

Dams 101

National Watershed Coalition Spring Workshop
Bowling Green, KY

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Freese and Nichols, Inc.



www.watershedcoalition.org



Dams 101 – Understanding Your Dams

What is a Dam?

Why was it Built?

How was it Made?

How does it Work?

Dams 101 – Understanding Your Dams

Dam Terminology
Dam Statistics
Dam Regulations
Dam Development

What is a dam?



What is a dam?

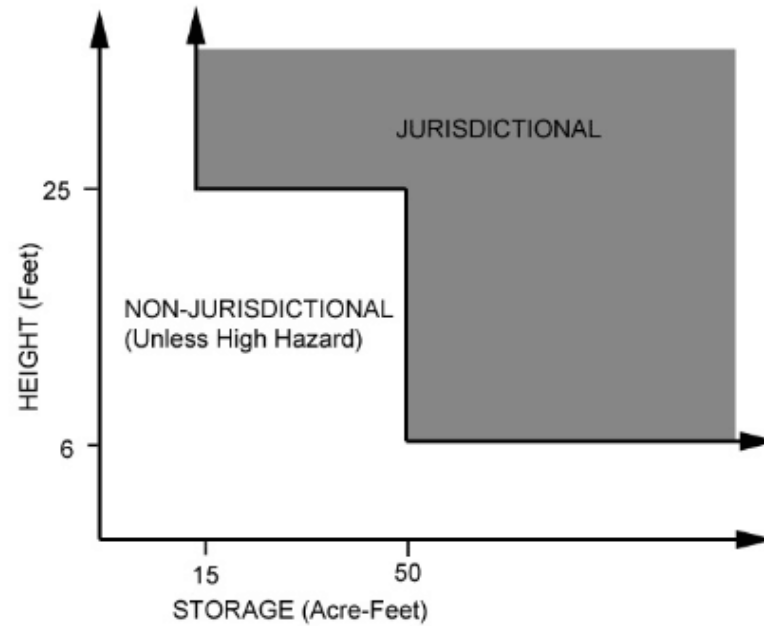


What is a dam?

Any barrier or barriers, with any appurtenant structures, constructed for the purpose of either permanently or temporarily impounding water.



JURISDICTION OF BOARD BY SIZE AND HAZARD CLASSIFICATION



Definition Of A Dam

Purpose of Dams

Flood Control

Water Supply

Recreation

Hydropower

Waste Storage (Tailings/Sludge)



Types Of Dams

Embankment

Earth fill
Rock fill

Gravity

Buttress

Arch

Multiple Arch

Timber Crib



Earth Fill Dam



Rock Fill Dam



Concrete Gravity Dam



RCC Gravity Dam



Masonry Gravity Dam

Concrete Core



 **FREESE
AND
NICHOLS**

Concrete Buttress



Masonry Buttress Dam



Concrete Arch



Multiple Arch Dam



Timber Crib

Built 1870

Concrete Cap Added 1930

Repair 1992

Timber Crib Dam
Under Repair On Delaware River
At Bulls Island, New Jersey



Photo: Carl Montana

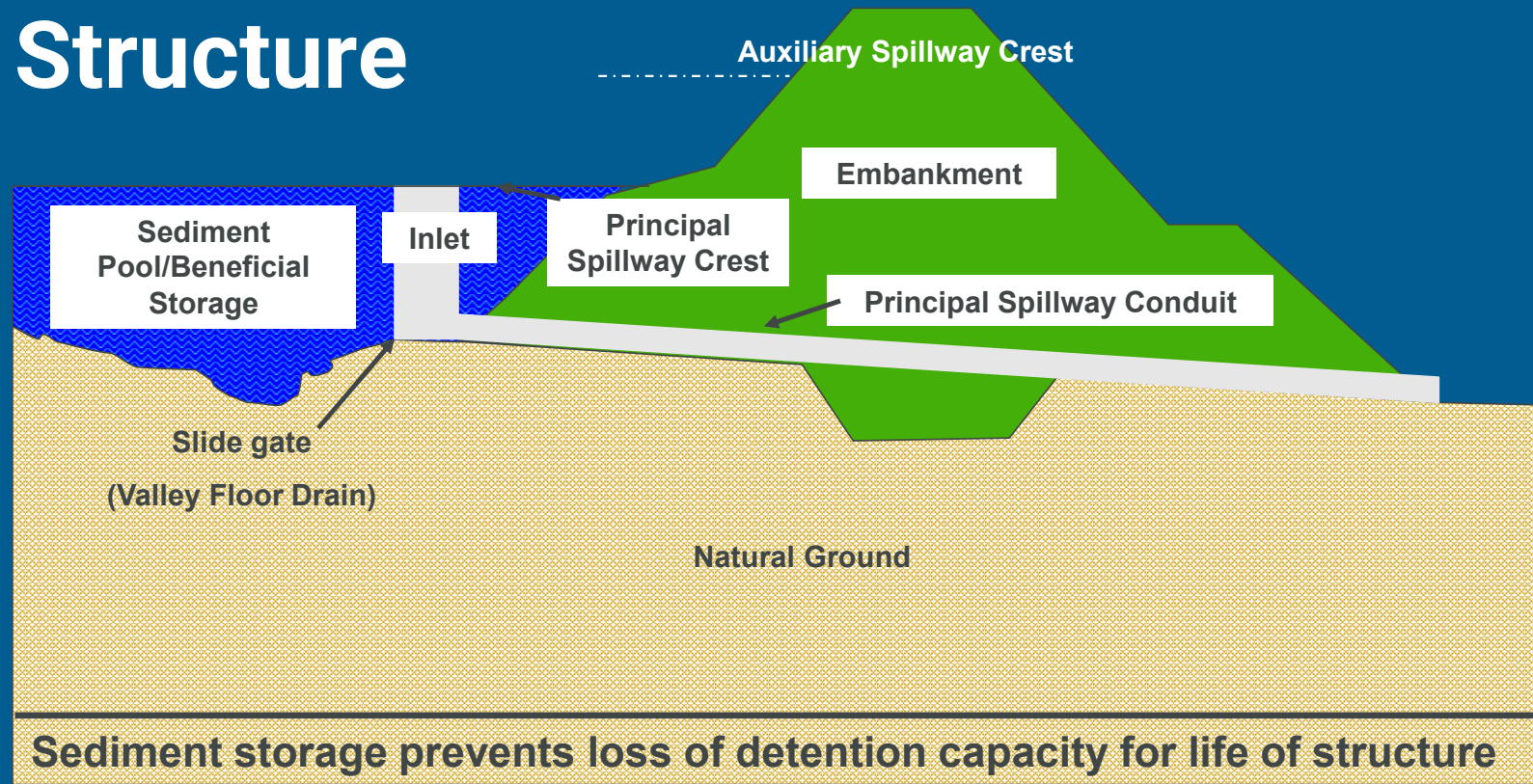


Photo: Carl Montana

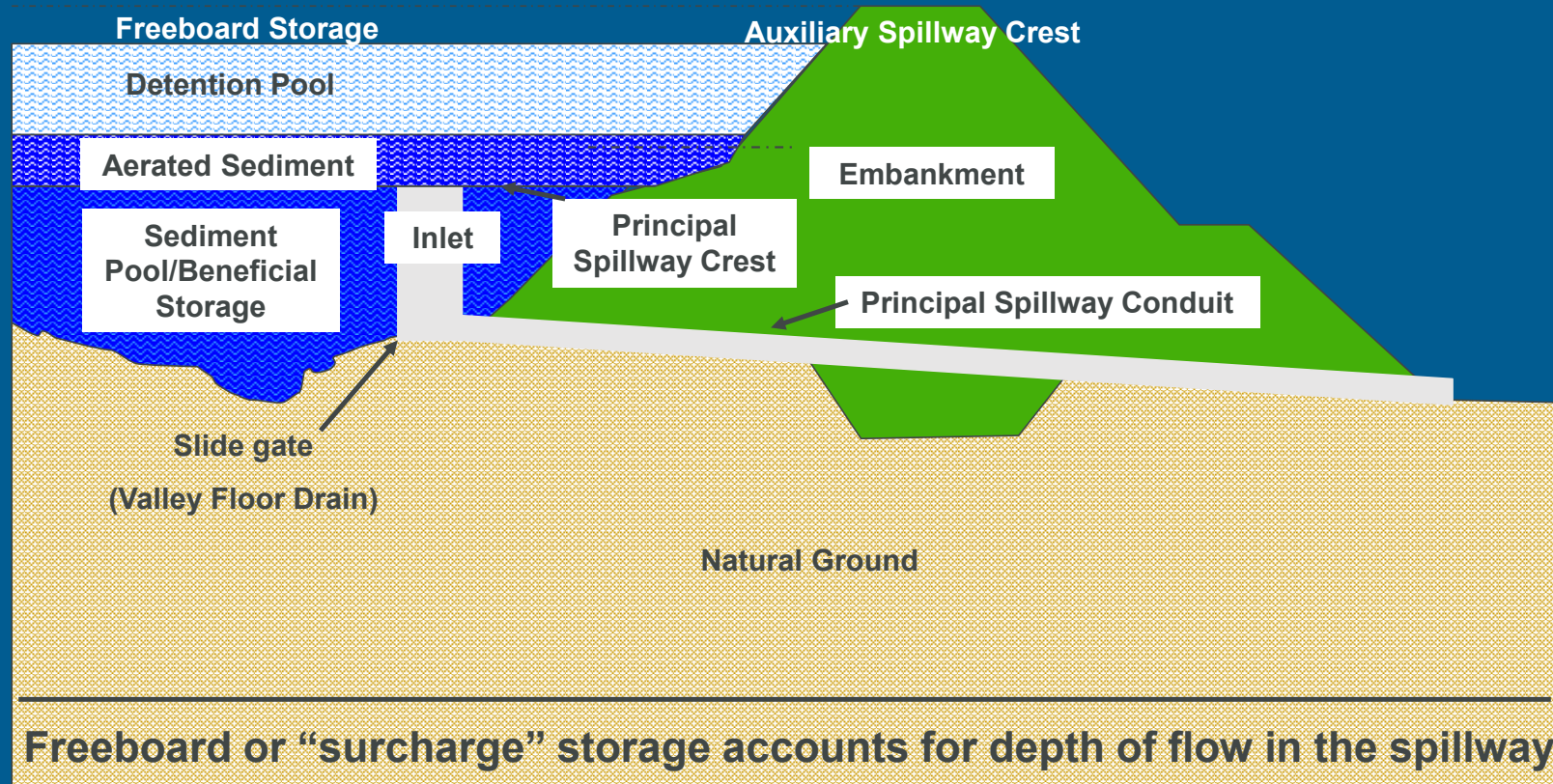


How does a dam work?

Cross-Section of Typical Floodwater Retarding Structure



Cross-Section of Typical Floodwater Retarding Structure



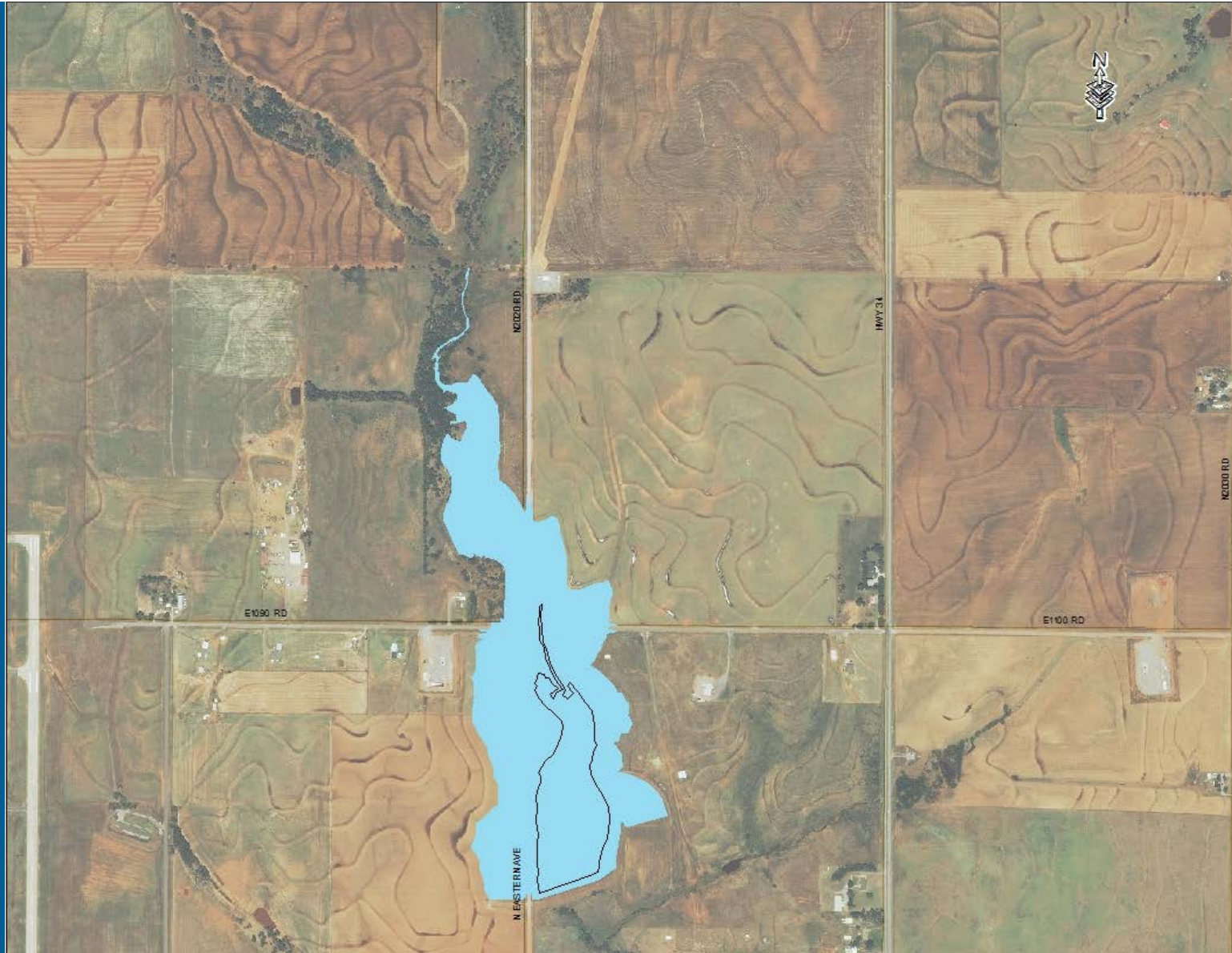
Sediment
Pool

Beneficial
Storage



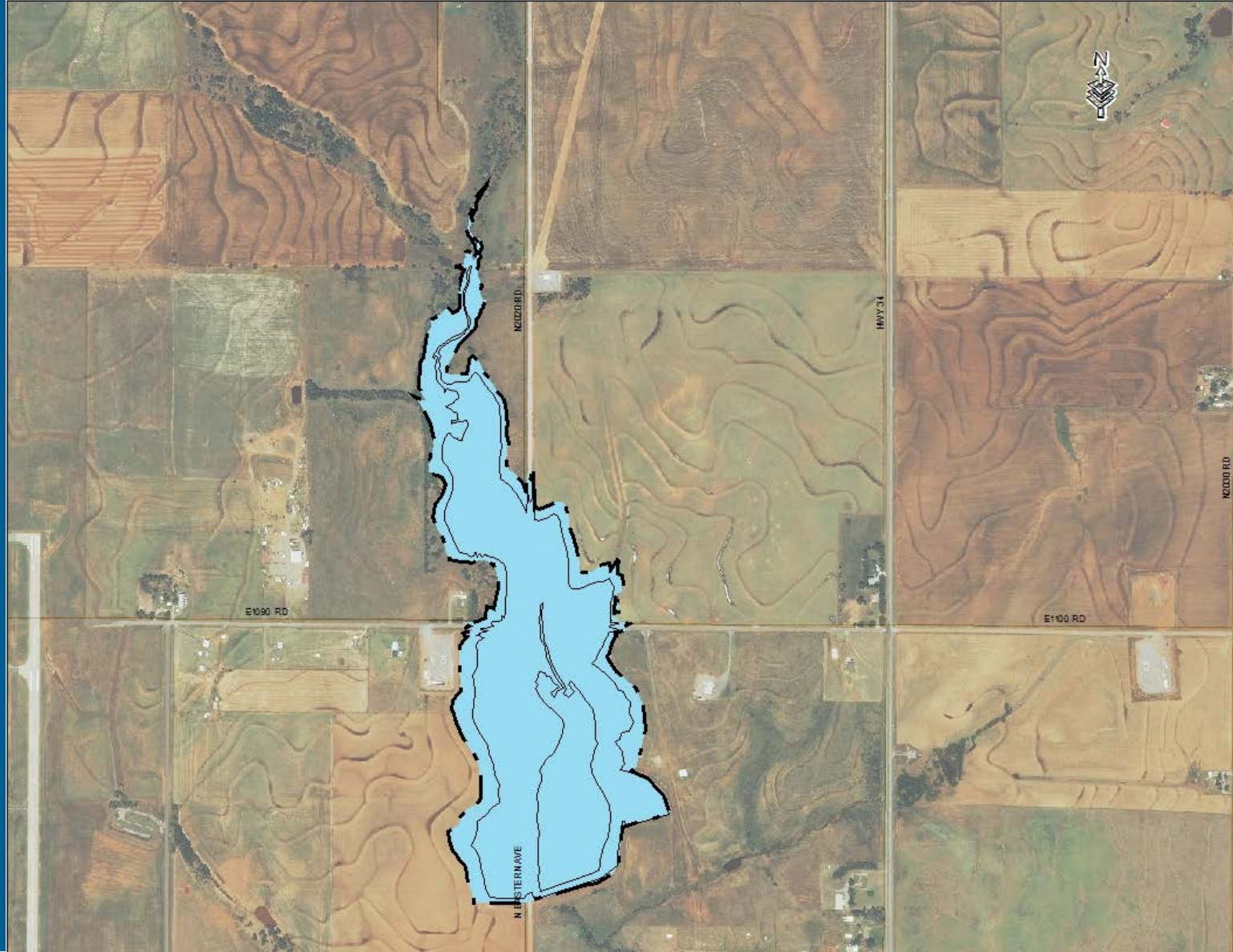
Detention
Pool

Temporary
Storage



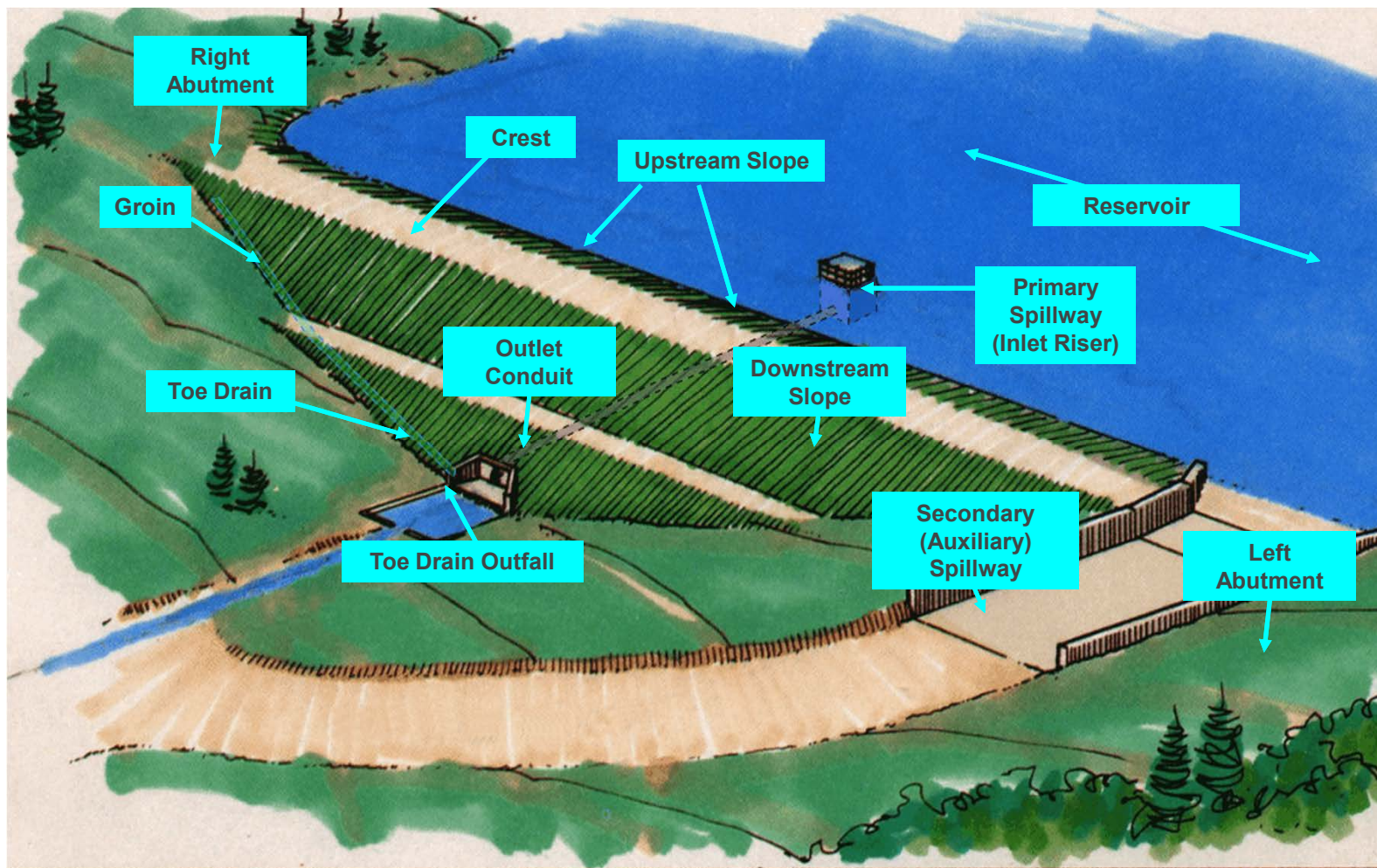
Top of Dam

Freeboard
Storage

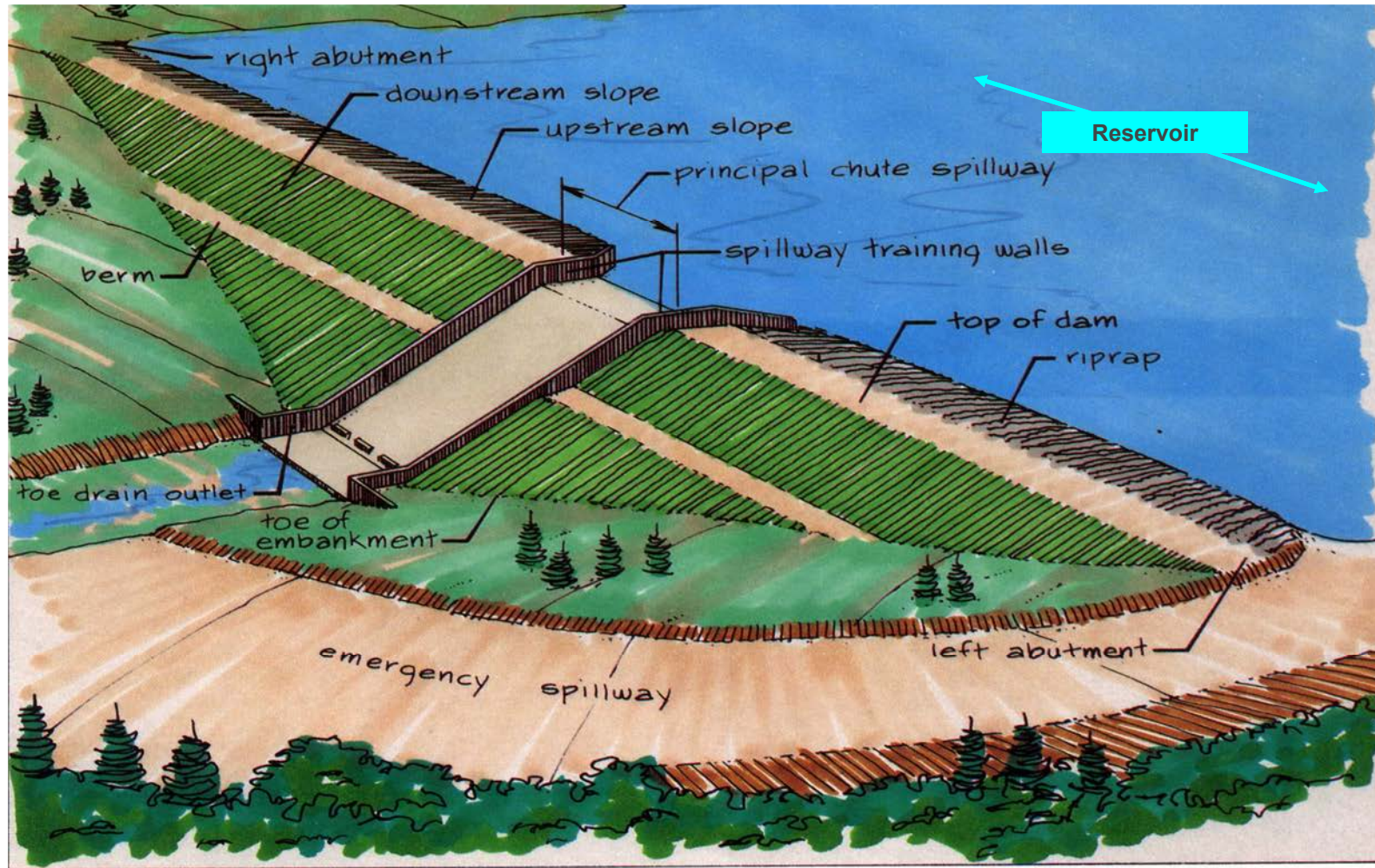


Dam Terminology

Parts of an Embankment Dam



Embankment Dam With Chute Spillway



Low Level Outlet



Gate stem to
low level outlet

Stem guides

Low Level Outlet Controls

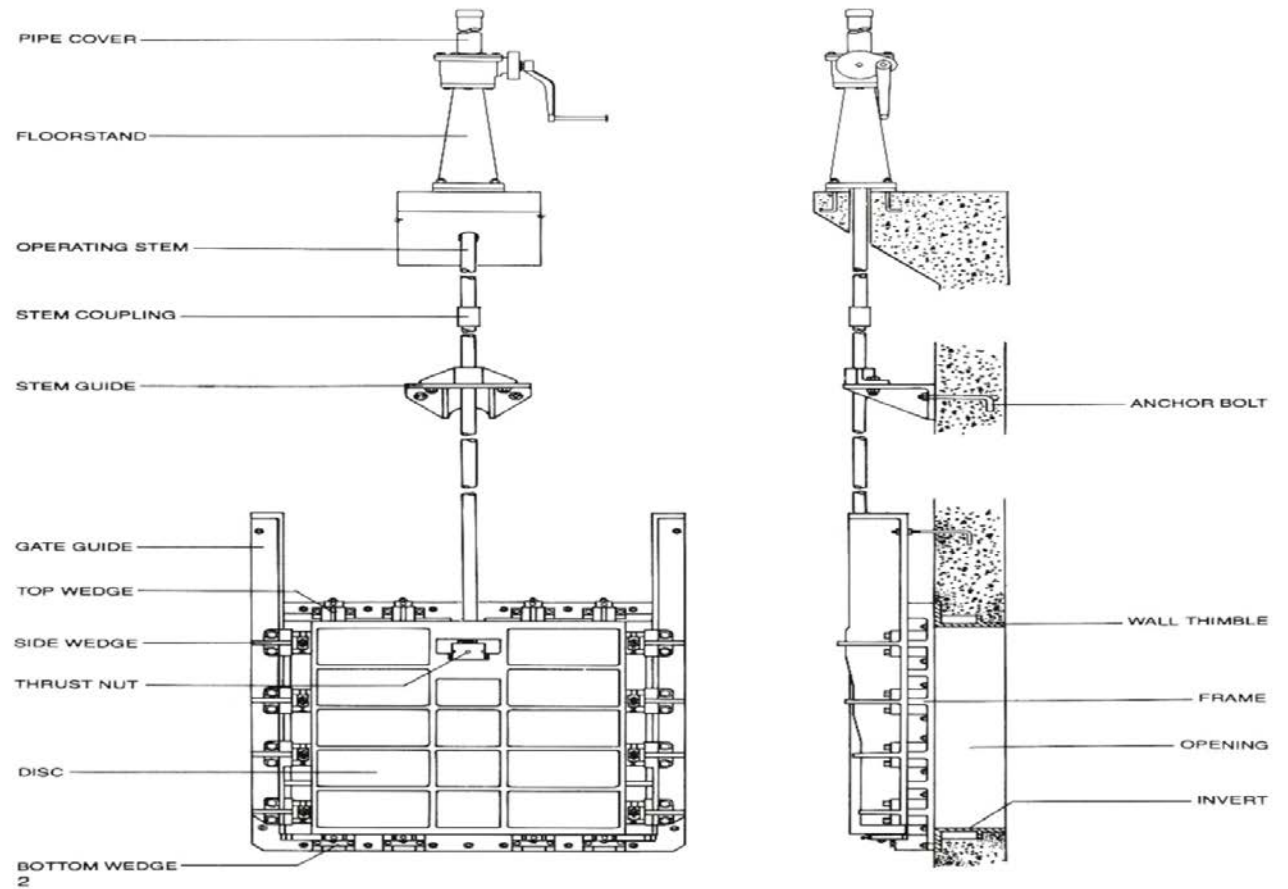
Pedestal w/ crank operator



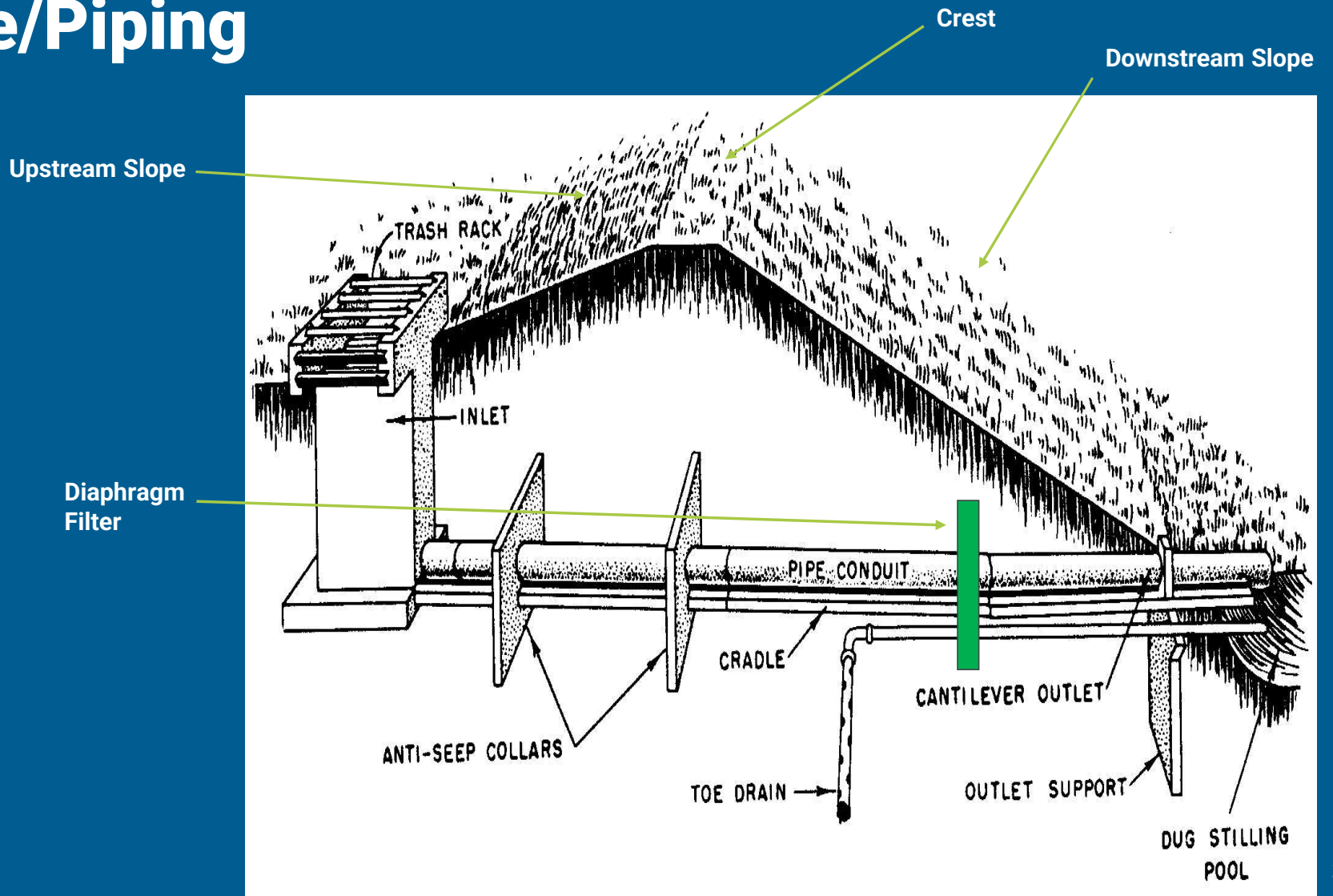
Operator w/ rising stem



Typical Sluice Gate



Seepage/Piping Control





nsafety.org

Embankment Drain Outlet

Animal Guard



Spillway Functions

Primary Spillway

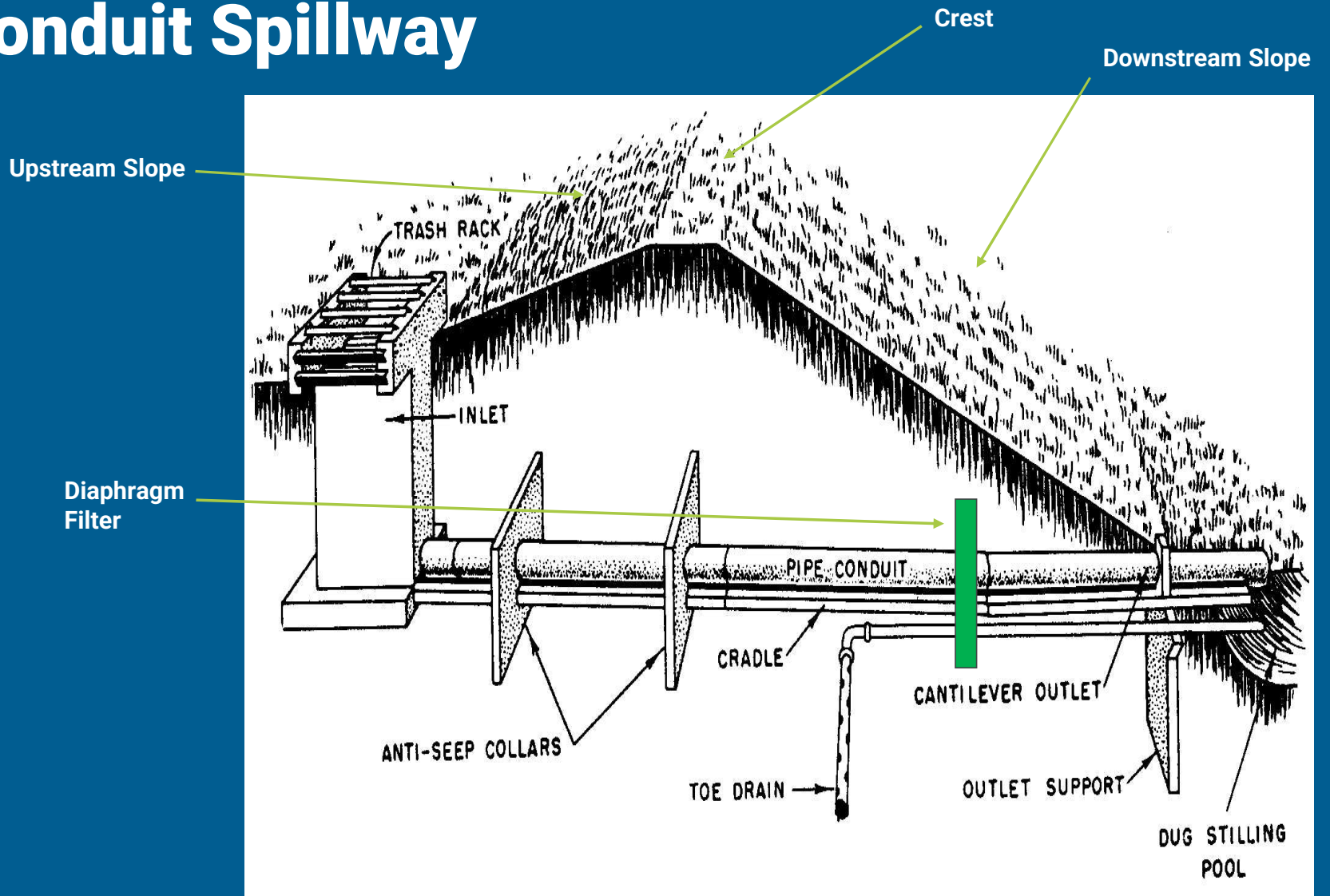


Secondary Spillway



Spillways Types

Riser/Conduit Spillway



NRCS Open Top Riser



Square Open Top Spillway



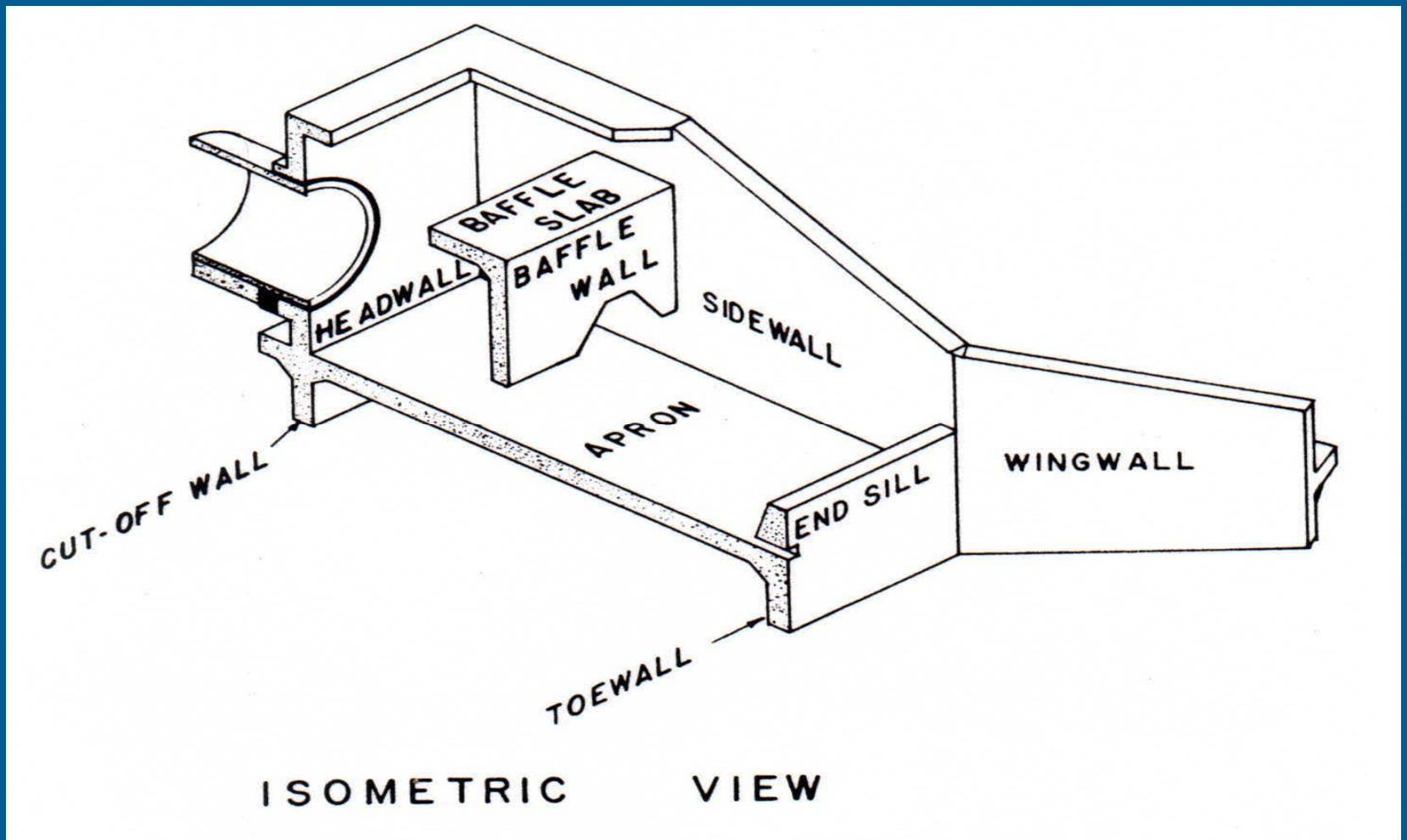
Conduit Outlet Protection – Plunge Pool



Rock Riprap Conduit Outlet Protection



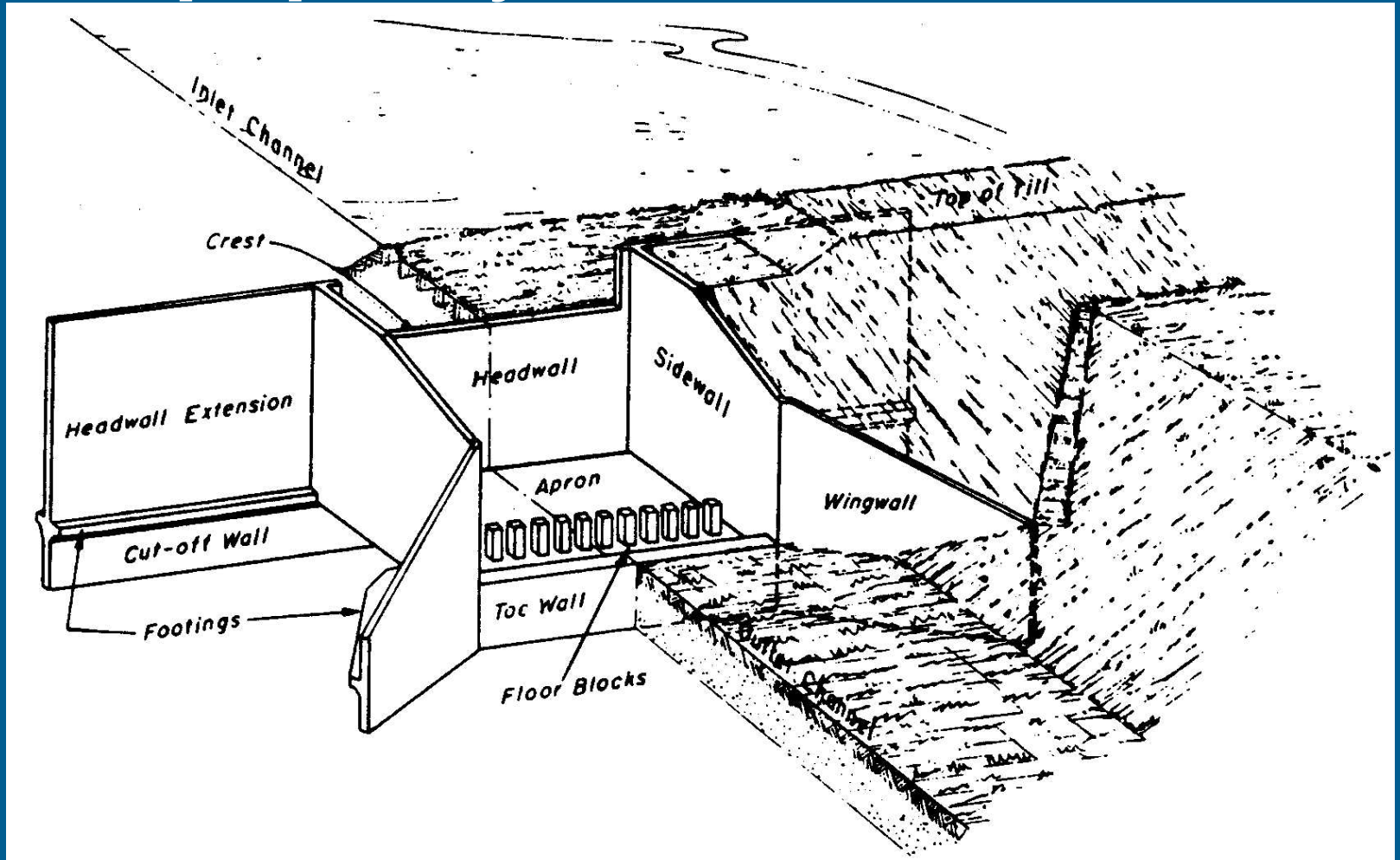
USBR Type IV Baffle Wall



USBR Type IV Baffle Wall Basin



Straight Drop Spillway



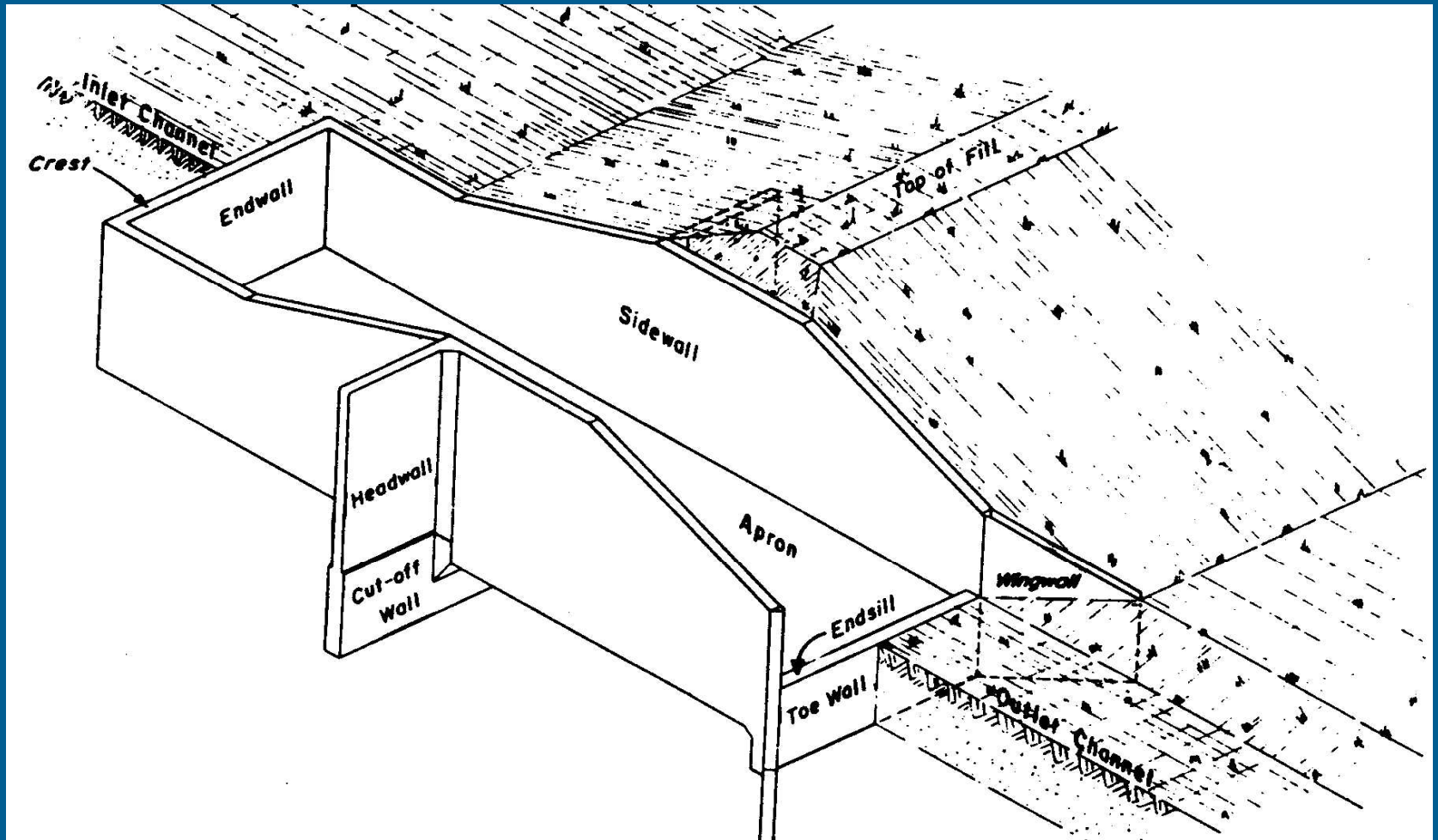
Gabion Drop Spillway



Two Stage Drop Spillway



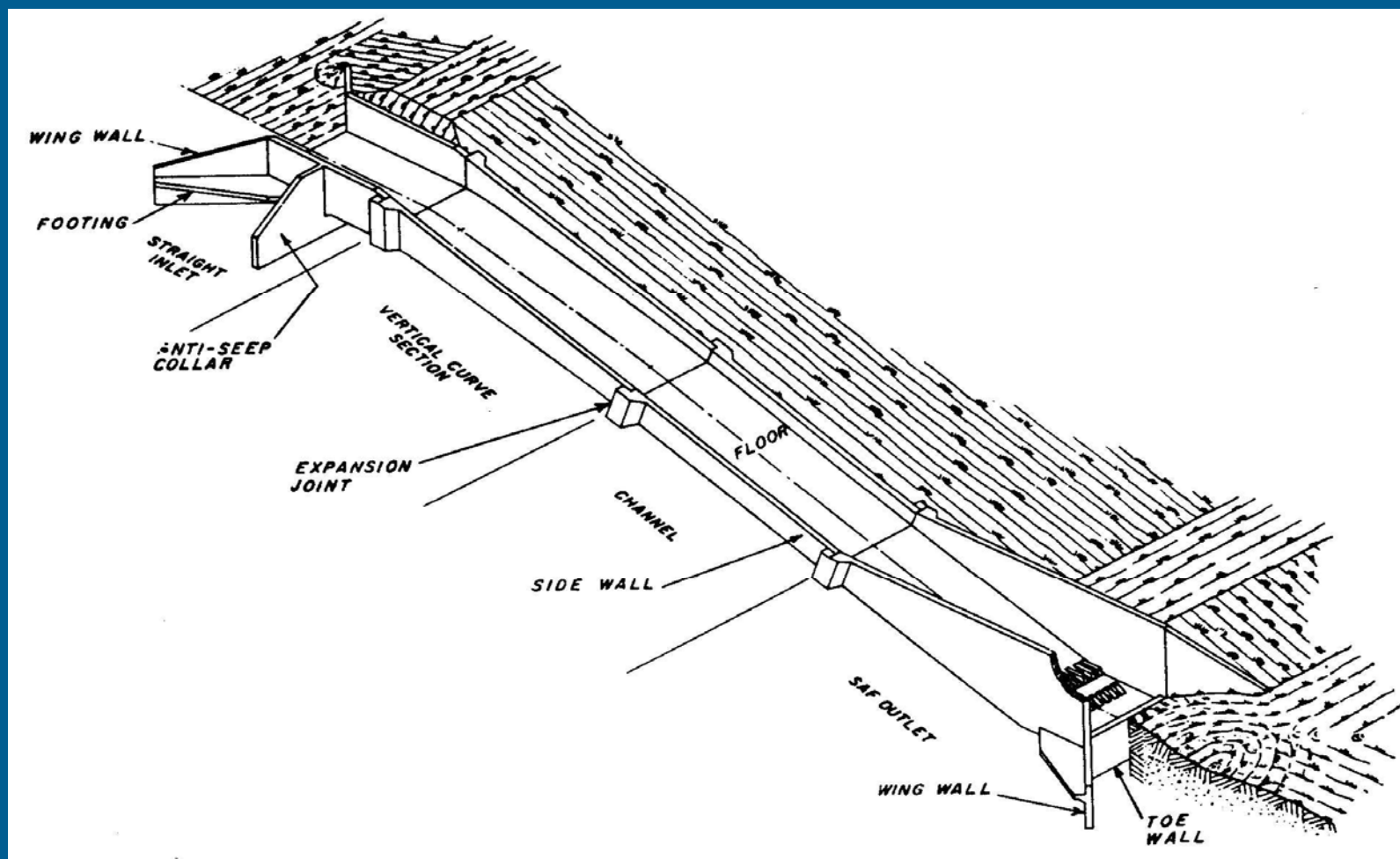
Box Inlet Drop



Box Inlet Drop



Chute Spillway



Chute Spillway



Baffle Chute

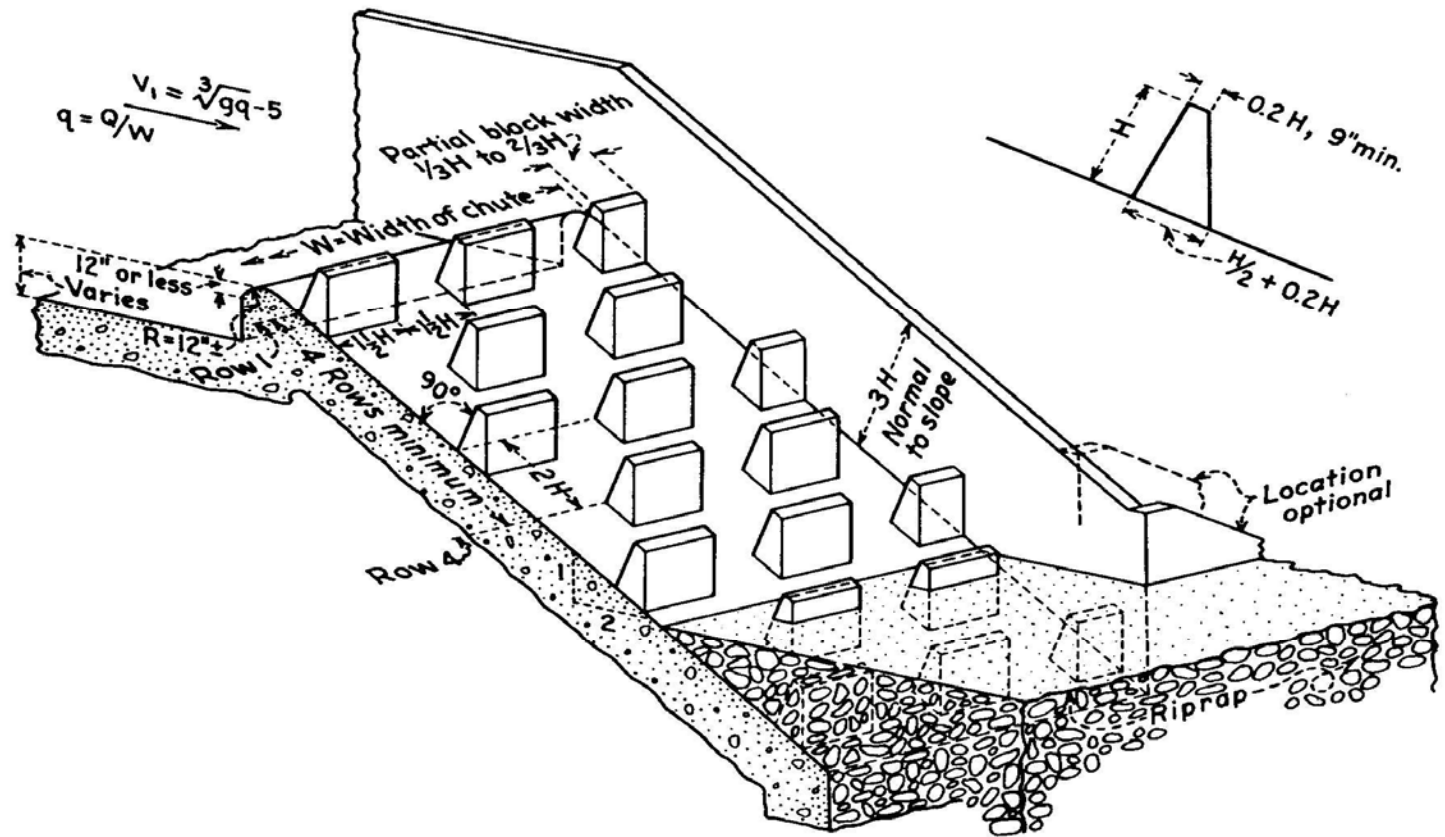


Figure 9-18.—Basic proportions of a baffled chute spillway. 288-D-2807.

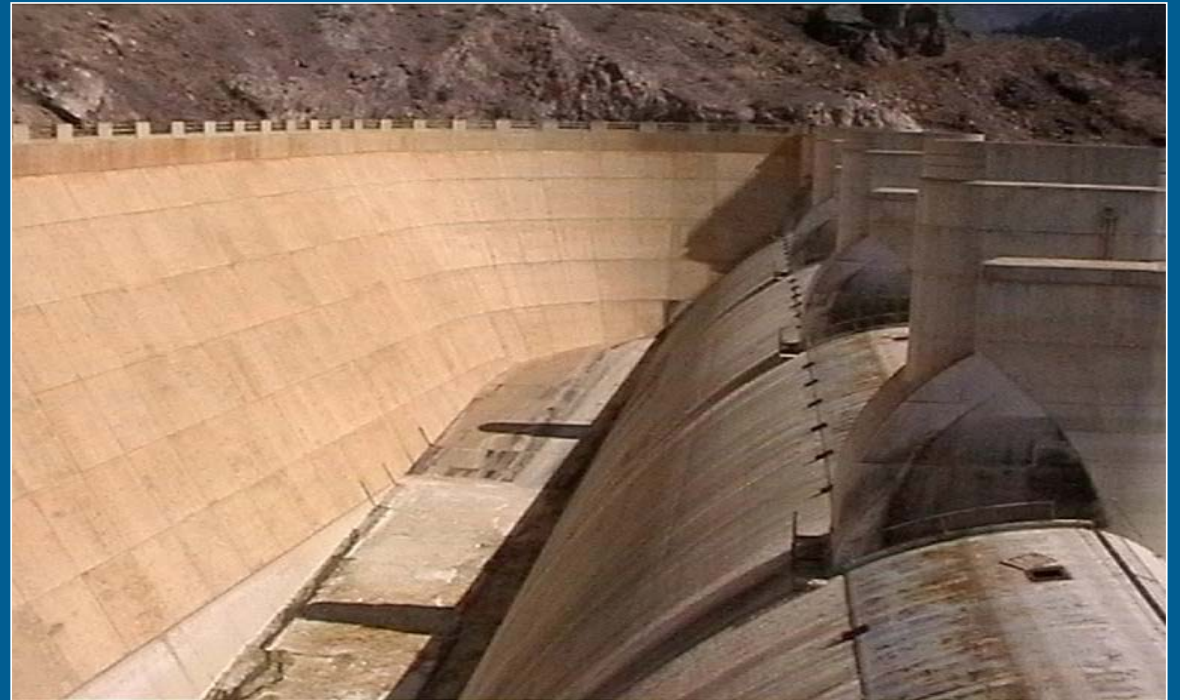
Baffle Chute



Ogee Spillway



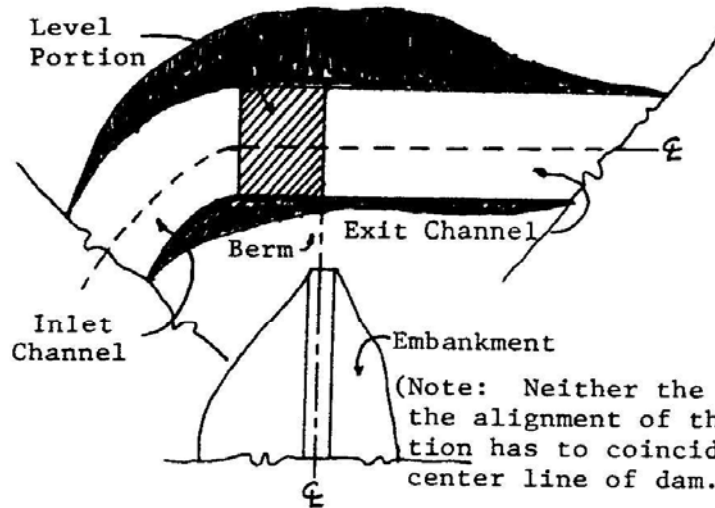
Side Channel Spillway



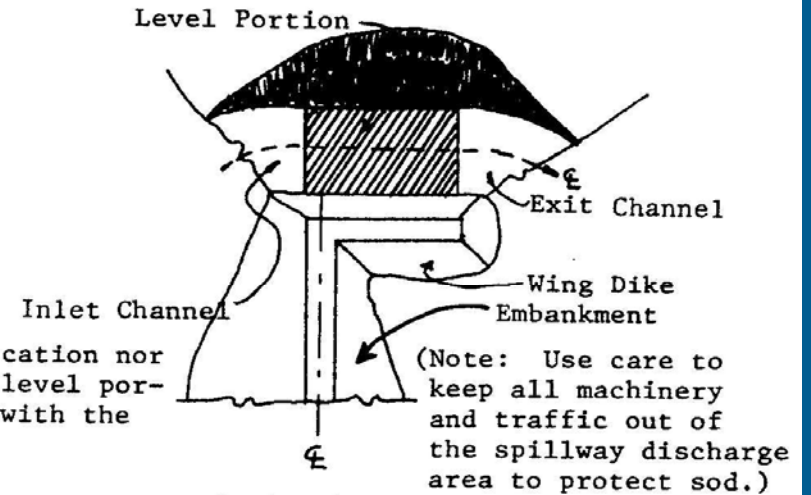
Labyrinth Spillway



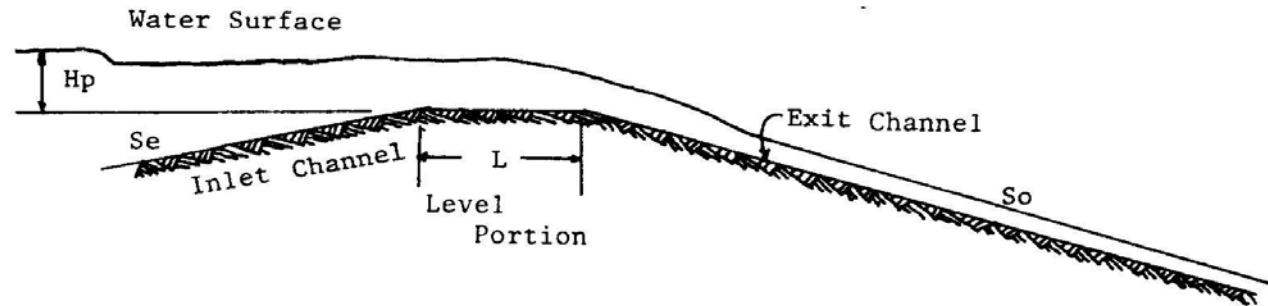
Earth Spillway



Excavated Earth Spillway



Optional with sod or riprap on wing dike



Earth Spillway



Gated Spillway

Crest Gate In Lowered Position



Gated Spillway



Un-gated Spillway



Dam Statistics

Highest dam in US, Oroville Dam (CA)
– 770 feet

Largest reservoir storage in US, Lake
Mead (Hoover Dam -NV) – 30 million
acre-feet

Highest dam in world, Jinpin-1 Dam
(China) – 1,015 feet



Dam Statistics

- 83,000 dams in National Inventory of Dams (NID)
- 86% regulated by states
- 14% federally owned/regulated
- Over 53,000 (65%) of these dams are privately owned
- Average age of NID dams is over 60 years



Dams in Kentucky: Hazard Class and Location

972* Active
Dams

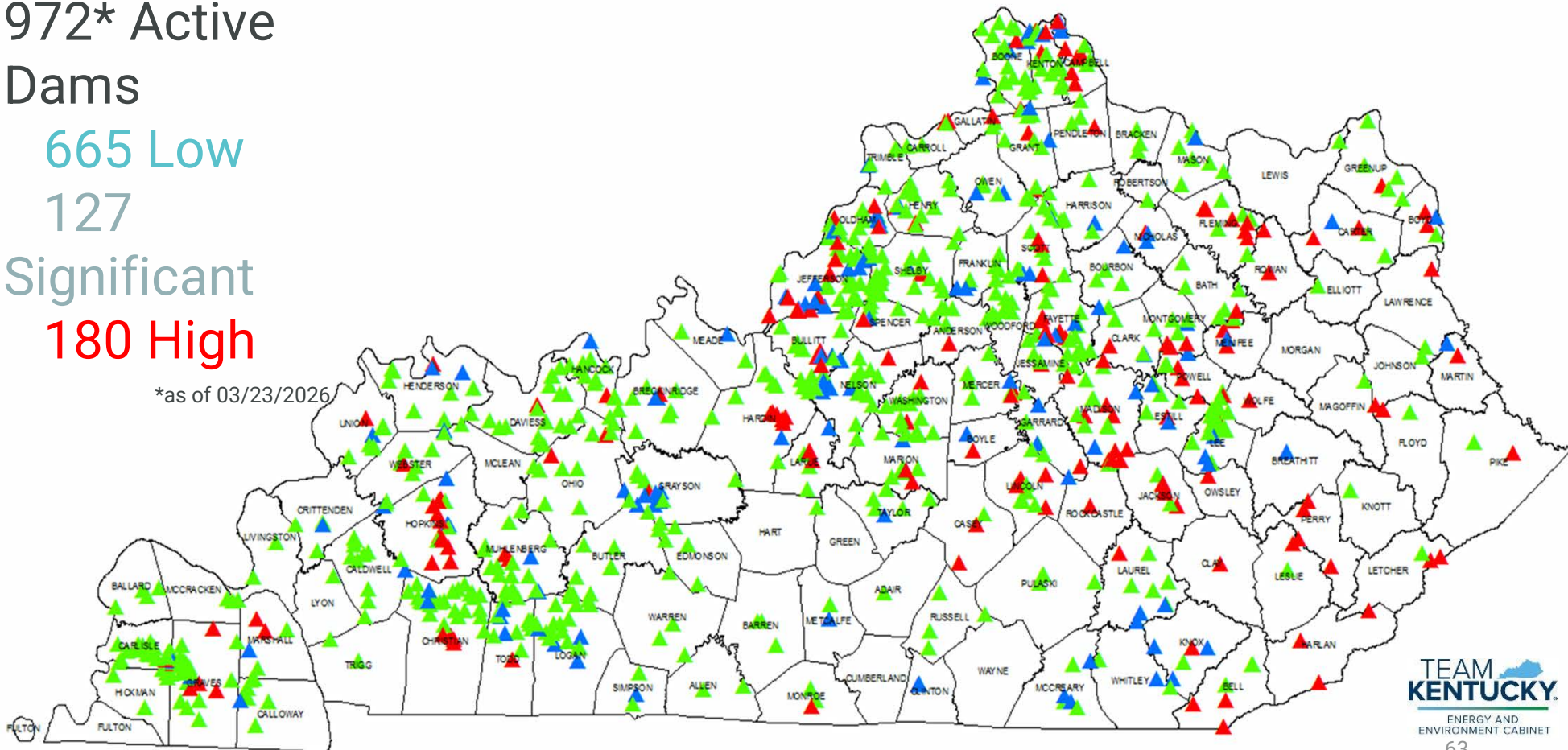
665 Low

127

Significant

180 High

*as of 03/23/2026



State Owned Dam Inventory (75 Total)

Agency Owners:

KY Transportation Cabinet (11)

KY Dept Env Protection (2)

KY Dept of Fish & Wildlife (25)

KY Dept of Parks (13)

KY Dept of Corrections (2)

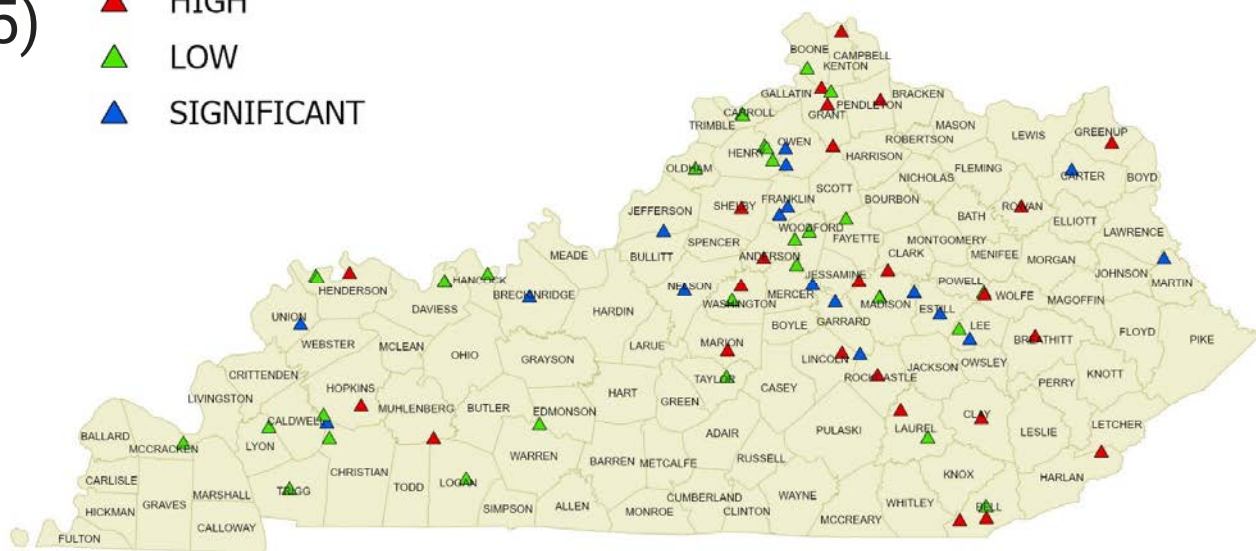
KY River Authority (14)

KY Division of Forestry (1)

Colleges & Universities (7)

Active State Owned Dams

- ▲ HIGH
- ▲ LOW
- ▲ SIGNIFICANT



Dam Statistics

- Dam failures that kill people
 - 20'-49' high – 86% of deaths *
- * *“A Procedure for Estimating Loss of Life Caused by Dam Failure”, Wayne Graham, Bureau of Reclamation, from 1960-1998*

Kentucky Dams

- Avg height – 33 feet
- Avg length - 633 feet
- Avg Volume - 1433 acre-feet
- Avg age – 58 years

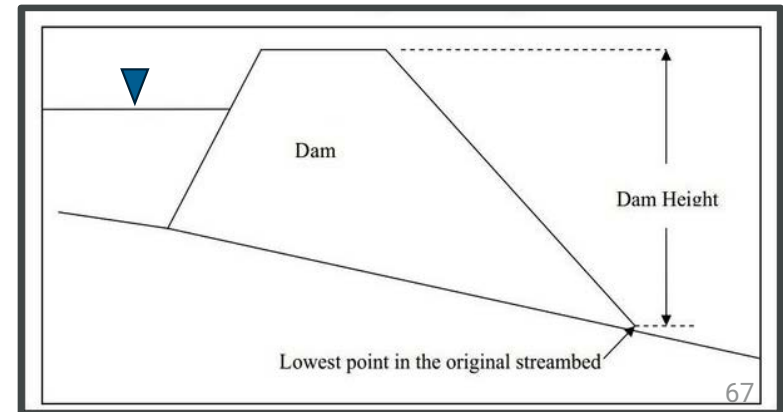


Dam Regulations

What is a Dam?

KRS 151.100 - Dam Defined:

- *Any artificial barrier that can impound or divert water*
- 25 feet or more in Height -OR-
- Impounds 50-acre feet or more





Hazard Classification Potential

What it is and what it is not.

What it is not:

It is not a representation of the quality or stability of the dam.

What it is:

It represents the condition downstream of the dam.

IF (big IF), the dam were to catastrophically fail, would be the consequences.

As a Dam Owner, this one is tough – you likely have no control over what happens downstream of your dam, but it can impact you greatly.

Hazard Classification

Hazard Classification – based on downstream impacts from dam failure. NOT the condition of the structure.

- **Low** – Little or no damage to other property
- **Significant (Moderate)** - damage to property and project operation, but loss of human life is not envisioned
- **High** - serious damage to houses, industrial or commercial buildings, important public utilities, main highways, major railroads or would cause probable loss of human life.

Dam(n) Development

Slide 71

CS1 [@Tony Grubbs] I added this back in, with limited slides. We list this section on the agenda, so I think we need to discuss it some here and then again later. Scott even sent me a site in KY to add. Its at the end and I have done this many times. I can make the time work.

Chris Stoner, 2026-04-03T16:33:45.609

Hazard Creep

April 2002
Google Earth Image



April 2008



April 2010



July 2022
(Latest)



Nov. 2004

Owsley Fork
Reservoir

(AKA)

Red Lick Creek
MSP 1

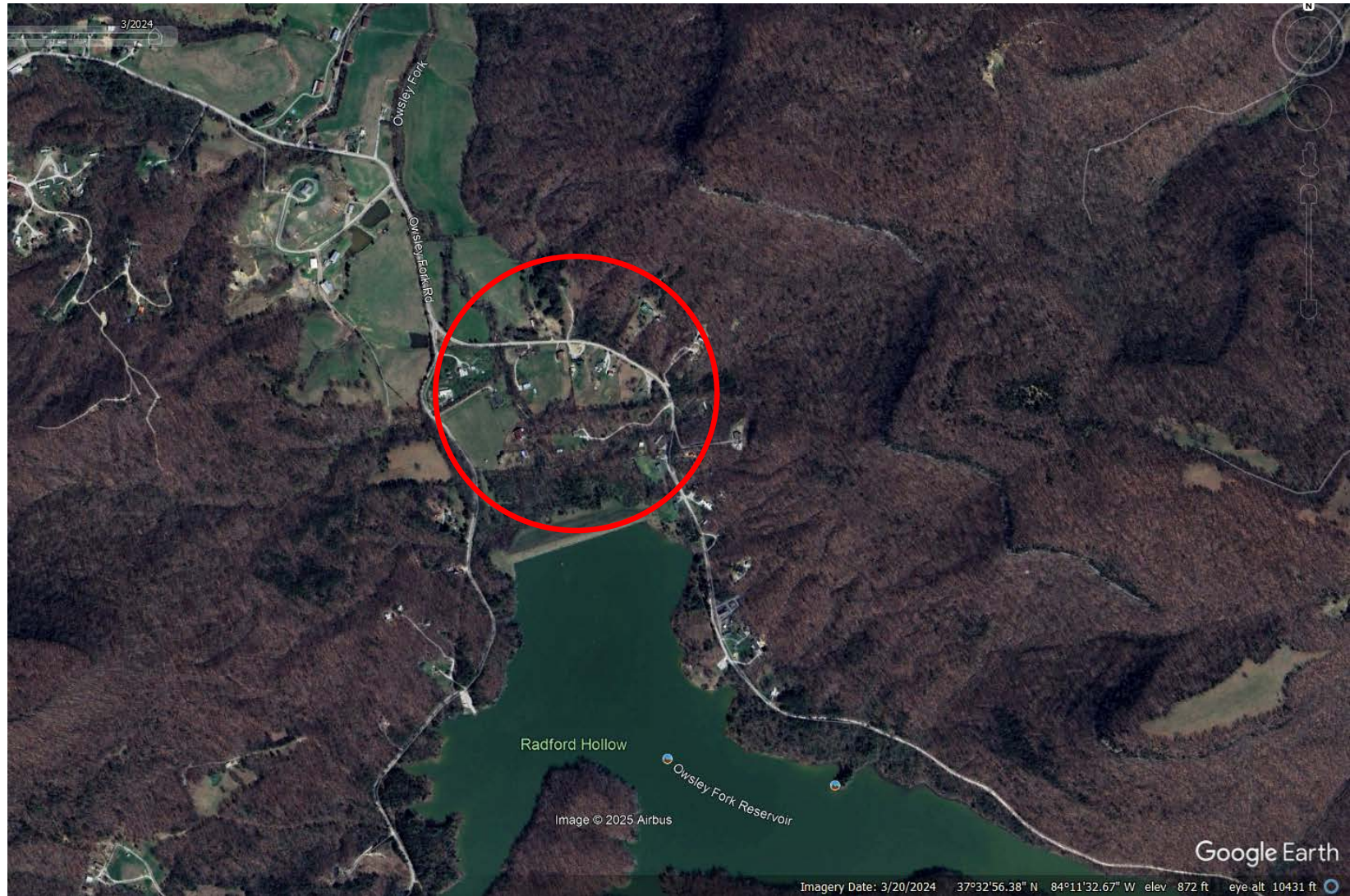


Nov. 2024

Owsley Fork
Reservoir

(AKA)

Red Lick Creek
MSP 1





Malcolm Baldrige
National Quality Award
Recipient **2010 & 2024**

Thank you

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