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**PROGRAM: CIVIL ENGINEERING**  
**COURSE: IRRIGATION ENGINEERING**  
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# Module 1: Irrigation Principles and Practices



- Introduction
- Necessity
- Advantages and Disadvantages of Irrigation
- Classification
- Method of Irrigation

# Introduction



- The process of artificially supplying water to soil for raising crops, in accordance with crop requirements throughout the crop period.
- World-wide 544 million acres of land is irrigated which comprise 17% of the total land and about one-third of total food production.

- It is known fact that India has a very large population and different studies show that it will continue to rise at least till 2050 A.D.
- According to the UN publication **Sustaining Water - An Update** (1994), the population of India by 2050 A.D. could vary between 1349 million (low projection) and 1980 million (high projection), with a medium projected figure as 1640 million.
- At present the country's food grain availability is around 523 grams per capita per day (though it varies significantly with the economic level). In China and USA, the corresponding figures are 980 grams and 2850 grams respectively. Assuming a population figure of 1800 million by 2050A.D, and a small rise in per capita consumption of food grain at about 650 grams, the annual requirement of the country would be around 430 million tonnes.

- The present productivity of irrigated land is about 2.5 tonnes/hectare and less than 0.5 tonnes/hectare for rainfed lands.

Assuming that these levels can go up to 3.5 and 1.0 T/hr respectively by 2050 AD (which should be the urgent needs that has to be addressed to by the water resource engineer), it is imperative that the irrigation potential of at least 130 million hectare is created for food crop alone and 160 million hectare for all crops to be able to meet the demands of the country by 2050 AD.

# Sustainable development in Irrigation

- For the survival of the country, there is an urgent need to implement and plan irrigation strategies for now, and in future, as the population continues to grow. But that should not be at the cost of degradation of the present available resources of land and water, which means the natural resources that we have, should more or less remain the same after 50 or 100 years and beyond. This concept is termed “**sustainable**”.
- It was not much of a problem earlier when compared to the resources the demand was less. But now it is reversed and for devising any planning strategy the constraints have to be kept in mind.

- As an example, the utilization of ground water may be cited. In many regions of India, there has been alarming withdrawal of ground water for meeting demands of irrigation and drinking water demand than that which can be naturally recharged. This has led to rise of further problems like arsenic and fluoride contamination. Since ground water recharge by natural means takes a long time, perhaps years and even decades, there is little hope of regaining the depleted table near future.

# Necessity

- Irrigation is a necessary complement to cultivation. The ultimate goal of irrigation is to maximize crop production, which depends upon the following factors:
  - ▣ Soil,
  - ▣ Sunshine, and
  - ▣ Water
- In tropical and sub-tropical countries, like India, soil and sunshine are abundantly available and do not require to be supplemented artificially.

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## □ India

- A tropical country with a vast diversity of climate, topography and vegetation
- The rainfall varies considerably in its place of occurrence as well as in its amount
- 70% population is directly dependent on agriculture & remaining 30% indirectly dependent
- 184 Mha out of 328 Mha area is cultivable area
- Average annual rainfall= 1150 mm

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## □ Factors Necessitating Irrigation

- Insufficient Rainfall
- Non-Uniform distribution of rainfall
- Growing Cash Crops
- Controlled Water Supply

# Scope of Irrigation Science

- Engineering Aspect
  - ▣ Storage, Diversion or Lifting of Water
  - ▣ Conveyance of water to the agricultural fields
  - ▣ Application of water to agricultural fields
  - ▣ Drainage and relieving water-logging
  - ▣ Development of water power

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## □ Agricultural Aspect

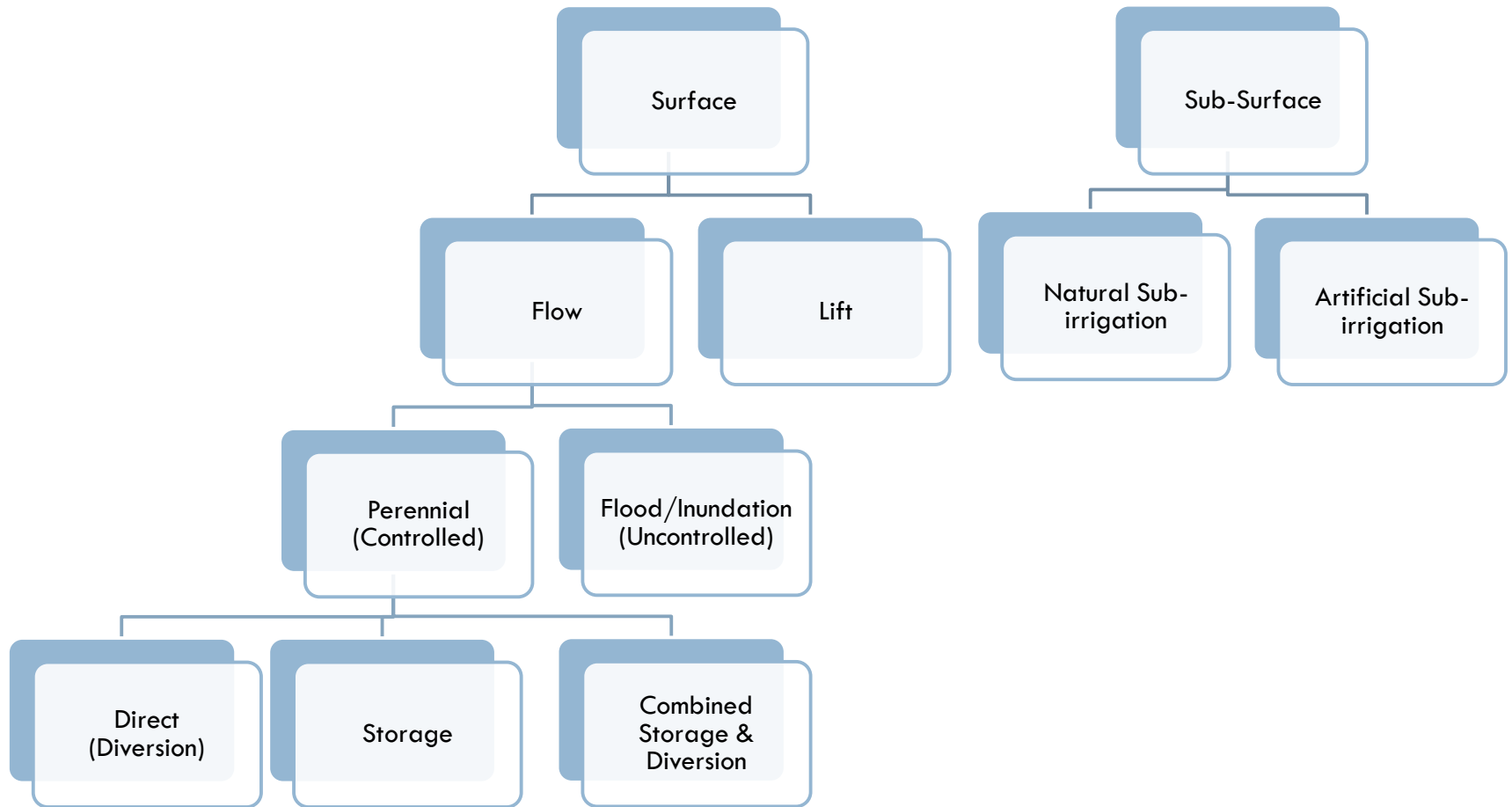
- ▣ Depth of water necessary in single application
- ▣ Uniform & periodic distribution of water
- ▣ Capacities of different soils for irrigation water, and the flow of water in soils
- ▣ Reclamation of waste and alkaline lands, where this can be carried out through water application

# Advantages and Disadvantages

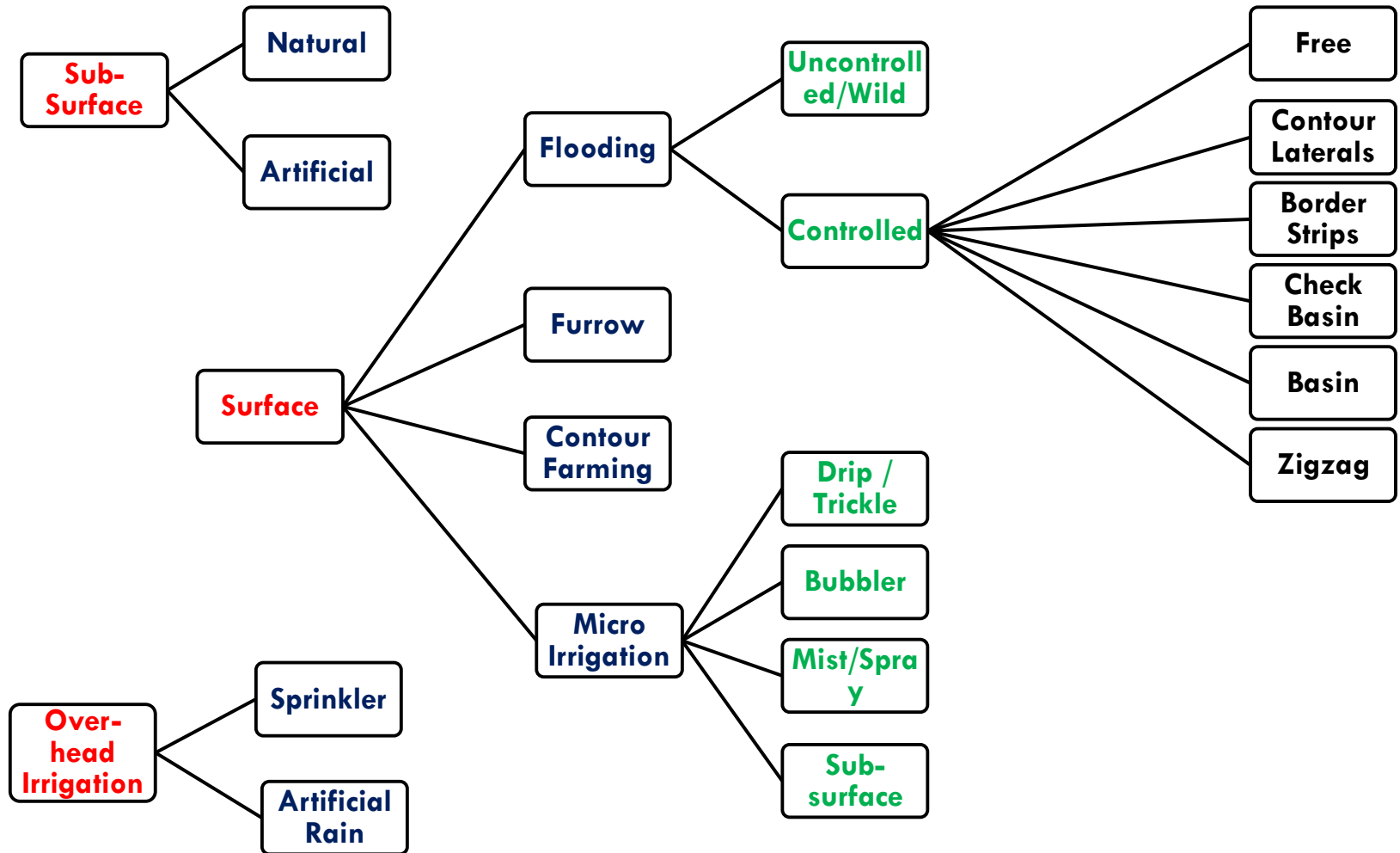


- What can be advantages of irrigation?
- What can be disadvantages of irrigation?

# Types of Irrigation



# Methods/Techniques of Water Irrigation









# Choosing An Irrigation Method

## Surface, Sprinkler or Drip Irrigation

- The suitability of the various irrigation methods, i.e. surface, sprinkler or drip irrigation, depends mainly on the following factors:
  - ▣ natural conditions
  - ▣ type of crop
  - ▣ type of technology
  - ▣ previous experience with irrigation
  - ▣ required labour inputs
  - ▣ costs and benefits.

## **Basin, Furrow or Border Irrigation**

Some of the important factors which should be taken into account when determining which surface irrigation method is most suitable: basin, furrow or border irrigation. Again, it is not possible to give specific guidelines leading to a single best solution; each option has its advantages and disadvantages.

Factors to be taken into account include:

- ▣ natural circumstances (slope, soil type)
- ▣ type of crop
- ▣ required depth of irrigation application
- ▣ level of technology
- ▣ previous experience with irrigation
- ▣ required labor inputs

# Administrative Classification of Projects

NITI AAYOG (Earlier Planning Commission of India)  
classification:

- Major Irrigation Project ( $CCA > 10000$  ha)
- Medium Irrigation Project ( $10000 > CCA > 2000$  ha)
- Minor Irrigation Projects ( $CCA > 2000$  ha)

# Planning an Irrigation Project

## ❑ Important Factors affecting Irrigation Planning and Development

- |   |   |
|---|---|
| <input type="checkbox"/> Soil                   | <input type="checkbox"/> Capital                      |
| <input type="checkbox"/> Climate                | <input type="checkbox"/> Commodity/Market Product     |
| <input type="checkbox"/> Topography             | <input type="checkbox"/> National Policy and Priority |
| <input type="checkbox"/> Water Source           | <input type="checkbox"/> Institutional Infrastructure |
| <input type="checkbox"/> Crops to be Cultivated | <input type="checkbox"/> Economic Factors             |
| <input type="checkbox"/> Energy                 | <input type="checkbox"/> Socio-Cultural Aspect        |
| <input type="checkbox"/> Labour                 | <input type="checkbox"/> Environmental Aspects        |

- 
- Concepts of Planning an Irrigation Project
    - ▣ Basin-wise Planning
    - ▣ Inter-Basin River Valley Projects
    - ▣ Multi-Purpose Projects

# References

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