenance security, they likewise assume an indispensable job in agriculture.

1. Introduction

Flood Management and Mitigation is intended to limit negative flood-related effects while safeguarding the advantages. Flood mitigation includes the overseeing and control of flood water development, for example, diverting flood run-off using floodwalls and flood entryways, instead of endeavoring to avert floods out and out. It additionally includes the management of individuals, through measures, for example, departure and dry/wet sealing properties for instance. The counteractive action and mitigation of flooding can be contemplated on various dimensions: singular properties, little networks and entire territory or towns or urban communities. The expenses of assurance ascend as more individuals and property are ensured. The best method for lessening the hazard to individuals and property is through the creation of flood chance maps. Most nations in the developed world will have delivered maps which show territories inclined to flooding occasions of known return periods. By distinguished zones of realized flood hazard, the most reasonable method for lessening hazard is to forestall further improvement in those realized flood chance regions. It is imperative for in danger networks to build up a far reaching Floodplain Management plan. Those people group that partake in the National Flood Insurance Program must consent to manage improvement in the most flood inclined territories. Networks ought to allocate a floodplain director to regulate the management of the floodplain advancement grant process. Decrease of disintegration risk we can use by MZWA (Mapping and zoning of watershed region), RZB (Restricted Zone of Build up), different delicate designing strategies and other important techniques with no negative effects of natural assets.

Chiefs overall face a troublesome test in developing a viable reaction to the danger of water-initiated disasters. After supplications to the downpour divine beings, replied in overabundance in parts of our nation, presently the center has moved to floods. Numerous states in our nation are flood inclined because of overwhelming precipitation or something else. The flood makes misfortune human life and wide spread harm to property. Unfathomable harm to agriculture happens influencing the States arranging and upset the financial planning there by backing off the entire economy of the nation. Individuals not influenced by the flood will in general overlook the occasion suspecting that it doesn't influence them so why trouble? Flood isn't one of a kind to India. Floods come in various pieces of the world. Floods are the greatest reason for death toll each year all through globe. Greater part of nations doesn't report or guide floods systematically. Flood influences numerous territories of national economy. Following are a portion of the territories requiring consideration from government bodies.

- Rural Damage
- Business and Industrial Damage
- Private Properties Damage
- Transportation Damage
- Man and Livestock Damage
- Level Land

1.1 Background of the Study Area

Stream Silabati and Dwarakeswar meet at Bandar, and the consolidated stream is named as Rupnarayan, which joins waterway Hoogly at Geonkhali covering a separation of 78 km. The examination zone stretches out between 22039'30"N and 87046'12"E and 22039'30"N and 87047'15"E to 22040'50"N and 87046'12"E and 22040'50"N and 87047'15"E at Bandar, Paschim Medinipur, West Bengal, India. The catchment territory of both the tributaries has normal tropical monsoonal kind of atmosphere with a normal precipitation of 1320 mm to 1630 mm. Yearly temperature ranges from 11°C to 45°C. The point of intersection of stream Silabati and Dwarakeswar as for waterway Rupnarayan are 230 and 360 individually. The slope

of Dwarakeswar (0039'52.56") is more than Silabati (0011'55.03") and Rupnarayan (009'25.16"). The normal rise of the intersection is 12 m. from mean ocean level. The intersection zone is described by an arrangement of pools and riffles. Semi-diurnal tide is dynamic here and tidal motivation enters a little past Bandar. Tidal bore of lower greatness is an essential wonder at that intersection.

1.2 Effects of Flood Incidents towards the Population's Economy

Flood is considered as a standout amongst the most far reaching disaster to hit nations everywhere throughout the world and causes misfortune in vast scale. As per the World Meteorological Organization (MWO), flood is the third most obliterating natural disaster on the planet in which it had asserted a great many lives and caused pulverization of hundred thousand million worth of properties. With regards to flooding impacts, a disaster like flood is ordered into three classes by most specialists, to be specific peril, hazard and disaster. Flood is viewed as risky on the off chance that it happens in a zone that is occupied by people and can possibly cause harm and loss of property, sway on wellbeing, damage and death toll. The peril of flood can likewise transform into a disaster if its impact can cause a great deal of harms and loss of people's lives. Essentially with hazard, such flood occurrence can be viewed as unsafe on the off chance that it can possibly cause negative effect on people and people's action. With regards to disaster, an episode can be viewed as a disaster if the general misfortune endured by the network is bad to the point that the vast majority of the open offices, private offices, structures, business premises and others are destructed

2. Review of literature

As per Merz et al. (2010), flood sway appraisal is a critical piece of flood hazard management. Along these lines, the estimation of misfortune endured by the populace can be limited by the usage of flood hazard management that is fabricated dependent on the studies of flood sway evaluation, particularly as far as economy. Among the studies talking about the impacts of flood in the part of economy are by Tuan Pah Rokiah et al. (2011), Merz et al. (2010), Tran, Marincioni, Shaw, Sarti and Van A (2008) and Hammond et al. (2015). Nonetheless, those studies just examine on the impacts of flood in the part of economy as a rule. The circumstance is distinctive with this examination that talks about the impacts of flood to the dealers in detail and incorporates two kinds of business which are deal things business and services business

As per Ibrahim (2007), flood is characterized as a critical increment in water dimension of waterways, lakes, bowls or shoreline zone. In Malaysia, flood comprises of blaze flood and rainstorm flood (Chan, 1997) which are normally connected with natural components (precipitation and winds) and human variables (logging, settlement and agriculture).

3. Objectives Of The Study

- To discover the fundamental driver of flood and its impact on the eco-geo-environmental condition.
- To talk about the current situation with flood at an intersection point between two streams at Bandar of Ghatal hinder in Gangetic delta and proposed an innovative answer for decreased defenselessness of flood
- To produce and apply eco-accommodating mechanical arrangements and courses of action bolstered by nearby specialized learning and materials for flood chance decrease

4. Experimental setup

At the point when toward one side of a tidal stream segment the water level changes, the water level at the opposite end of the segment will likewise change after some postponement. The deferral is controlled by the length of the waterway segment and by speed the underlying change spreads through the stream. For the significant part this engendering speed relies upon the normal profundity of the stream segment.

C= (g.h) (+)/(-) V

Where,

c=propagation velocity

g=acceleration of the gravity

h=average depth

v=velocity of the flow

(+)=when c and v are in same direction

(-)=when the direction of the v differs from that of c

The propagation velocity (c) is much higher than the current (v).

In a stream segment with normal profundity 10m, engendering speed is around 10 m/sec. what's more, with a normal profundity of 5m, it is around 7 m/sec, expecting the estimation of 'V' near zero. The water level at the conversions of the significant waterways with the ocean is always showing signs of change because of tides. These progressions engender O along their own courses as well as along the numerous bifurcations, brooks and so forth., changing with fluctuating time-length water levels at the two closures of every stream of river segment, commencement an example of streams in the different conduits.

A few past studies had displayed discrimination between the straight, winding, and interlaced streams based on release and channel slant. Path recommended the accompanying standard for the event of interlacing.

$$S>0.004\ (Q_m)^{-0.25} \quad (1)$$

Where, Q m=mean annual discharge; and S=channel slope.

Using bank full discharge Qb , Leopold and Wolman in 1957 proposed the relationship for braiding to occur, which also predicts braids at higher slopes and discharges:

$$S>0.013\ Q_b^{-0.44} \quad (2)$$

Where, Qb= bank full discharge.

Antropovskiy (1972) developed the following criterion for the occurrence of braiding

$$S>1.4Q_b^{-1} \quad (3)$$

Leopold and Wolman also indicated that braided and meandering streams can be separated by the relationship:

$$S=0.06\ Q^{0.44} \quad (4)$$

Where, S=channel; and Q=water discharge

Be that as it may, these pointers have been reprimanded by Schumm and Khan as none of these recognizes the significance of dregs transport. These outcomes infer a higher power consumption rate in plaited streams, an end strengthened by Schumm and Khan's flume tests. Be that as it may, none of these specialists recognizes the control of channel design by sedimentology. Since, bed material transport and bar arrangement are important in both wind and interlace improvement forms, the limit between the examples ought to identify with bed load. Henderson re-examined Leopold and Wolman's information to determine an articulation including d50, middle grain estimate (mm)

$$S>0.002\, d_{50}^{1.15} Q_b^{-0.46} \quad (5)$$

Where, d50=median grain size

As per condition (5), a higher limit incline is fundamental for interlacing in coarse bed materials. Bank material opposition influences rate of channel movement and ought to likewise impact the edge, despite the fact that its impact might be hard to measure and furthermore be non-straight since more prominent stream control is required to disintegrate muds and cobbles than sands.

Parker's security analysis indirectly outlines the impacts of bank material opposition by characterizing the wander - mesh limit as:

S/Fr=D/B (6)

Where, D=mean depth of the flow; B=width of the stream, and Fr=Froude number.

However, depth, width and Froude number may be expressed in terms of discharge and bank silt-clay percentage, as suggested by Schumm (Richards, 1982). Meandering occurs when S/Fr ≤ D/B, braiding occurs when S/Fr ≥ D/B, and transition occurs in between S/ Fr ~ D/B.

Ferguson (1981) suggested for braiding to occur, which predicts steeper threshold slopes for braiding in channels with resistant silty banks.S>0.0028 (Qb)-0.34 $B^{0.90}$ (7) Where,Bcontent in the bank material (Figure 2)

5. Data analysis and results

Floods differ in level of seriousness as far as territories degree or extent and top to bottom. They are, in this manner, named minor or real flooding. In a minor flooding, immersion could possibly be expected to overbanking. At the point when there is no bank flood, flooding is basically because of the aggregation of unnecessary surface run-off in low lying level zones. Floodwaters are generally limited to the flood plain of the waterway along the channel, on arbitrary low-lying zones and discouragements in the landscape. Floodwater is generally shallow and there may not be a discernible stream.

Amid a noteworthy flood, flooding is brought about by the flooding of streams and lakes; by genuine breaks in barriers, levees, dams and other defensive structures; by wild arrivals of appropriated water in stores and by the gathering of extreme spillover. Floodwaters spread a wide adjacent region and spread quickly to abutting regions of moderately lower rise. Flooding is moderately somewhere down in many pieces of the stricken zones. There is an exceptionally noticeable present as the flood spreads to different territories.

While floods take some time, as a rule from 12 to 24 hours or considerably more, to create after the event of exceptional precipitation, there is a specific kind which creates after close to six hours and, oftentimes, after an even less time. These are what are known as blaze floods.

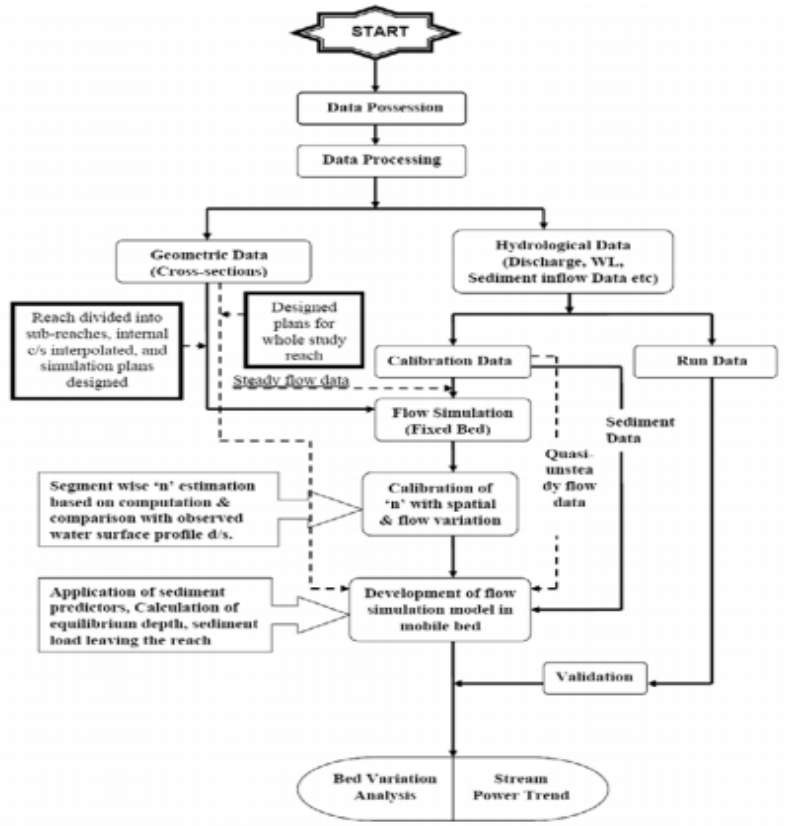

Figure 1 Flow Chart of Methodology

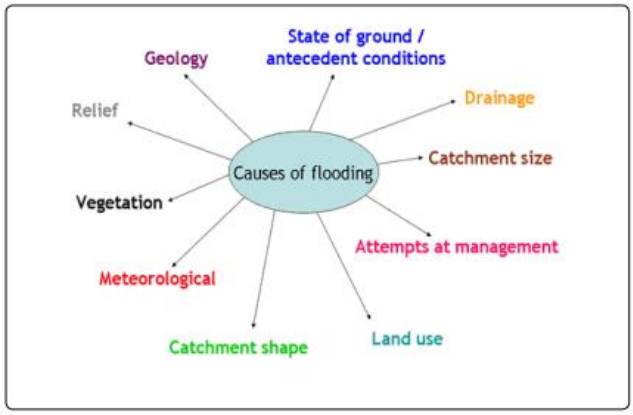

Figure 2 Causes of flood of the Study Are

Table 1Month wise rainfall chart (Silabati development authority)

Month	Rainfall in mm.		
	2013	2012	2011
January	0	0	0
February	35.6	36.6	37.7
March	128.7	122.7	132.6
April	54	64	56
May	182.2	158.7	147.3
June	333.6	340.6	339.1
July	1092.7	1127	1198
August	356	355	361
September	442.5	338.6	498.6
October	52.8	78.7	69
November	31.6	35	38
December	0	0	10.2

6. Causes of flood in the study area

Main causes of the flood at Bandar of ghatal block are -

- Meteorological: High downpour fall in rainstorm season is fundamental driver for flood at Bandar territory of Ghatal square. Month astute precipitation diagram (Silabati advancement expert) (Table 1 and Figure 4)
- Catchment measure: Badar is an intersection purpose of dwarakeswar and silai stream and the joined stream is named as Rupnarayan. So in a storm season two waterways carry on enormous sum water and when meet the intersection purpose of Bandar, water is flood. Since catchment size of waterway isn't sufficient here (Figure 5).
- Catchment shape: The real width of the waterway Silabati and Dwarakeswar is 50 m., yet it is 80 m for Rupnarayan. The normal width of Rupnarayan is 66.66 m. The expansion volume of water because of tidal impact is one essential reason for the additional width of Rupnarayan River at intersection. This abrupt enlarging causes stream division prompting expanded sedimentation.

7. Consequences of flood

Flooding can be unsafe – just 15 cms of quick streaming water are expected to thump you off your feet! Floodwater can truly upset open and individual transport by cutting goes romping and railroad lines, just as correspondence joins when phone lines are harmed. Floods upset typical seepage systems in urban areas, and sewage spills are normal, which speaks to a genuine wellbeing risk, alongside standing water and wet materials in the home. Microscopic organisms form and infections, cause illness, trigger unfavorably susceptible responses, and keep on harming materials long after a flood. Floods can disseminate a lot of water and suspended residue over immense zones, restocking important soil supplements to rural grounds. Conversely, soil can be dissolved by a lot of quick streaming water, demolishing crops, crushing agrarian land/structures and suffocating homestead creatures.

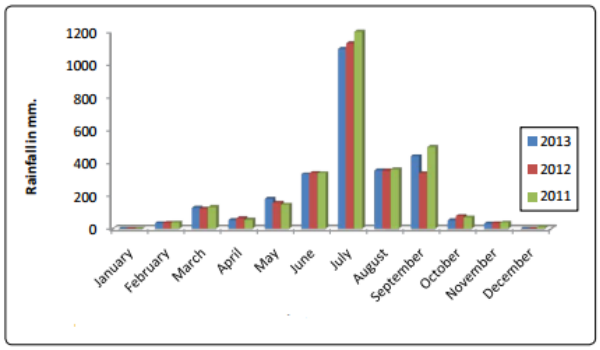

Figure 3 Month wise rainfall in various year of the Study Area

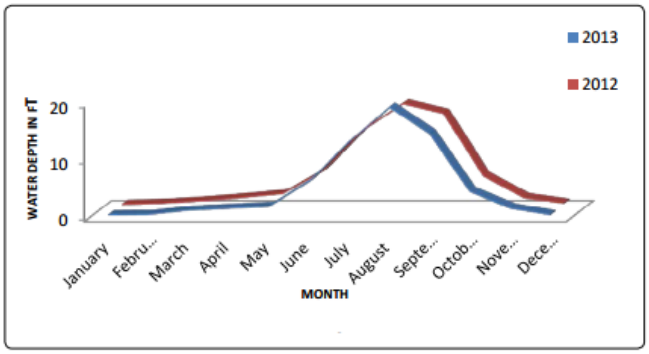

Figure 4 Depth of water in river at Bandar

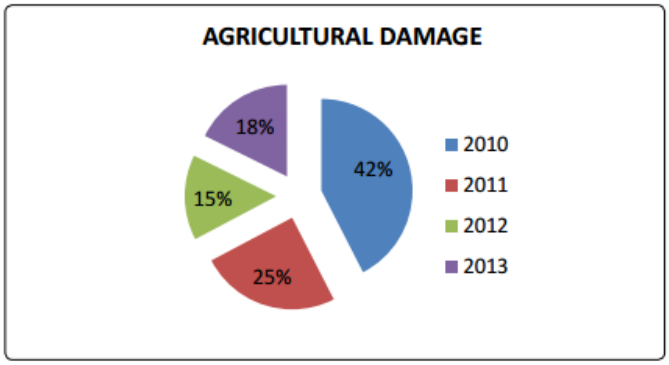

Figure 5 Agricultural loss

- Agricultural misfortune: Agricultural land is the crucial asset for the general population living in study region uniquely the individuals who live in land, all out horticultural generation of that specific land and work constrain occupied with that occupation. The poor had less measure of land to help their family. Just about 62 percent of the complete populace lives on agriculture (Figure 6).
- Loss of family units: Last couple of years some private house is somewhat or totally harmed by flood and a disintegration of the chose zone (Table 2 and Figure 7)
- Loss of street: Last four years consistently 1.5 to 2.5 km normal street is pulverized by flood of the chose region (Table 3 and Figure 8)
- River bank disintegration: River bank disintegration put huge worry to the general population who dwell alongside riverbanks as they lost their residence, horticultural terrains and in general agrarian generation (Figure 9).
- Damage of populace: Unfortunately numerous family or individual is influenced by flood or moved of the chose region in a decade ago (Table 4 and Figure 10**)**

8. Flood risk reduction management

Flood control alludes to all techniques used to lessen or keep the adverse impacts of flood waters. A portion of the regular procedures utilized for flood control are establishment of shake berms, shake tear raps, sandbags, keeping up ordinary inclines with vegetation or utilization of soil bonds on more extreme slants and development or extension of waste channels. Different techniques incorporate levees, barriers, dams, and maintenance or confinement bowls. There are two kinds of measures to moderate the flood harm: auxiliary mitigation measures and non– basic mitigation measures.

Table 2 Households

Year	Full Damage	Part Damage
2010	8	18
2011	3	7
2012	0	5
2013	1	9

Source: B.D.O and field survey

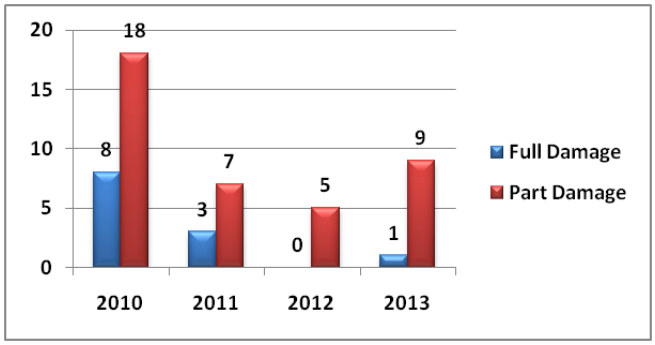

Figure 6 Households

Table 3 Damage of road

Year	Shifted Population	Affected Population
2000	325	2082
2001	275	1565
2002	272	1365
2003	155	1090
2004	300	750
2005	172	542
2006	135	460
2007	0	45
2008	85	350
2009	132	572
2010	62	350
2011	55	275
2012	42	180
2013	22	150

Source: B.D.O and field survey

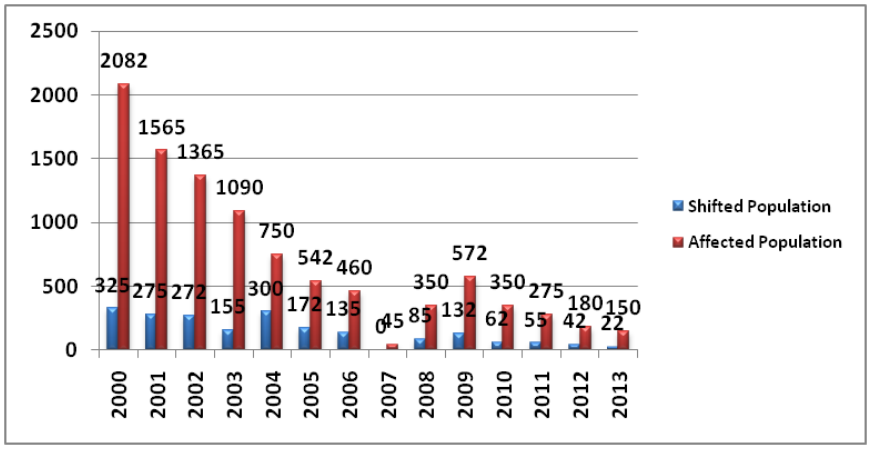

Figure 7 Damage of road

Table 4 Total population

Year	G.PROAD (JHAMA)	P.S ROAD (JHAMA)	KATCHA ROAD(mt)
2010	500	300	1700
2011	300	450	1100
2012	275	212	300
2013	200	250	700

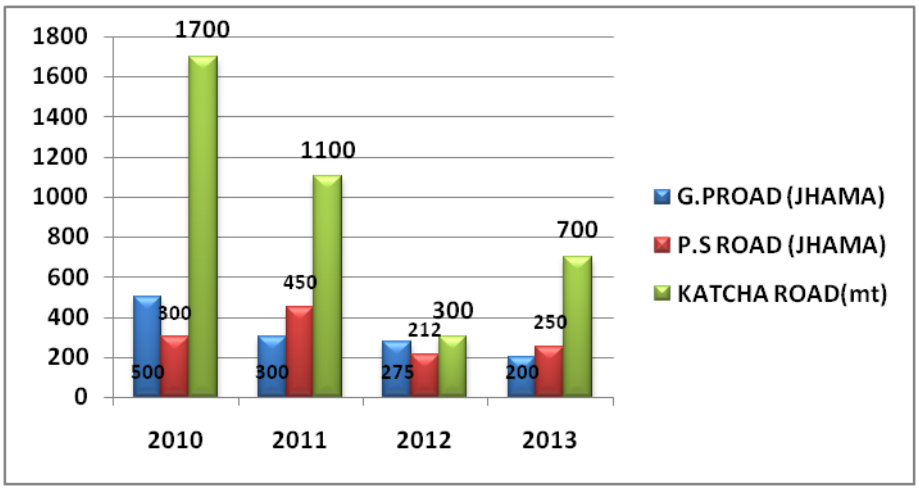

Figure 8 Total population

8.1 Structural mitigation measures

- Reductionoffloodpeakbystoragereservoirs
- Storage reservoirs and detentionbasin
- Confining river flood byembankments
- Floodwall
- Channel improvementworks
- Cut –off
- Diversion of flood water:floodway
- Construction of higher earthen platform in low – flyingflood pronearea
- Sluices
- Ringbund

8.2 Non-structural mitigation measures (Figure 11):

- Drainage linkage system(DLS)
- Prepared RZB (Restricted Zone ofBuildup)
- Prepared MZBA (Mapping and Zoning of BasinArea)
- Connection of rivers withsource
- Flood forecasting orwarning
- Floodproofing
- Weathermodification
- Mathematicalmodeling
- Flood insurance (Figure12)

9. Conclusion

Water system and Waterways Department (I and WD) Govt. of West Bengal has officially taken up refining works in some significant scopes of the waterway. Be that as it may, the advancement isn't sufficient and there is no far reaching undertaking to take care of the issue. This is a direct result of the high demolition and harm of the deal things and premises/slow down/stand. The compromising flood disaster has demonstrated that flood episode is a natural event that must be tended to by all gatherings, particularly on the flood planning measures. Aside from that, an incorporated flood management likewise assumes a vital job in diminishing the effect towards individuals and harm to property. With the enhancements as far as early arrangement for the flood among

brokers, it will almost certainly lessen the misfortune endured by dealers, particularly in zones that are submerged. Indirectly, this methodology will most likely form a feasible society and ready to make due after a flooding occurrence.

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