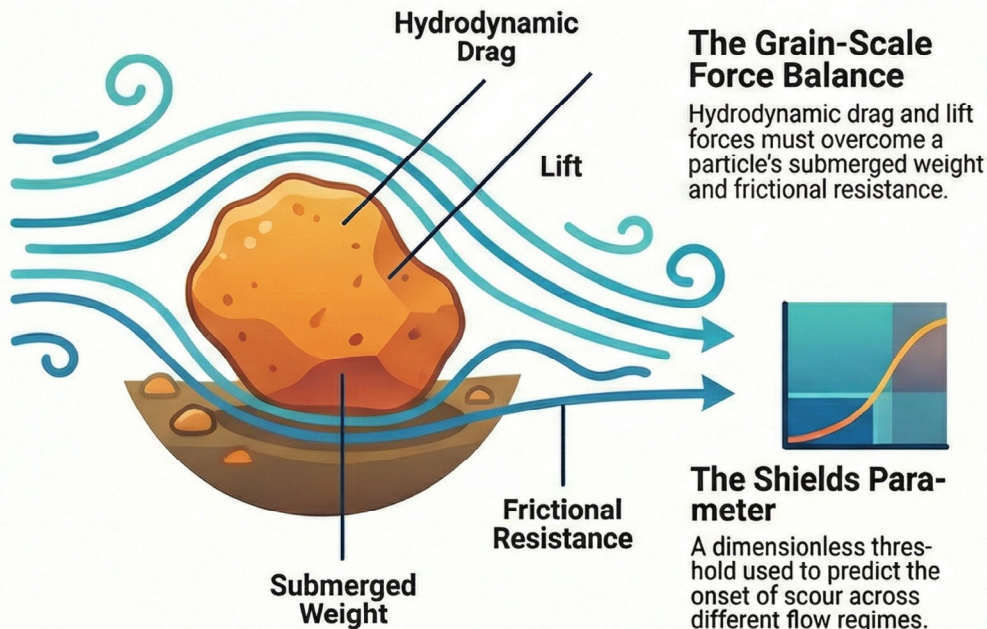# The Mechanics of Stable Channel Design:
From Particle Physics to Hydraulic Engineering
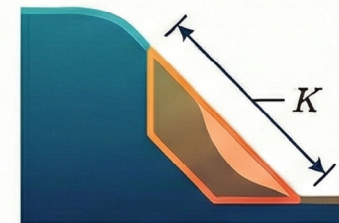
Foundations of Incipient Motion

The Threshold Condition ($\tau_0 = \tau_c$)

Sediment motion begins only when applied boundary shear shear stress equals the material's critical shear stress.
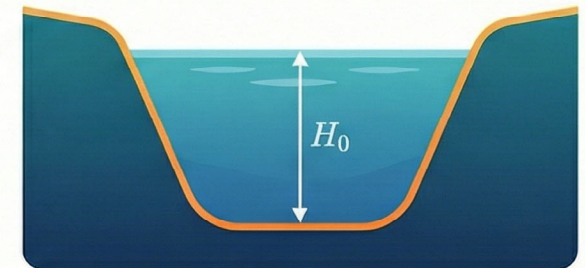

Hydrodynamic Drag

Lift

Submerged Weight

Frictional Resistance

The Grain-Scale Force Balance

Hydrodynamic drag and lift forces must overcome a particle's submerged weight and frictional resistance.

The Shields Parameter

A dimensionless threshold used to predict the onset of scour across different flow regimes.

Engineering Stable Channels

Defining Maximum Depth (H_0)

Designers calculate the maximum centerline depth allowable before water flow triggers sediment transport.

K

H_0

Side Slope Vulnerability

Bank slopes become unstable before the channel bed and require a reduction factor (K).

Ideal Geometry Models

Stable designs use either simplified trapezoidal shapes or complex "Glover–Florey–Lane" curved banks.

Method A: Trapezoidal	Method B: Curved Banks
Constant (1.2.62)	Varied (G-F-L Ideal)
Top Width: 11.0 m	Top Width: 9.87 m
Bottom Width: 7.88 m	Bottom Width: 5.98 m