

## UNIT : V

### APPLIED GEOMORPHOLOGY - HYDROLOGY

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#### Study carried out with following Objectives

- Survey of whole water emphasising the morphometric character of size , shape , pattern etc.
- An analysis of drainage network with respect to drainage density and density.
- The geomorphology of river channel and mode of development of aggradational part of the basin.
- Geomorphological and hydrological relationship in tidal areas.
- Discharge characteristics of the main river and its tributaries and the sediment yield of the basin.

## RELATIONSHIP OF GEOMORPHOLOGY TO SURFACE WATER RESOURCES

- Mapping of drainage river , lakes , swamps , floodplains etc .
- Study of hill slopes and average angle .
- Study of spring present .
- Study of vegetation .
- The impact of run off on ground water resources .

## Application of geomorphology to hydrology includes following three sets of condition

- 1) The landform may give a clue to sub surface occurrence of sinkholes fracture , joints or the features which contains water in them.
- 2) The relative important of surface run off and infiltration which can be estimated from the comparative drainage density scale
- 3) Use of remote sensing or aerial topographic interpretation technique to study lithology , structures , aquifers.

## Three main aspect for study

- a) Fluvial geomorphology
  - b) Morphometric environment
  - c) Geomorphological analysis of the drainage basin
- Hydrology and geomorphology are intricately linked through erosional and depositional process that create a dynamic equilibrium in the healthy watershed.

# HYDROLOGICAL SIGNIFICANCE OF LOWLAND GEOMORPHOLOGY AND CHANNEL SHAPE

- Braided river
- Alluvial fans
- Natural levees
- River meanders
- Deltas
- Anamomosing channel

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## Braided channels

- ❖ Network of low sinuosity channels separated by mid-channel bars/islands
- ❖ Found in :
  - glacial outwash plains (sandur)
  - distal(furthest) reaches of alluvial fans
  - mountainous drainage systems
- ❖ Typically has:
  - minimal vegetation cover
  - high run off
  - high rate of sediment supply

- Sudden decreased in gradient
- In braided river there are lack of capacity to transport the entire load
- Lack of competence to transport all sizes which either of these situation leads to mid-channel bars



# Alluvial fans

- Found where the tributaries enters the main streams of a river of less gradient and near mountain streams when they enter the plain.





## Hydrological condition

- Rapid deposition of coarse material
- Radial pattern of partially abundant channel.
- The occurrence of spring when fan tapers out down the slope.
- The occurrence of imperfect sheets of flood in semi arid areas
- Gravity flow of ground water when water table is low

## NATURAL LEVELS

- Form around lowland river and creeks without human intervention , Elongate ridges of mud/silt that form on floodplains immediately adjacent to the cut banks.
- Levee systems Prominently built along the Mississippi river, Scheldt in Netherlands.



## Hydrological condition

- ❖ Water logging is common in the bank swamp formed and this are commonly happens at meandering times.
- ❖ The tributaries of the river are prevented from direct entering the main channel due to high position of banks with the result they start flowing parallel to the river.
- ❖ High portion of river beds with respect to adjacent plane leads to seepage of ground water through natural levees.
- ❖ The arial lines between natural levees after the external drainage and due to the fine texture of soil material the natural levees is affected.

## Meandering channel

- ❖ Formed during quick aggradational stage where only medium to fine texture material are deposited.
- ❖ High sinuosity , large channel systems.
- ❖ Finer sediment load(compared with braided) dominantly by silt and clay .

❖ Migration of pattern is coarse cross-bedding in deposits ,fine silt/ mud dominate overbank deposit high suspended load content coarse channel/ pointbar deposits(alluvium).



## Hydrological condition

- ❖ The mode of cut off in the meanders is significantly the nature of discharge of the river system.
- ❖ The cut off may be neck cut off or chute cut off
  - In neck cut off the drainage is fairly regular , load is insufficient and stable channel.
  - In chute cut off the fluctuation in river drainage cause flooding.

## Anastomosing channels

- ❖ Hybrid form: similarities to meandering and braided morphologies
  - multiple channel stream
  - low gradient
  - narrow , deep channels
  - laterally stable banks
  - therefore typically highly vegetated , evolved ecosystems
- ❖ Anatomosing channel splits around floodplains elements.

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# Hydrological condition

- ❖ Rapid deposition , large frequent change of the drainage pattern.
- ❖ Channel parts are longer than one curved channel part around one bar.
  - Flow and sediment patterns in each channel are independent from one another and channel splits around bars or islands.





# Delta

- Tract of alluvium usually fan-shaped, at mouth of a river
- The river becomes divided into two or more channels which may further divide and rejoin to form a network of channels .



# Hydrological condition

Delta is form by combination of two process

- a) Fluvial factors
- b) Burial factors

## Fluvial factors

includes frequency , duration of flood to the rise and fall in river stage , flood volume , main dry period of floe and amount of transport of sediments.

## Burial factors

Includes astronomical types , occurrence , magnitude of storms , landforms.

## Geomorphology of limestone terrain to Hydrology

- The rock vary in their ability to rain water permeability and is partly primary and secondary as acquired
- Permeability is depend upon presence of initial interconnecting voids in the calcareous sediments
- Secondary permeability results from joints and fractures , opening created by solution of rocks along joints , bedding plane.

❖ The presence or absence of such large solutional cavity depends upon the top portion of limestone.

❖ The surface permeability varies most notably with respect to topography of region, such variation in permeability w.r.t geomorphology effects the hydrology condition of an area.



- ❖ The Ecological Limit Of Hydrologic Alteration (ELOHA) offering a flexible , scientifically defensible compromise for broadly assessing environmental flow needs.
- ❖ Watershed Assessment of River Stability and Sediment supply (WARSS).
- ❖ Technical developed by Dr. David L. Rosgen for water quality scientists to use in evaluating streams and rivers impaired by excess sediment.
- ❖ Proper Functioning Condition (PFC)  
qualitative watershed assessment proper functioning of wetland areas.

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