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GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

PART XI HYDROLOGY

Section 4 Hydrographs

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Indian Standard

GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

PART XI HYDROLOGY

Section 4 Hydrographs

0. FOREWORD

0.1 This Indian Standard (Part XI/Sec 4) was adopted by the Indian Standards Institution on 7 April 1973, after the draft finalized by the Terminology Relating to River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A number of Indian Standards have already been printed covering various aspects of river valley projects and a large number of standards are in the process of formulation. These standards include technical terms, the precise definitions of which are required to avoid ambiguity in their interpretation. To achieve this end, the Institution is bringing out 'IS : 4410 Glossary of terms relating to river valley projects' which is being published in parts. The other parts of this standard so far published are given on fourth cover page.

0.3 Part XI covers the important field of hydrology which is a separate science by itself. In view of the vastness of this subject, it is proposed to cover the subject in different sections. Other sections will be the following:

Section 1 General terms

Section 2 Precipitation and runoff

Section 3 Infiltration and water losses

Section 5 Floods

Section 6 Ground water

Section 7 Discharge measurements

Section 8 Quality of waters

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country. This has been met by deriving assistance from the following publications:

UNITED NATIONS. ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST. Glossary of hydrologic terms used in Asia and the Far East. 1956. Bangkok.

INDIA. INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE. Multilingual technical dictionary on irrigation and drainage. 1967.

INDIA. CENTRAL BOARD OF IRRIGATION AND POWER. Glossary of irrigation and hydro-electric terms and standard notations used in India. 1954. Manager of Publications, Delhi.

Nomenclature for hydraulics. 1962. American Society of Civil Engineers. New York.

0.4.1 All the definitions taken from 'Multilingual technical dictionary on irrigation and drainage' are marked with asterisk (*) in the standard.

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1. SCOPE

1.1 This standard (Part XI/Sec 4) covers the definitions of terms relating to hydrographs in hydrology.

2. HYDROGRAPHS

2.1 Base Flow* — The sustained or dry weather flow of streams resulting from the outflow of permanent or perched ground water, and from the draining of large lakes and swamps. Also water from glaciers, snow and all other possible sources not resulting from direct runoff.

2.2 Composite Unit Graph* — A tabular presentation of unit hydrograph for the important sub-divisions of a large area, with the times of beginning of rise appropriately lagged by the times of travel from the outlets of the sub-areas to the major gauge station. The runoff is computed independently for each area multiplied by unit graph ordinates for that area. The sum of all flows thus computed in a vertical column gives the flow to be expected at the outlet of the basin.

2.3 Compound Hydrograph — The hydrograph of an intermittent storm when the flow on account of one sub-storm continues during the next substorm.

2.4 Depletion Hydrograph — The recession, after the flow created by direct runoff has ceased, is ground water depletion curve. A normal or master ground water depletion curve is the mean of a number of such curves.

2.5 Design Flood Hydrograph* — The hydrograph of flow adopted to represent limiting volumes and concentration of runoff for use in determining design capacities of spillways for dams, etc, or other hydraulic studies.

2.6 Distribution Graph — A graph showing the typical distribution of runoff from a drainage basin in terms of the percentage of the total runoff

that occurs in each of a number of equal intervals of time. In hydrology, a unit hydrograph in which the ordinates of flow are expressed as percentages of the volume of hydrographs.

2.7 Dimensionless Unit Graph — One plotted in dimensionless units with respect to time and flow, useful for comparing unit hydrographs of different drainage areas or those resulting from different storm patterns.

2.8 Double Mass Curve — A plot of accumulated annual or seasonal precipitation at an individual station against the concurrent accumulated mean precipitation for a group of surrounding stations.

2.9 Ground Water Depletion Curve — *See* **2.4.**

2.10 Ground Water Reccession Curve — *See* **2.4.**

2.11 Ground Water Storage Curve* — A curve derived by summing the area under the ground water depletion curve, so as to show the volume of water remaining in the ground that is available for runoff, at specific rates of ground water flow.

2.12 Hydrograph — A graph showing the stage, volume of flow, velocity sediment concentration or sediment discharge or some other feature of flowing water with respect to time at a given place. For example, a graph showing the discharge of a stream as ordinate against the time as abscissa is called a discharge hydrograph (*see* Fig. 1).

2.13 Hydrograph Separation — The division of a hydrograph of a specific storm into various components, such as surface runoff, interflow, ground and water.

2.14 Hydrograph — A bar graph of average rainfall, rainfall excess rates or volumes over specified areas during successive units of time during a storm.

2.15 Instantaneous Unit Hydrograph — When the unit duration of the rainfall excess is infinitesimally small, the resulting hydrograph is known as the instantaneous unit hydrograph.

2.16 Lag

a) Referring to discharge or water level, it is the time elapsing between the occurrence of corresponding changes in discharge or water level at two points in a river.

b) Referring to the runoff of rainfall, it is the time between the centre of mass of rainfall excess to the centre of mass of the resulting runoff.

c) Referring to unit hydrographs, it is the time between the centre of a unit storm and the peak discharge of the corresponding unit hydrograph.

d) Referring to snow melting, it is the time between the beginning of snow melt and the start of the resulting runoff.

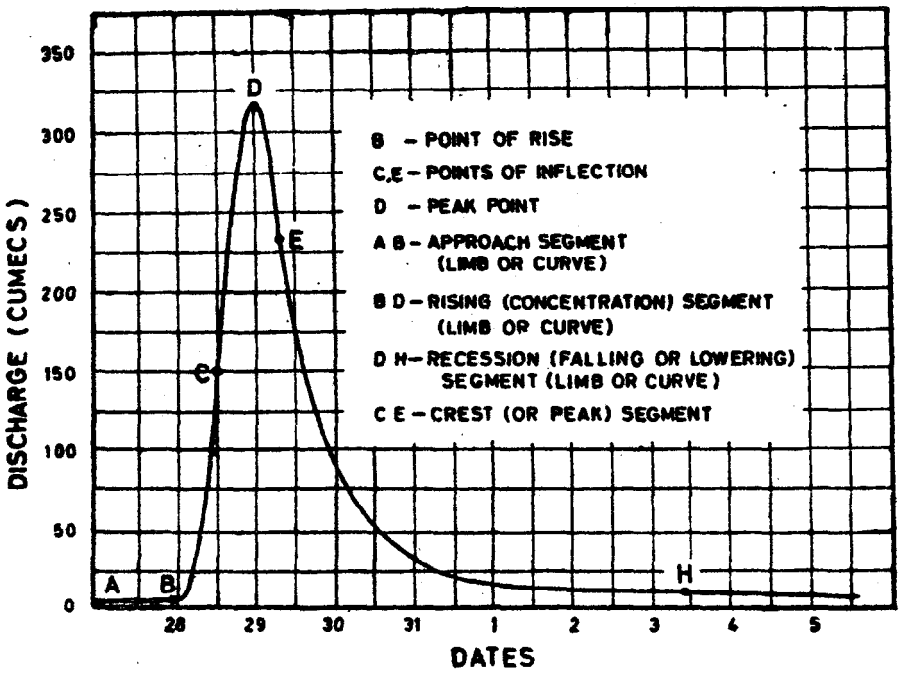

FIG. 1 TYPICAL SINGLE PEAKED SIMPLE HYDROGRAPH

2.17 Mass Curve — A curve with values of cumulative rainfall or runoff, etc, plotted against time.

2.18 Mass Diagram — *See* **2.17.**

2.19 Normal Recession Curve* — This is derived from segments of hydrograph that represent discharge from natural valley or channel storage after the base flow has been subtracted.

2.20 Operating Rule X Curve — A curve devised to indicate operation of a reservoir so as to obtain the best results based on past experience, and to be applied to future operation with a view to attaining best use of the reservoir for its intended purposes.

2.21 Pluviograph* — A theoretical hydrograph which would result from a storm if the runoff were 100 percent of the precipitation and if the proportions fixed by the distribution graph were applicable to the gross precipitation. It is in theory, therefore, a limiting hydrograph that would be caused by that storm.

2.22 Rainfall Excess — Part of the rainfall that appears as runoff in the stream.

2.23 Recession — Falling arm of discharge hydrograph after a flood event representing withdrawal of water from storage in valley and stream of channel, also from sub-surface runoff; that is, the part of the descending arm, from point of inflexion to point when direct runoff has ceased.

2.24 Recession Hydrograph — *See* **2.23.**

2.25 A diagram or graph plotted with rectangular co-ordinates, each ordinate being equal to (i) to the summation of all proceeding quantities up to a given point, minus (ii) the arithmetical mean of the series times the number of quantities in the series up to the given point, with the corresponding abscissa representing time, number of the item in the series, etc. When the general slope of a section of such a graph is upward, it indicates that the terms in the series within such section are, in general, in excess of the average for the series; and where such slope is downward the reverse is indicated. The diagram is used in determining cyclic variation of such quantities as precipitation (*see* Fig. 2).

2.26 Residual Mass Diagram — *See* **2.25.**

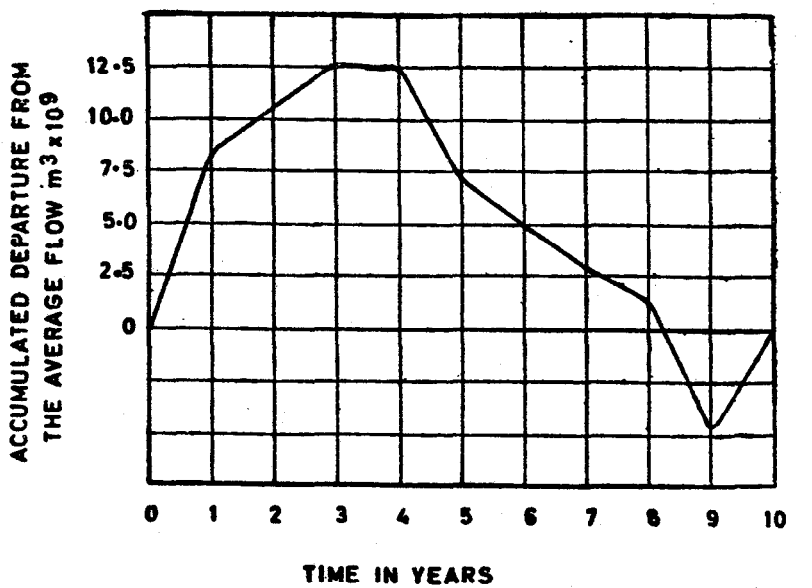

FIG. 2 RESIDUAL MASS CURVE

2.27 Rise* — It is the period during and following rainfall from the time when the hydrograph first departs from the normal depletion curve until it again becomes coincident with the normal depletion curve. A rise consists of a period of increasing flow, which may result either from increased ground-water flow, from surface runoff or both. This culminates in the crest or peak of the rise which is followed by a recession period.

2.28 Rising Period* — *See* **2.27.**

2.29 Rule Curve — *See* **2.20.**

2.30 S-Curve — A graph showing the summation of the ordinates of a series of unit hydrographs spaced at unit rainfall duration intervals. It represents the hydrograph of average rate of rainfall excess of the unit duration continued indefinitely.

2.31 S-Hydrograph — *See* **2.30.**

2.32 Synthetic Unit Hydrograph* — A unit graph developed on the basis of estimation of coefficients expressing various physical features of a catchment.

2.33 Unit Graph* — Hydrograph of storm runoff at a given point on a given stream which will result from an isolated rainfall excess of unit duration occurring over the contributing drainage area and resulting in a unit of runoff.

2.34 Unit Hydrograph* — *See* **2.33.**

2.35 Unit Rainfall Duration* — The duration of runoff-producing rainfall or rainfall excess that results in a unit hydrograph.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 1 kg.1 m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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