Snyder's Synthetic Unit Hydrograph

Basin lag, standard rainfall duration and peak of a 1 cm unit hydrograph for an ungauged catchment by Snyder's method, from area, stream lengths and coefficients.

Method: Classical engineering hydrology relations

Input parameters

Unit system: SI

Parameter	Value	Unit
Catchment area	1,500.0	km²
Main stream length to the divide	80.000	km
Stream length to the point nearest the centroid	40.000	km
Lag coefficient	1.8000	
Peak coefficient	0.60000	

Calculated results

Parameter	Value	Unit
Basin lag	15.201	h
Standard rainfall duration	2.7639	h
Peak of the 1 cm unit hydrograph	164.59	m³/s
Time from start of rain to peak	16.583	h

Notes for this case

• Snyder related the basin lag (centroid of effective rain to peak) to catchment shape: t_p = 0.75C_t(L·L_ca)^0.3 hours with lengths in km. The standard unit hydrograph duration is t_p/5.5, and its peak for 1 cm of runoff is Q_p = 2.78C_pA/t_p (m³/s, A in km²). The coefficients (C_t about 1.35–1.65 in steep areas to 2 or more in flat ones; C_p 0.56–0.69) come from gauged catchments in the same region. Widths and base time then shape the hydrograph.

Formula and method

$$t_p = 0.75 C_t (L L_{ca})^{0.3}, \quad t_r = \frac{t_p}{5.5}, \quad Q_p = \frac{2.78 C_p A}{t_p}$$

Variables

A	Catchment area	m²
L	Main stream length to the divide	m
L_{ca}	Stream length to the point nearest the centroid	m
C_t	Lag coefficient	-
C_p	Peak coefficient	-
t_p	Basin lag	s
t_r	Standard rainfall duration	s
Q_p	Peak of the 1 cm unit hydrograph	m³/s
T_p	Time from start of rain to peak	s

Method and standards

Snyder UH.

Assumptions and limits

- SI form; 1 cm effective rainfall.

References

Classical engineering hydrology relations

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/hydraulics/snyder-synthetic-unit-hydrograph

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.