**INTRODUCTION:**

Floods are one of the most widespread and destructive natural disasters. It is an overflow of an expanse of water that submerges land. Floods are caused by weather phenomena and events that deliver more precipitation to a drainage basin than can be readily absorbed or stored within the basin. Floods can be caused by natural, ecological or anthropogenic factors. There are several causes of floods and differ from region to region. Some of the major causes of floods are:

1. Heavy rainfall
2. Heavy siltation of the river bed reduces the water carrying capacity of the river/stream.
3. Blockage in the drains leads to flooding of the area.
4. Landslides blocking the flow of the stream.
5. Construction of dams and reservoirs.
6. In areas prone to cyclone, strong winds accompanied by heavy down pour along with storm surge leads to flooding.

Flood is resulting from extreme geophysical event to create an unexpected threat to human life and property. Flood occurring in densely populated area have the capacity to do maximum damage to life and property. Agricultural practices and deforestation have considerably changed the situation in whole river basins. Death, disease, injury, displacement of people and economic loss are the usual consequences of flood.

The Tapi River experience high flood magnitudes occasionally. The flood duration of Tapi ranges between 6 to 10 days. This fact is highly hazardous for the district.

The development and management plan Preparation process was identified for 92 of the 674 villages in the district spread in four talukas prone to floods every year.

**FLOOD AFFECTED SETTLEMENTS IN DHULE DISTRICT:-**

<table>
<thead>
<tr>
<th>SR. NO</th>
<th>TALUKAS</th>
<th>NAME OF RIVER</th>
<th>FLOOD AFFECTED SETTLEMENTS</th>
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(Source- Samarth Dhule Jihla-2020)

All these settlements are located on the banks of Panzara, Kan, Burai, Tapi, Arunavati, and Aner river. During the floods of 2007 nearly 30 villages located on the river bank were flooded and they require immediate rehabilitation at the safe location.
Which is free from floods? Therefore it is necessary to study of flood affected settlements in particular district.

**LOCATION OF STUDY AREA:**

Dhule district, formerly known as west Khandesh is located in northern part of Maharashtra State. It is spread between Latitude 20° 38’ to 21° 61’ N. and Longitude 73° 50’ to 75° 11’ E. Dhule district is bounded by the district Jalgaon is located to the East, Nashik to the South, Gujarat State and Nandurbar district is located to the North-West. It is located at the crossing of three National Highways namely NH-6 (Surat-Nagpur), NH-3 (Mumbai-Agra), and NH-211 (Dhule-Solapur) Because of the Satpuda ranges. Dhule district is separated from Madhya Pradesh. A Satmala range also separates it from Western Maharashtra. Dhule district has an area of 8061 sq.km and it contributes 2.62% area of the Maharashtra state. The height of the district varies from 300 to 600 Metres above mean sea level.

Dhule district comprises four tahasils namely,

1) Dhule  2) Shirpur.  3) Shindkheda  4) Sakri

Dhule district forms a distinct geographical unit as it is occupied by ‘Satpuda’ ranges in the north, ‘Satmala’ in the South and central Part is occupied by Tapi basin with its major tributaries like Panzhara, Burai and Arunawati. Most part of the Sakri and Dhule Tahsil is occupied by Dhanora and Galana hills ‘Hanuman’is highest peak on Galana hills, Kondaibari and Laling bari are minor Ghats in the district. Babakuvar is the highest peak in shirpur tahsil, Bijasan Ghat to the North- East of Shirpur tahsil. Central and Eastern part of district is occupied by fertile plain. Shindkheda, Shirpur and Dhule tashil are included in central fertile plain.

**GEOLOGICAL STRUCTURE:**

Geological foundation covers the structural arrangement and the deposition of rocks in the earth crust. Geological foundation of Dhule district represents an assemblage of rocks of different kinds and ages from upper Cretaceous to the recent. However, the fairly exposed rock formations are the Deccan trap basalt rock formation – from Danian of upper Cretaceous to Eocene and Alluvial formation of recent period.

1) **DECCAN TRAP BASALT ROCK:** - The Deccan trap basalt formation covers nearly 2/3 part of Maharashtra. The overall thickness of Deccan trap
basalt formation varies greatly in Dhule district. However an average thickness fluctuates around 1000 meters in the District. The deposition of trap is nearly horizontal and forms flat topped hills and plateaus. Spheroid weathering is the characteristic weathering of basalt rocks observed all over the district. It produces thin concentric cells or layers and become soft and fall off gradually. The deep penetration weathering is observed along the well developed joints. The district is lack in mineral resources. However, the massive fine grained basalt is hard and durable. It is extensively used as building material like masonry rubble, building stones, road metals, railway ballast, concrete caustics etc.

The district belongs to the stable peninsular shield. Therefore resists the tremors of earthquakes. However due to the great water reservoirs in the vicinity of the district like Ukai Dam and Sardar sarowar Dam may creates hydrothermal earthquake tremors in near future. In the trap basalt an interesting feature of topography of Dhule district is the occurrence of numerous dykes. They follow east-west orientation along trend line of Satpuda in Tapi basin. However, in some areas they are also oriented in North-South direction. The later phase of volcanic eruption was comparatively weaker. The lava erupted in weaker section of trap rocks and solidified in the vertical manner. Such feature is known as dyke. The most of the dykes in tapi basins are dolerites in composition. The length of the dyke varies greatly and range from hundred of meters to over hundreds of k.m. the dyke range forming the Northern divide of Panzara is nearly 150 k.m. in length.

II) ALLUVIAL FORMATION:-

According to Geologists in alluvial formation includes alluvial and colluvial sedimentary deposits. Since this formation is associated with the glacial aggradations phase during mid to late quaternary period. The quaternary deposits are comparatively thick in the form of extensive flood plain in Tapi basin. Where in, the alluvial thickness is over 100 M. on the both bank of Tapi in Dhule district.

The alluvial formation of Dhule district covers the southern part of shirpur and the northern part of shindkheda tahsil in a approximately East-West narrow strip of rolling plain covering 1/5 part of total geographical area of the district. It also occurs in small pockets along main tributaries of Tapi like Panzara, Burai, Amaravati, and Bori from southern side and Anner and Arunavati from northern side.
RELIEF:

Relief is the elevation of the surface above the common datum plain of the region. There are two measurable dimensions of relief. One is absolute relief and relative relief. The absolute relief is the direct measure of altitude above mean sea level and relative relief is the difference in elevations between the highest and lowest elevation in a unit area. Both the measures of relief determine the topography. Slope, Drainage, Ground water, Soil, and Climate. Therefore, they are significant attributes of land and water resources.

Dhule district can be divided into four relief division-

I) NORTHERN SATPURA MOUNTAIN RELIEF: - The Northern side of the Dhule district is defined by the Satpura ranges. Satpura itself is a horst block between Narmada and Tapi grabens to its north and south respectively and Satpura attains its maximum elevation at asthamba peak (1398 M AMSL) in Akkalkuwa tahsil of the Nandurbar district. Its orientation is approximately in West to East direction. The Crestline of satpura is dotted with numerous isolated hills and plateaus like Guliamba (120 M), Bhoksa Dogar (1208 M) and Toranmal (1155 M). Satpura Mountain of Dhule district belongs to the western satpura. Babakuwar is the highest peak in Dhule district with 886 M (92659 feet) altitude above mean sea level. Satpura covers a very small area of the district. This portion of the Satpura receives higher rainfall due to the altitudinal influence. Though this area is small in proportion, it is very potent in respect of recharging ground water in piedmont zone of Satpura. The Shirpur tahsil of Dhule district has a good potential of ground water.

II) SAHYADRI: - The Sahyadri is usually referred as the Western ghat lies on South Western boundary of the district; it covers very small area of the district. Western Ghat ridges are scattered ridges with curious and picturesque outline without any well marked peak. On the North Western side of the district there is a wide gap between Western Ghat Satpura covered by extensive flat terrain of the Tapi alluvial plain. To the West of the district Western Kondaibari pass provides access between Navapur tahsil of Nandurbar district and Sakri tahsil of Dhule district. There are many Eastward stretching ridges originating from Western Ghat one behind one other. The Southernmost is Galna hill.
III) THE MIDDLE TROUGH OF TAPI ALLUVIAL PLAIN RELIEF: - The Tapi is a major Westward flowing river of Dhule district. It forms a trough of the graben filled with alluvial material forms a flat rolling plain surface with extremely faint relief on both side of the river channel. It covers nearly 1/5th portion of total geographical area of the district. It is the best agriculturally suitable land resource of the district and bears a good potential of ground water. The drainage from North and South are converging in this trough. The average elevation of this surface is less than 150 meters above mean sea level.

IV) THE SOUTHERN RESIDUAL HILL RELIEF AND DYKES: - This is the prominent portion of hill relief of Dhule district and covers nearly half portion of the total geographical area. This area comprises Southern part of Shindkheda, Dhule and Sakri tahsils. This region consists of the Galana hills on Southern boundary of the district. The river courses of Panzara, Burai and Amarawati have oriented by East West dykes. Apart from the dykes there are numerous residual hills in the range of 250 to 750 m. like Bhamer hills, Dhanora hills, Laling, dhamnya dongar, Pratappue fort, Songir hill etc. These all are the flat topped basaltic hills. Galna hills divide Dhule from Nasik district. To the South of Pimpalner Galana hills attains maximum elevation in Mamgi-Tungi in three peaks with elevations of 1291, 1224 and 1331 MAMSL.

❖ RIVERS:

Tapi is the major river in Dhule district. Formerly, It was perennial river but at present due to over exploitation of ground water it became dry. The length of Tapi in the district is about 71k.m. It enters from Jalgaon district and flows from East to West. Aner, Arunawati are the major tributaries flowing from Northern bank, where as Panzhara, Burai Amaravati joins to the Tapi on southern bank. It is an anomalous inverse drainage pattern. The Northern tributaries in middle reach follow subsequent orientation path over the Southern slope of Satpura mountain and Southern ones follow consequent path to main channel of the Tapi river. Panzhara is the largest tributary of the river Tapi. Therefore most part of the Dhule district is made fertile by the tributaries of Tapi River.

DRAINAGE BASINS OF DHULE DISTRICT
<table>
<thead>
<tr>
<th>SIDE SR.NO.</th>
<th>SR.NO.</th>
<th>NAME OF THE TRIBUTARY</th>
<th>SOURCE HEIGHT IN M.</th>
<th>TOTAL LENGTH (Kms)</th>
<th>TOTAL CATCHMENT'S AREA (Sq.Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>1</td>
<td>Aner</td>
<td>600</td>
<td>94</td>
<td>1702</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Arunavati</td>
<td>450</td>
<td>53</td>
<td>935</td>
</tr>
<tr>
<td>southern</td>
<td>3</td>
<td>Bori</td>
<td>600</td>
<td>130</td>
<td>2580</td>
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<tr>
<td></td>
<td>4</td>
<td>Panzara</td>
<td>600</td>
<td>128</td>
<td>2758</td>
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<tr>
<td></td>
<td>5</td>
<td>Burai</td>
<td>600</td>
<td>64</td>
<td>1419</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Amaravati</td>
<td>562</td>
<td>55</td>
<td>740</td>
</tr>
</tbody>
</table>

(Source- Samarth Dhule Jihla-2020)

❖ CLIMATE:

The district is characterized by warm and dry climate. Summers are dry where as winters are cold. The average temperature during the month of May is 45°C and the average temperature during December is 12°C.

The average annual rainfall is 60 cm. The distribution of rainfall is uneven and unreliable, therefore Dhule district comes under ‘Drought prone region’ the district receives most of the rain from South-West monsoon. The Western region receives more rainfall as it is located on higher elevation, whereas Shirpur, Shindkheda and Dhule receives comparatively low rainfall.

❖ NATURAL VEGITATION:-

The forest of the district is spread over about 2, 08,890 hectare which is about 28.50% of district geographical area. The major area under forest is spread over sakari (35.27%) tahsil. Very less area is covered under Shindkheda tahsil, three divisions working for the development of forest which is West, North, and forest development Corporation. The major commercial species like Teak, Bamboo, Anjan, Moh and Tendu are grown in this forest. Whereas the important forest products are Tendu Leaf, Grass, Gum, Teak wood, medicinal oil etc.

❖ SOIL:-

The major portion of the earth crust of the district has been synthesized from the igneous rocks and the soils are black, medium black, shallow and calcareous types having different depth and profiles. As regards the geographical area of the district
there are light and shallow soils (60%) medium deep black soil (25%) and deep black soil (15%) Medium deep black soil spread over a Shindkheda. Sakari and Western part of Dhule tahsils. This is favorable irrigation purpose. The North part of district on the bank of river covered a Shirpur tahsil having a deep black soil.

The area along Tapi and her tributaries shows deposition of black cotton soil, Mountainous region of the hilly West having sandy soil. Soils of the study area are divided in to three major types:

1) DEEP BLACK COTTON SOIL:-

These soils occur in a narrow strip of land around 3 km on both the sides of the river Tapi and her major tributaries. The local name for it is ‘Bharikali’. The soil is deep black in color and highly fertile, which generally supports excellent vegetation growth. The average depth of the soil in this region does not exceed 3 meters. This soil has a tendency to develop deep cracks in summer and tends to be waterlogged in the rainy season.

2) MEDIUM BLACK SOIL:-

A major part of Tapi basin is covered by this type of soil. It is found in the plain and also the undulating areas of the Southern zone and along the rivers and streams in extensive patches. The soil is fertile. It is granular to sub-granular and loamy to clay in structure.

3) COARSE SHALLOW SOIL:-

This type of soil is confined only to the hilly areas. The slope and foot hills of the Shirpur ranges, Galana hills and Dhanora hills are covered by these soils. These soils are formed of the disintegrated basaltic rock. These rocks produce ‘Murum’ as a result of disintegration which ultimately produces soils of varying depth, color and texture. These soils are often very gravelly and at places are mixed with gravels.