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CRITICAL ANALYSIS OF KRISHNA SUB-BASIN FLOOD 2019

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ABSTRACT- *The present research work includes the details of Krishna sub basin also the study of flood events of Krishna basin 2019.The capacity of reservoir & rainfall pattern of Krishna basin was studied. The data of flood prone area was collected & Analysis of flood 2019 in Sangli District was done by various Organizations like Indian Metrological Department (IMD) & IITM Pune, Water Resources Department (WRD), Central Water Commission New Delhi (CWC) & Maharashtra Remote Sensing Application Centre & also suggested existing floods mitigation in infrastructure in Krishna basin. The solutions were suggested from the reasons studied.*

Keywords – Krishna sub basin study, Rainfall , Flood analysis and discharge analysis.

1.INTRODUCTION

A flood is defined as water overflowing onto land that usually is dry flooding is often thought of as a result of heavy rainfall, but floods can arise in a number of ways that are not directly related to ongoing Weather events. In 27july to 3 august 2019 Maharashtra experienced an unexpected heavy rainfall for This situation resulted in severe flooding in 3 out of 36 districts in the state. On July and august 2019. Maharashtra experienced an unexpected heavy rainfall for this situation resulted in severe flooding in 3 out of 36 districts in the state. On July and August 2019 Sangli district in Krishna Sub Basin experienced heavy rainfall for long duration due to this condition it negatively impacted on life property & crops. etc. Sangli district faced heavy flood situations in past& also floods of 2005 & 2006 where noteworthy. However, flood event was comparatively much more sever which latest more than a week. In 2019 year Sangli district are hited by flood in Krishna river basin. Flood comes due to these reasons Abnormal rainfall pattern, climatologically Conditions & topographical features.etc. The main Focus of this paper is to give some suggestions to Overcome the flood related problems.

2.METHODOLOGY

2.1.Material and methods :-

The data used for this study is obtained from Water Recourses Department (WRD), Warnali , Sangli and The data includes Average Rainfall of year 2019 and recorded at all Talukas of Sangli district. Sangli district basin information collected from literature review and A report on flood 2019, (Krishna sub basin) by Expert study committee was referred.

2.2.Study area :-

In Maharashtra Krishna basin drains 69,425 sq.km which is 28.61% of total Krishna basin. There are 5 basins in Maharashtra i.e. Godavari, Krishna, Narmada, Tapi & Western flowing rivers. The drainage area of Krishna sub basin in Maharashtra is 69,425 sq.km which is 26.81% of area of Maharashtra. It is the second highest basin in Maharashtra.

Fig No.1. Map of Krishna basin

3. Study of Krishna sub basin and analysis

The Krishna River is the fourth largest River in India. Krishna basin extends over Andhra Pradesh, Maharashtra, and Karnataka having total area of 2,58,948 sq. Km which is 8% of total geographical area of country. The Krishna River rise from western Ghats of Maharashtra an altitude 1337m just north of mahableshwar. The total length of river is about 1400 km. The 26% of the basin falls in Maharashtra.
Krishna basin is having two major broad sub basins namely Krishna & Bhima. They are further divided in 5 sub basins

as K1, K2, K3, K5 & K6. Following table 4.1 shows details of areas.

Table No.1 : Sub basin wise area

BROAD SUB BASIN	SUB BASIN	SUB BASIN WISE AREA IN SQ. KM.	AREA SQ. KM.
Krishna	Upper Krishna sub basin (K1) Middle Krishna sub basin (K2) Ghatprabha (K3)	17128 1388 2010	20526
Bhīma	Upper Bhima sub basin (K5) Upper Bhima sub basin (K6)	45335 3564	48999
	Total	69425	69425

3.1.Study of Drainage area :-

Krishna Godavari commission had divided entire Krishna basin into 12 sub divisions & they are designated as K1 to K12 spread in all states. The 5 basins K1, K2, K3, K5 & K6 are spread in Maharashtra state.

Table No.2: Region wise Area

SR NO	SUB BASIN	TOTAL AREA IN SQ.KM.	RIGION WISE AREA IN SQ.KM.			
			PUNE	NASIK	AURANGABAD	KOKAN
1.	Upper Krishna sub basin (K1)	17128	17128	0	0	0
2.	Middle Krishna sub basin (K2)	1388	1388	0	0	0
3.	Ghatprabha (K3)	2010	1893	0	0	117
4.	Upper Bhima sub basin (K5)	45335	34598	6180	4557	0
5.	Upper Bhima sub basin (K6)	3564	1997	0	1567	0
	Total	**69425**	**57004**	**6180**	**6124**	**117**

3.2.Analysis of annual rainfall for Krishna sub basin :

The average annual rainfall of Krishna sub basin is 85% during south west monsoon. The annual rainfall varies from 1000-3000mm in region of western ghat. River further enters in the region of the western ghat which receive less than 600mm annual rainfall. Which is continuously increases to 900mm.towards east coast. The average Annual rainfall of Krishna basin is 1096.92mm

SR. NO.	SUB BASIN	GEOGRAPHIC AREA (SQ KM)	MAX (MM)	STATION	MIN (MM)	STATION	MEAN (MM)
1	2	3	4	5	6	7	8
1	Upper Krishna (k1)	17128	6208	Mahableshwar	500	Khanapur	1300
2	Middle Krishna (agrani) (k2)	1388	814.22	Pandegaon	209.42	Pandegaon	481.30
3	Ghatprabha (k3)	2010	8997.70	Kitwade	407.00	Kadal	1300
	TOTAL	20556					

Table No.3: Annual observed station Rainfall in Krishna sub-basins.

3.3.Study of water level for Krishna basin

Krishna River Basin is in for worst floods in comparison to August 2005. The water level has crossed the previous HFL – Highest Flood Level recorded by CWC (Central Water Commission).

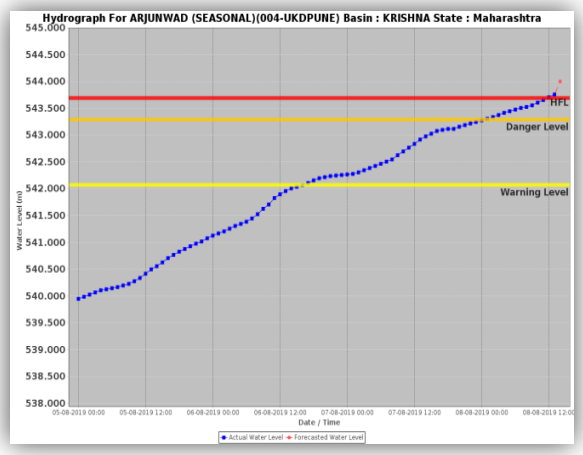

Fig No.2. Water level of Krishna basin

3.4.RESERVOIRS IN KRISHNA BASIN

Table No. 4.Major dams in Krishna basin

SR.NO.	NAME OF RESERVOIR	LIVE STORAGE CAPACITY (MCM)
1	Koyana	2835.54
2	Dhom	331.05
3	Kanher	271.68
4	Warana	779.34
5	Dudhganga	769.11
6	Radhanagari	219.97
7	Tulsi	91.92
8	Kesari	77.96
9	Patgaon	104.77
10	Dhom balkawadi	112.14
11	Urmodi	273.27
12	Yeralwadi	19.60
13	Tarali	165.46

4.Result& Duscussion : Result & Duscussion :

- Return period analysis by India meteorological department and IITM pune under MOES:- The return period for sangli district has been analyzed. The below Figure. Shows return values of 50,100 and 200 years for 1 day rainfall in district. The value for sangli district are up to 10-20 cm, which is the same as excess rainfall. The 1 day Rainfall variability due to low.

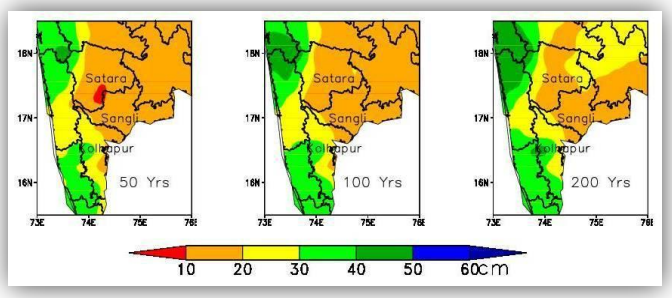

Fig.No.3.One day rainfall in Sangli District

- Study report by Maharashtra the Remote sensing application centre (MRSAC):- MRSAC has study the situation of Krishna sub-basin flood 2019 using Remote Sensing and GIS. From various Geo-Spatial data bases layers such as Digital Elevation Model (30m), Slope, Drainage, Watershed, Administrative Layers, Transport Layers, Rainfall Data, Inundation Map, Flood Line 2019, etc. such as National Remote Sensing Agency (NRSA), MRSAC, WRD GoM available from a variety of sources. These are the major observations of rainfall on the Krishna basin: Work was carried out for the ISO- Hytel Curves and daily precipitation using the Interpolation- Inverse Distance Method (IDM) during period from 25 July to 15 Aug 2019-daily evaluation done in GIS platform. Then sangli district received more than 100mm of rainfall between 26 to 8 Aug Krishna, Warana river in Sangli district was flooded due to heavy rainfall of 250 mm occurred on 4 Aug 2019 and three to four day onwards. Estimated cumulative runoff on Irwin bridge from 30July to 1Aug 2019 is 5214 MCM. Against the actual measured runoff is 5418 MCM.

- Critical flood period by Water Resources Department, GoM:- In 2019, the Krishna valley dams had at least 14.40% reserves before the onset of monsoon, as the goal of flood reduction and conservation was achieved through the dams. Due to simultaneously in different sub-basins of Krishna valley, causing severe floods in Krishna, Warana and other rivers and in their tributaries in the upper and middle krishna basin for a short period, especially from 27 July to 10 Aug 2019. Sangli district had to face severe flood.

Table No. 5.Danger level of Irwin bridge,Sangli

SR.NO.	PERIOD (IRWIN BRIDGE, SANGLI)	DANGER LEVEL (Meters)
1.	5 Aug 2019	540.77
2.	9 Aug 2019	544.57

- Central Water Commission New Delhi:- During the period ending 1June to 7 Aug 2019,upper Krishna and Bhima sub-basins received max. Rainfall, respectively and from 1 Aug to 7 Aug, the entire Krishna valley received max. Rainfall more than 396% in the upper Krishna valley. The first spell of flood in the context of Koyna dam started on 7 July and it ended on 13 July and the second spell again 29 July. On August 4, the Koyna dam reached very close to its HFL, and on August 7, 1, 20,000 cusecs begin to discharge water.

5.Flood Event of 2019 in Krishna Basin:

It can be seen that the flood effected districts of Satara, Sangli and Kolhapur continuously received excess to large excess rainfall during 25 July 2019 to 13 Aug 2019.This part of Krishna river flowing through Sangli district. The catchment area of Krishna sub basin is 6792sq km up to gauging station at Irwin Bridge. Major flood situated was experienced in Sangli town between 5th August to 14th August when flood crossed danger levels. on 9th August when highest flood of 6324 m3 /sec (2, 23,399 Cusecs) had passed over Irwin bridge, which was highest in known history. In addition, loss of Infrastructure, Animals, Artisans, Commercial properties, Houses etc were reported. Total losses suffered for above 3 districts were estimated to Rs.3475 crore.

The overall observed rainfall over the normal was about 18 times. Rainfall is also expected in the mattress-free watershed. The contribution of free water in the catchment area released into the Krishna River from the Irwin Bridge in the sangli was 49%. Discharge from free watersheds, which was bulky and out of control.

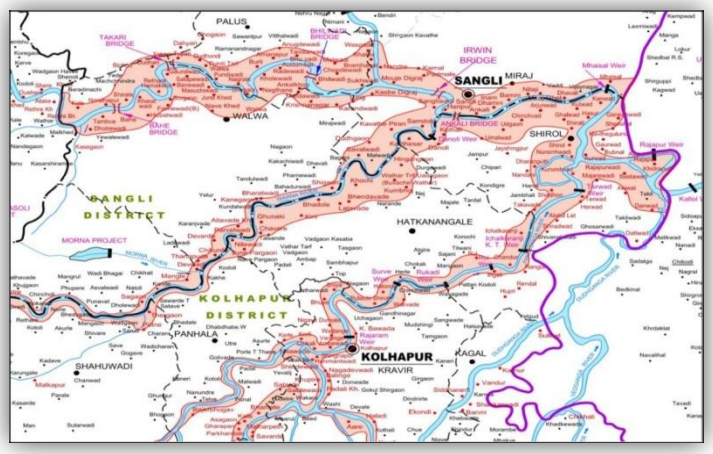

Fig.No.4.Flood spread area of Sangli District

6.Analysis Of Rainfall Of Aug 2019

In 2019 Aug, Sangli on the banks of Krishna river in western Maharashtra had to face historical flood._Nearly one lakh people were displaced in this district alone and more than 30 people lived their lives._In the previous photobags, we are reporting the effect of floods on agriculture and rural fabric of Sangli.

In Maharashtra, Upper Krishna Valley means Sangli district has received heavy rainfall. The district has received 1 177.mm mm of rainfall from 1st to August respectively. Rainfall in the first week of August was 1,000,000% above normal.
The Koyna and Warna dams are almost 100% full at 5aug when the current flood wave started.
The dam does not start releasing water on July 25 when the Koyna and Varna dams are only 50% full. the FRL of Koyna is 965.4 found out according to the website of the Maharashtra Water Resources Department, and it is 658.65 so full that it exceeds the direct storage capacity.

6.1.DISCHARGE – KRISHNA BASIN

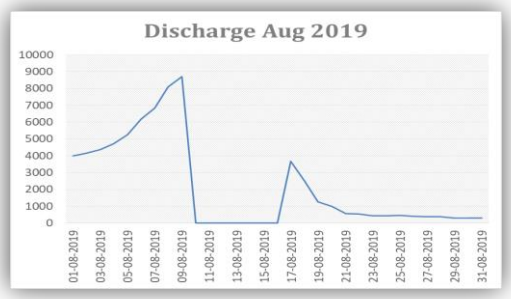

Chart No.1. Discharge of July 2019

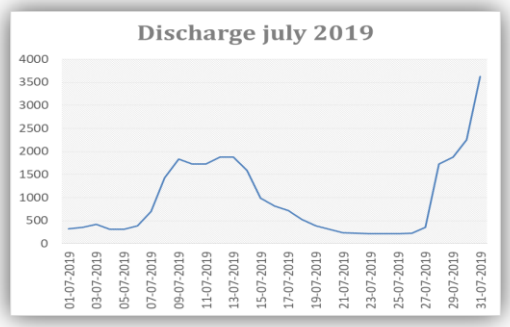

Chart No.2. Discharge of Aug 2019

6.2.Sangli District All Taluka Average Rainfall 2019:

Table.No. 6. Sangli district all taluka average rainfall 2019

7.Reasons:

Usually in the Krishna valley there is a steady increase in the water table of the groundwater table as the increased water table accumulates in the soil and does not infiltrate but increases the volume of water carried away which sometimes causes floods. Due to the reduction in the height of all the bridges, the flood level in 2005 was a few meters higher than the flood level.

Although the District Collector demarcated the river flood line, houses and huts have been illegally constructed and therefore 200 particulars in Sangli district are especially responsible. Due to the meteorological conditions the low pressure area in some areas is usually connected to small and large disturbances. Heavy rain falls. This was also a cause of the flood.

Heavy rains in the catchment area of the dam have released excess water in the river basin which was lead to an increase flood levels. Due to change in climatologically condition posing threats of natural disaster like flood. Typical topographical feature plays measure role in slowing down the flood dissipation beyond city. Deforestation plays many roles in flooding as it prevents plants from being carried away and retains more water and the roots absorb water from the soil and the soil dries out and is able to store more rainwater. Due to the poor project planning of reservoir impacted on flood absorption capacity. Due to sudden change in the slopes of river bed and sedimentation occurs in the river courses thus deflecting the floods further to the outer sides.

SR. NO.	TALUKA	AVERAGE RAINFALL
1.	Miraj	612.46
2.	Jath	617.29
3.	Khanapur vita	644.17
4.	Walva islampur	755.98
5.	Jasgav	649.72
6.	Shirala	1058.48
7.	Atpadi	441.20
8.	Kavthemhankal	497.90
9.	Palus	363.50
10.	Kadegav	656.60
11.	Sangli	721.80

8.Solutions:

This is the solutions for reducing severity of flood situations.

1. For improving river capacity long term ecological measures are very important.

2. More tree plantation and project wetlands due to trees, shrubs and Deadwood along riverbank and on floodplain area act as a controller of flood water, it holds water back and slowing flow of flooding.

3. Understand and identify the water ways, severing their flow.

4. Improve soil conditions is very important due to impermeable soils and rocks such as clay or shale increasing flood risk, but permeable soil rocks allow water to infiltrate into them it reduces flood risk.

5. By removing dumped debris, siltation, vegetation developed in between cross sections of river including its tributaries nallas and local drains. Should clean this as routine by local authorities.

9.Conclusion:

1. This project provides information about situation of flood in 2019 and what are the critical analysis of Krishna sub basin flood
2. Flood can not be absolutely controlled flood can only be managed to reduce flood losses.
3. What are the main reasons behind the earlier flood and hydrological parameter of Krishna basin.
4. The worst affected districts noticed were Sangli and Kolhapur (Krishna and panchganga sub basin).
5. Suggesting different solutions for flood controlling or managing.

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