

Discharge Rating Curves

DLS-114, Module 2.13



U.S. ARMY



**US Army Corps
of Engineers®**

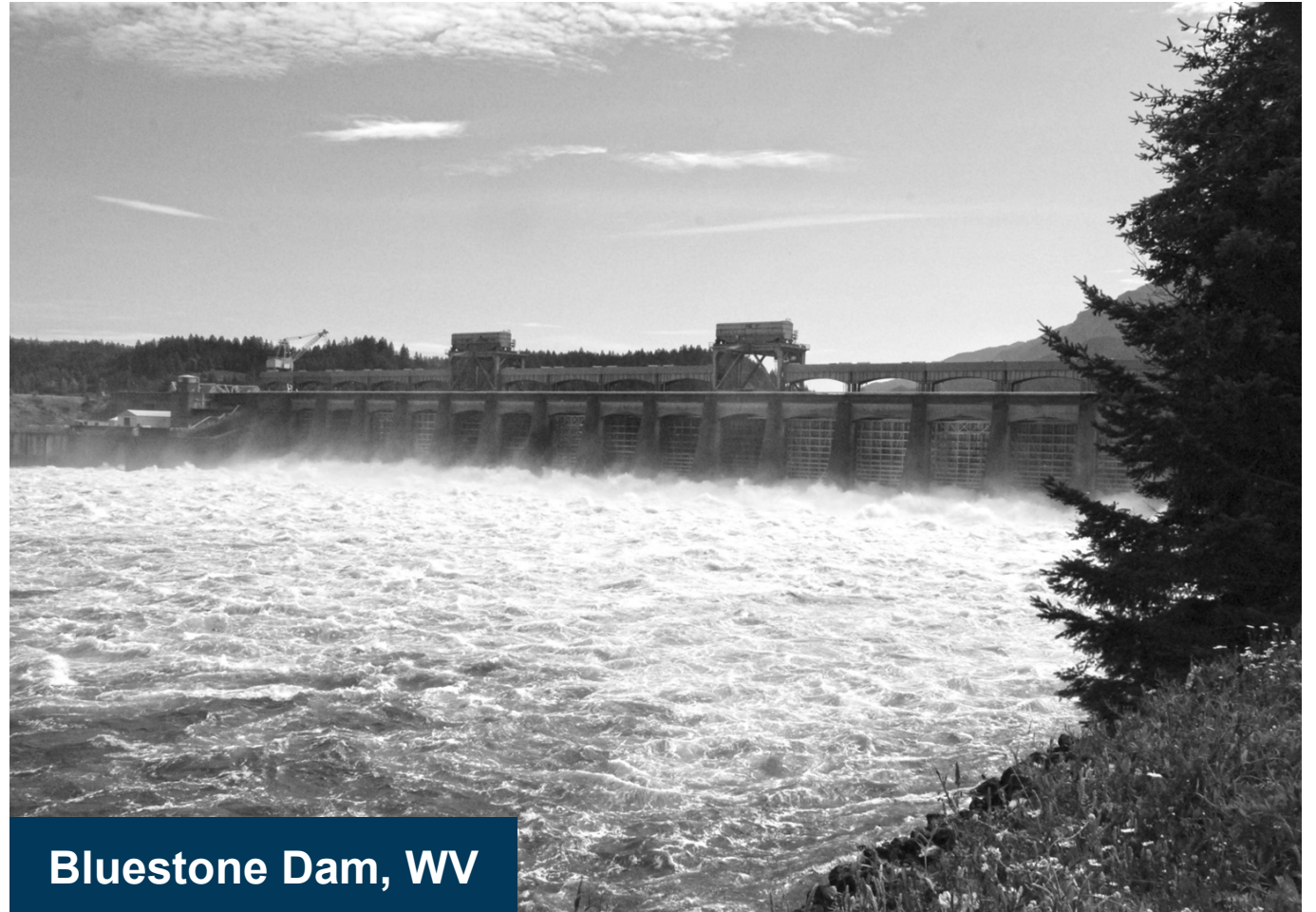
Dam and Levee
Safety Programs

March 2026 / Version 1

BLUESTONE DAM, WV (SOURCE: USACE)

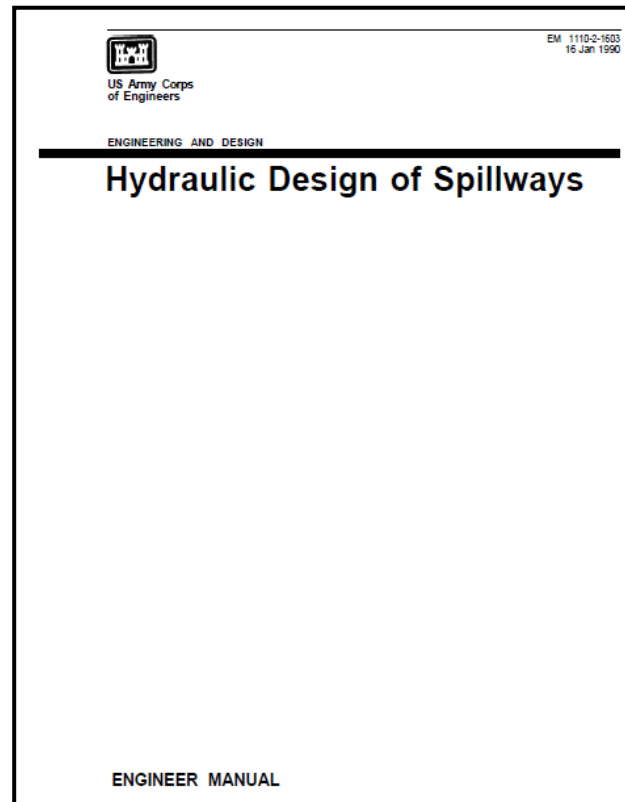
Learning Objectives

- Identify four spillway flow regimes
- Discuss typical rule curves for gated spillways
- Describe common mistakes
- Demonstrate how to extrapolate the rating curve

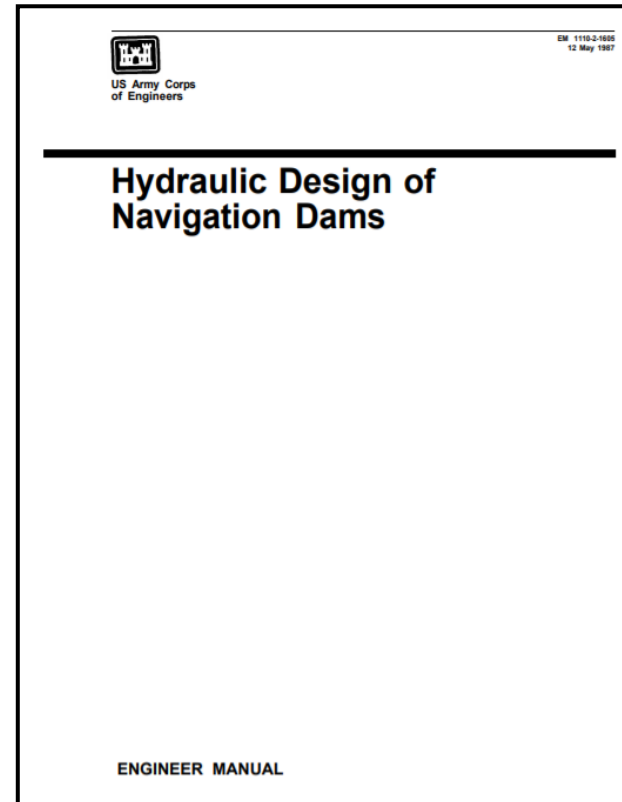


Resources

EM 1110-2-1603

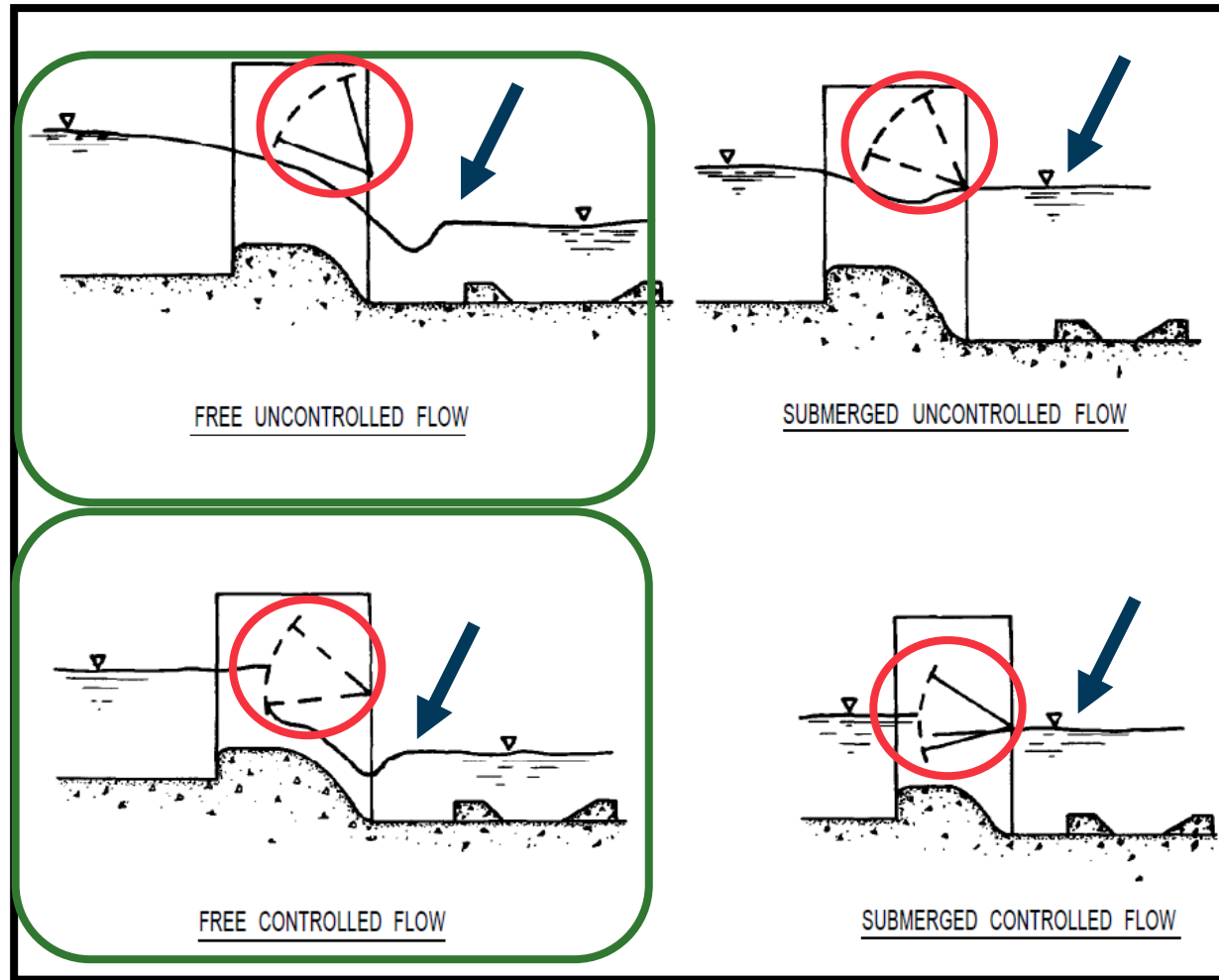


EM 1110-2-1605



Four Flow Regimes

Free
uncontrolled

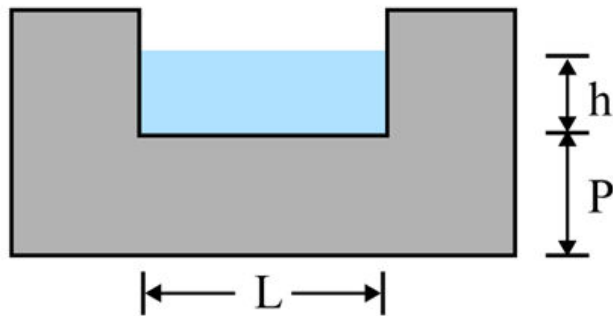
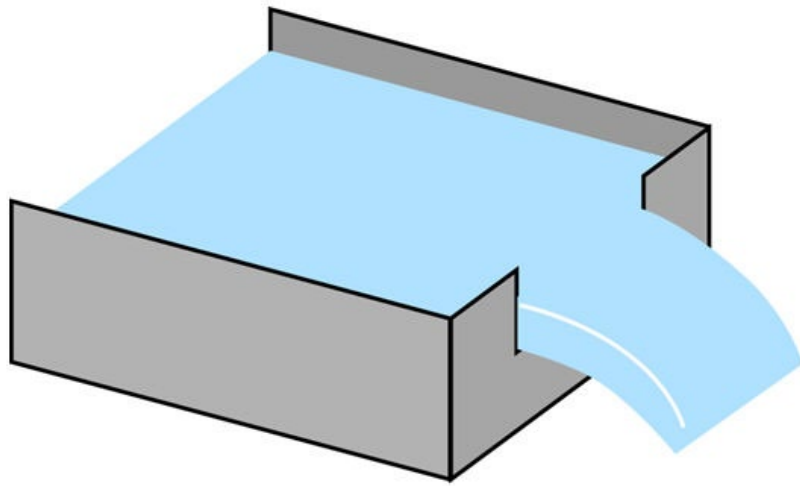


Submerged
uncontrolled

Free
controlled

Submerged
controlled

Free Uncontrolled Flow

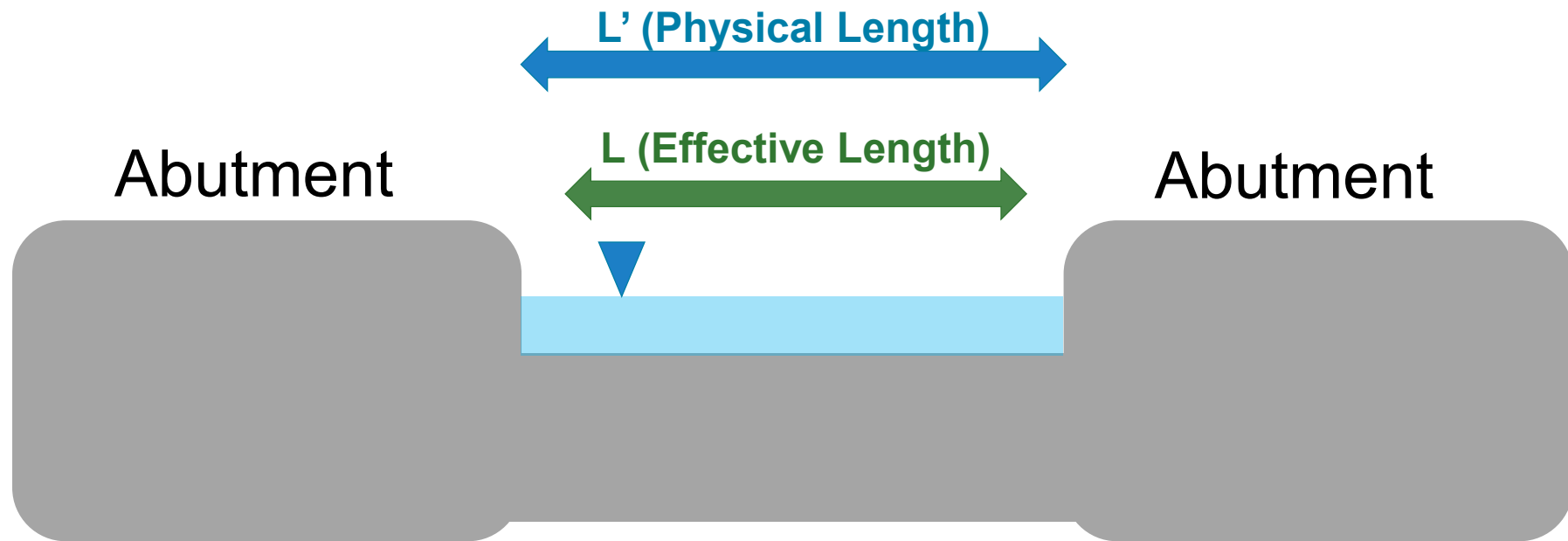


Weir equation

$$Q = CLH^{3/2}$$

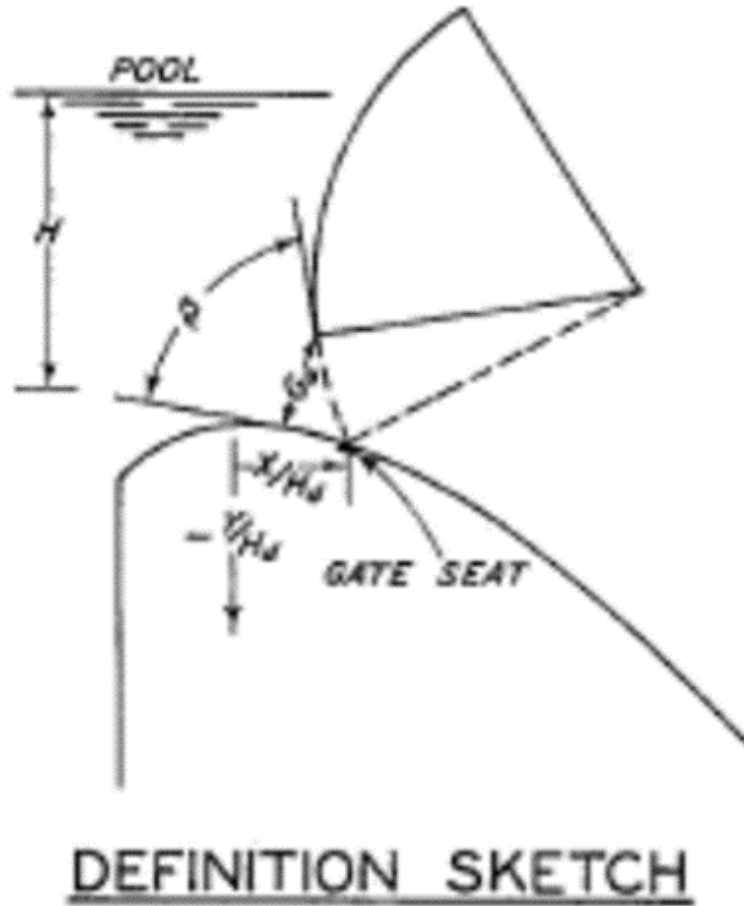
Effective Length

$$L = L' - 2(NK_p + K_a)H_e$$



Free uncontrolled flow

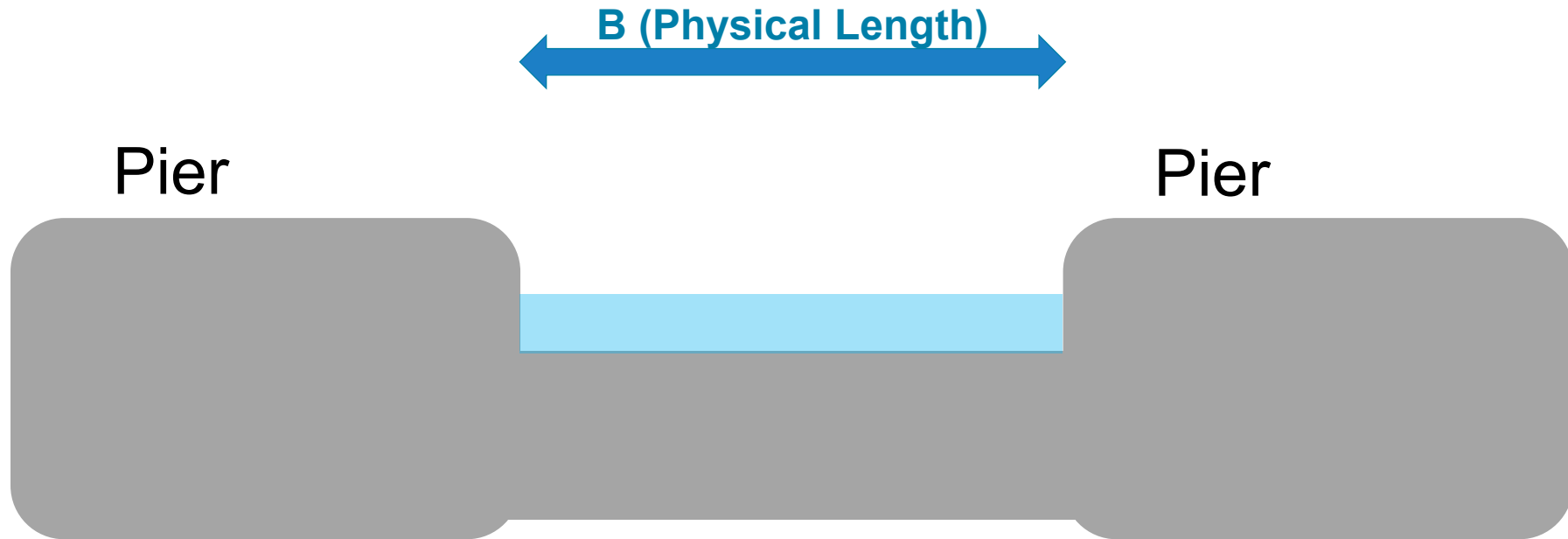
Free Controlled Flow



Orifice equation

$$Q_g = C_d G_o B \sqrt{2gH}$$

Gate Width (B)

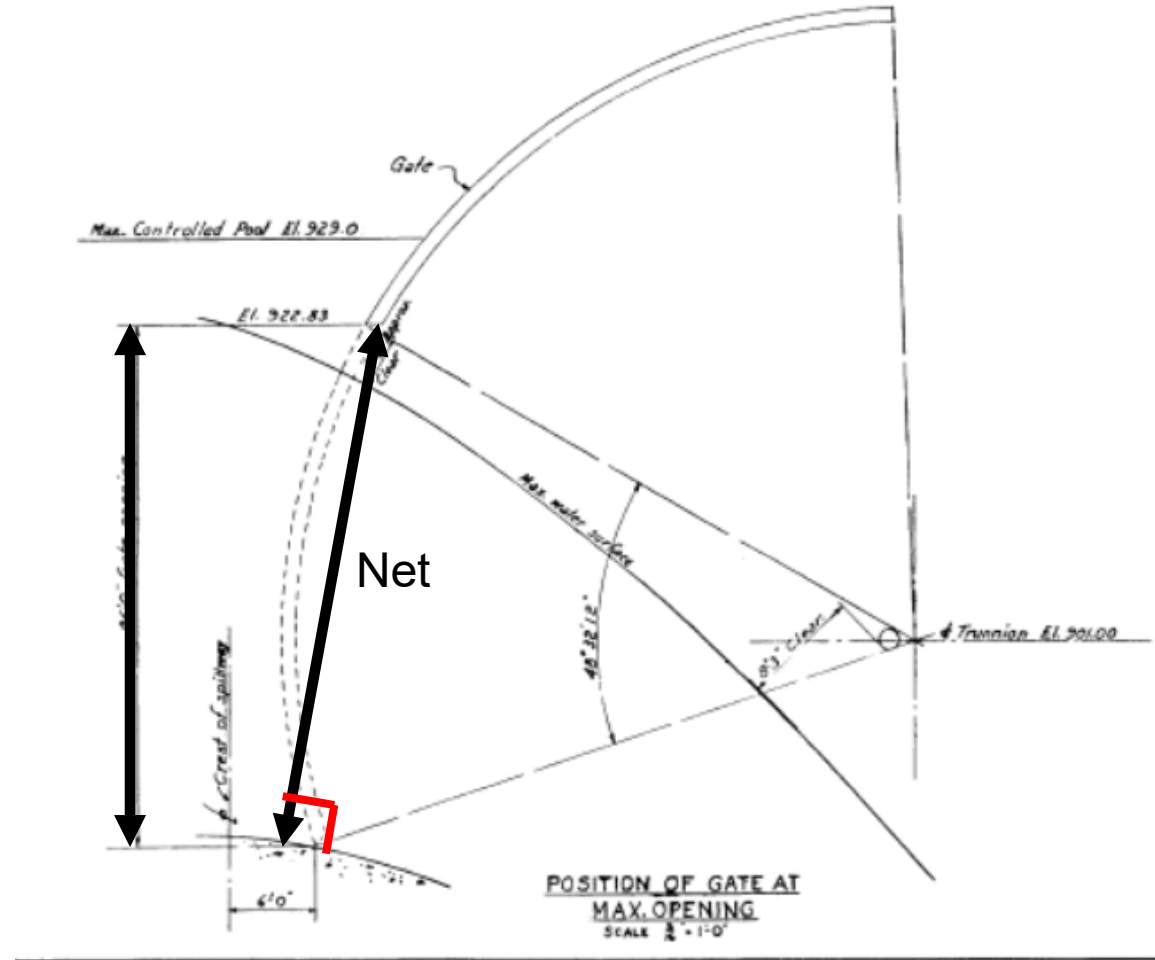


Free controlled flow

Nominal Gate and Net Gate Opening

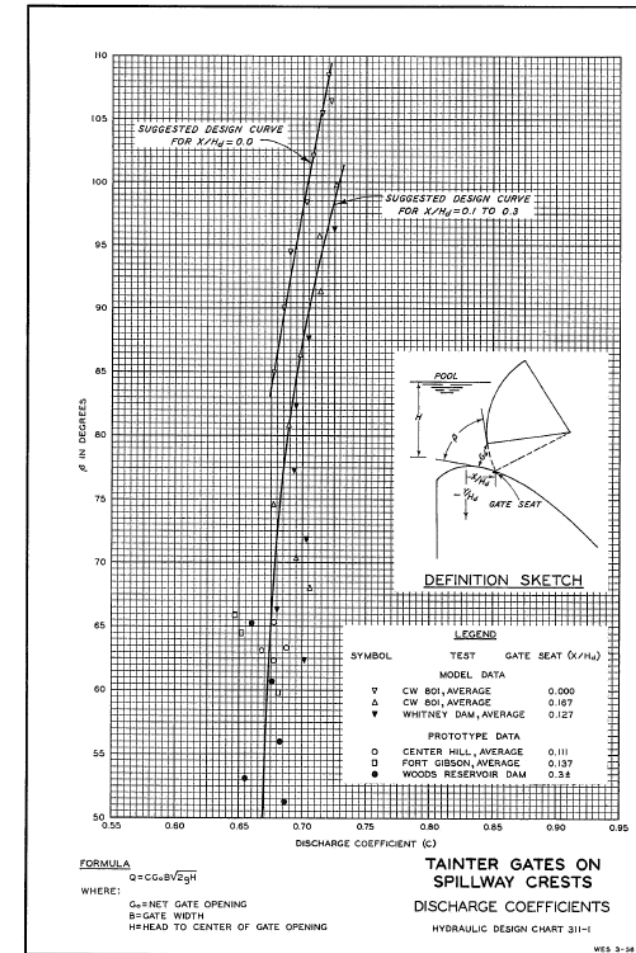
Nominal

Net



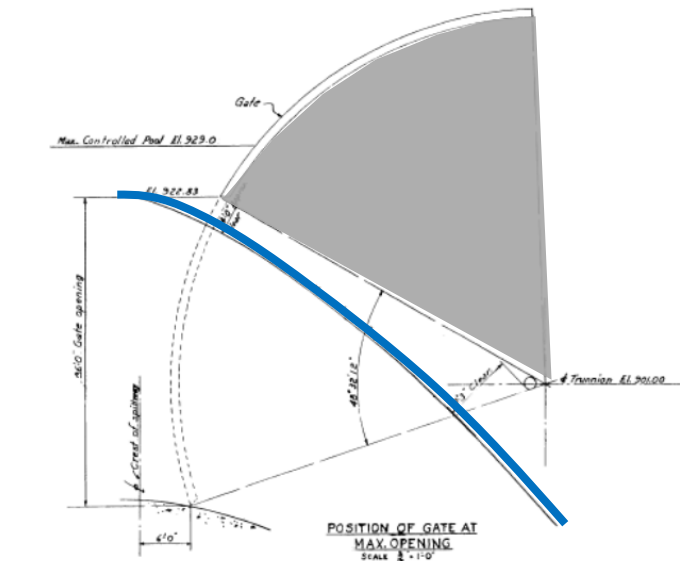
Discharge Coefficient for Tainter Gates

- Based on physical model tests
- Three spillway gates
- Gate ratio (G_o/H) less than 0.6

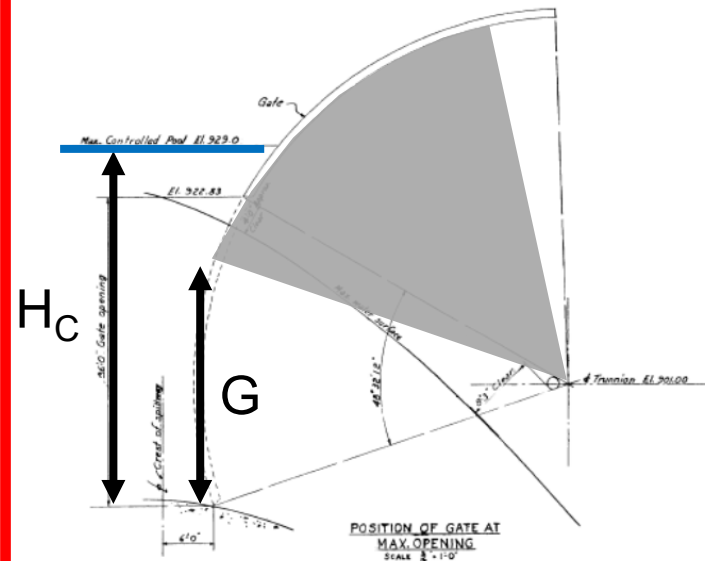


Three Important Zones

Stable uncontrolled flow

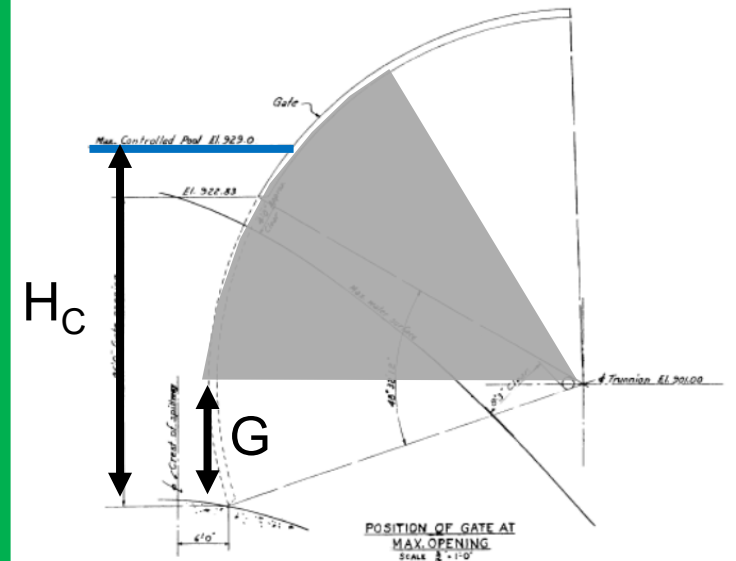


Unstable orifice flow



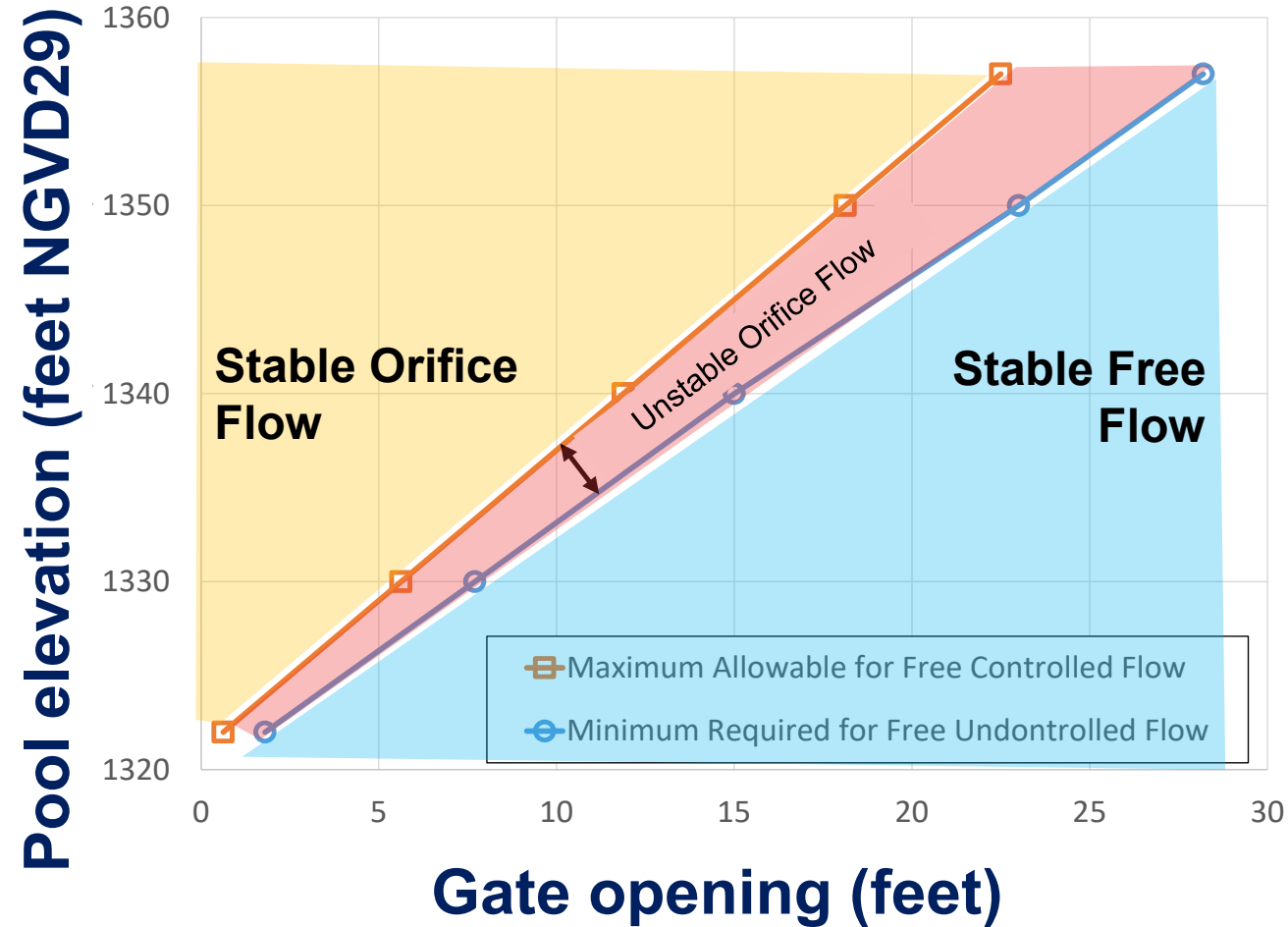
$$G > 0.625 H_C$$

Stable orifice flow



$$G \leq 0.625 H_C$$

Gated Dams - Flow Transitions





Questions