

**Project & Lands – Item 4**

**C-43 West Reservoir  
Entrapment Issues  
and Next Steps**

**Project and Lands Committee  
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Everglades Restoration and Capital Projects*

# Wildlife Entrapment Issues with Reservoirs

## USFWS Concerns

- Wildlife entrapment on the interior side slopes of reservoirs
  - Features such as stair-step soil cement prevent wildlife from migrating out or returning to the reservoirs

## USACE / SFWMD Concerns

- Embankments must ensure human safety, long-term life of the facility, and life cycle cost-effectiveness to meet the Design Criteria Memorandums (DCMs)

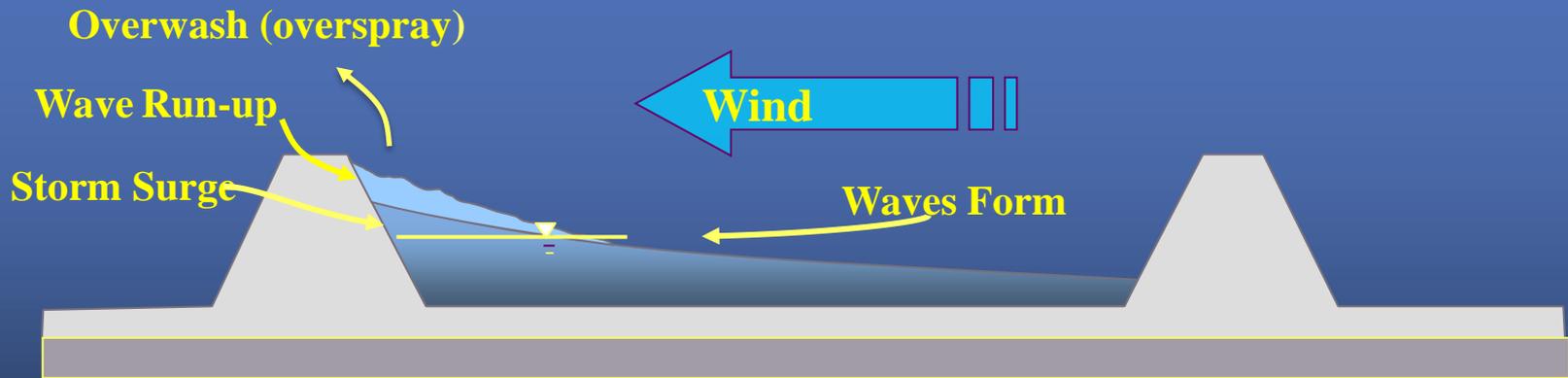
# Background

- 2006 USFWS begins monthly avian monitoring of Ten Mile Creek
- Wildlife began being entrapped in 2007
- From June through August 2008, 93 turtles observed entrapped (based on 11 surveys)
- November 16, 2009, all agencies agree a redesign of reservoirs, without steps, would be prudent

# Design challenges - hurricanes



Design pool depth determined by required volume and reservoir footprint



# Wave run-up



SOUTH FLORIDA WATER MANAGEMENT DISTRICT





## Reasons for turtle movement

- Locate food
- Find mates
- Establish nest holes in dry upland soil
- Respond to temperature gradients
- Respond to rapid water level declines

06/24/2008

**Mottle duck brood returns to water  
after failed attempt to leave reservoir**



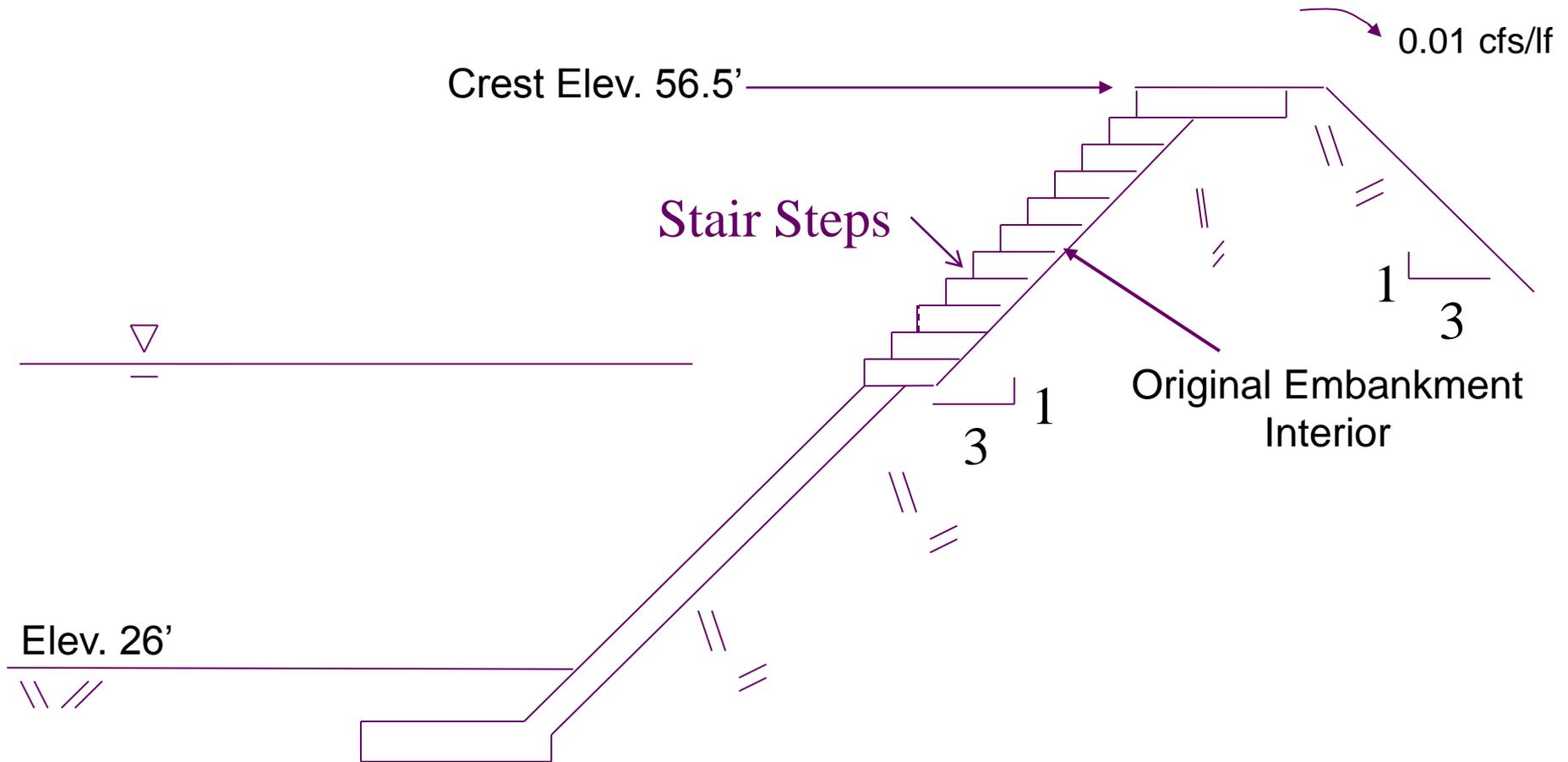
# Entrapped Wildlife Monitoring and Rescue

- **Perimeter surveys and rescues**
  - Every third day Jan to first week of March and Nov – Dec
  - Two circuits around the reservoir every day Mar – Oct
- **Perimeter Site I Reservoir ~7.5 miles (39,600 ft)**
  - Estimated cost \$240,483/year to provide the required wildlife monitoring. Project life cycle cost of 50 years is \$12M
- **Perimeter C-44 Reservoir ~9.3 miles (49,100 ft)**
  - Project life cycle cost of 50 years is \$14.9M
- **Perimeter C-43 Reservoir ~16.4 miles (86,300 ft)**
  - Project life cycle cost of 50 years is \$26.4M

# Alternatives for Avoiding Entrapment

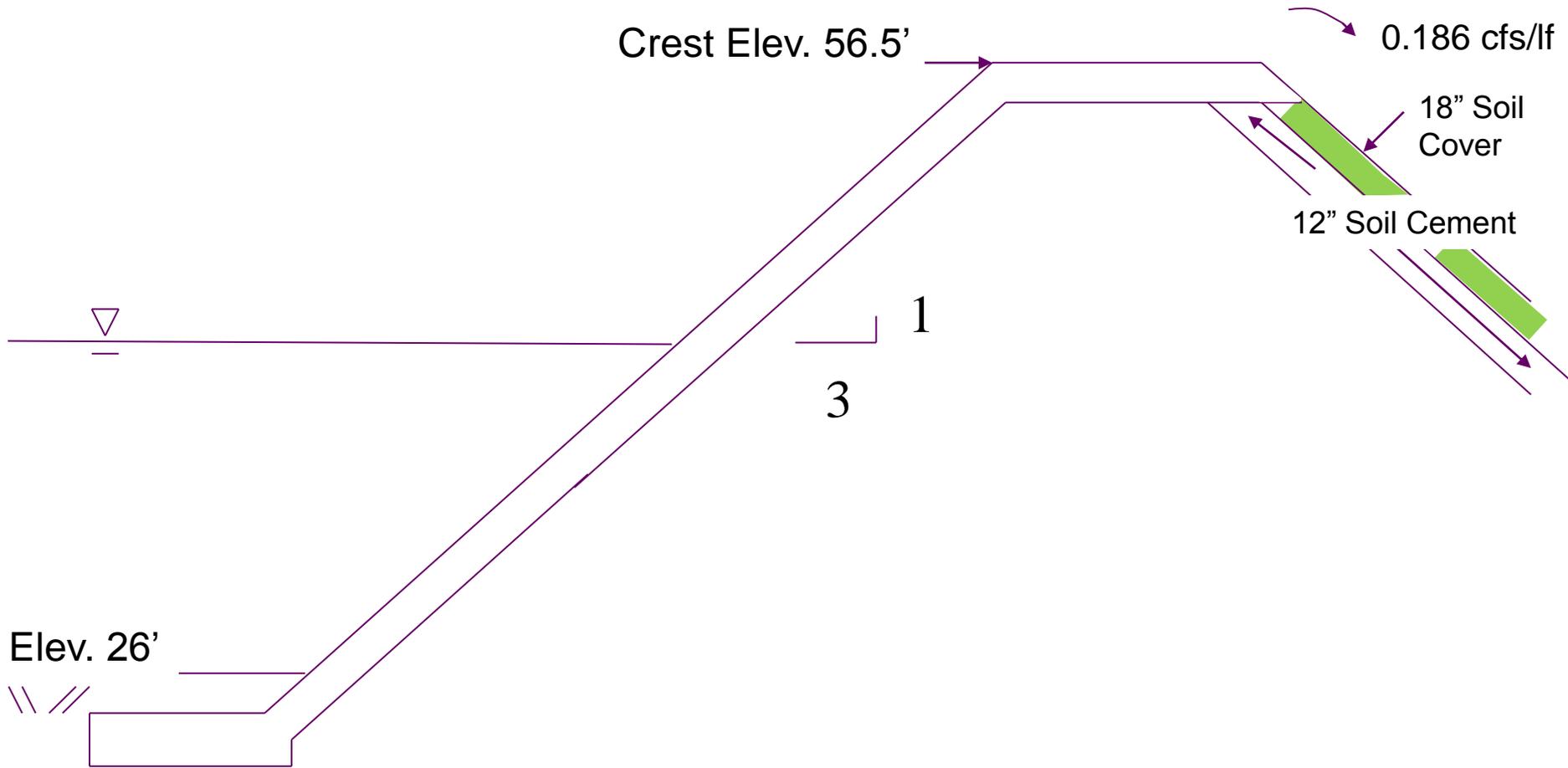
- Multi agency team worked on developing solutions
  - Modify steps with wildlife paths
  - Replace steps with large gabions dispersed across flat plate
  - Provide full height embankment with no stair steps
  - Armor outside of embankment for lower embankment height
  - Incorporate wave bench into design
  - Provide expendable material for coverage of steps
- Recognition by agencies that site-specific situations require unique consideration

## Current Design – Entrapment

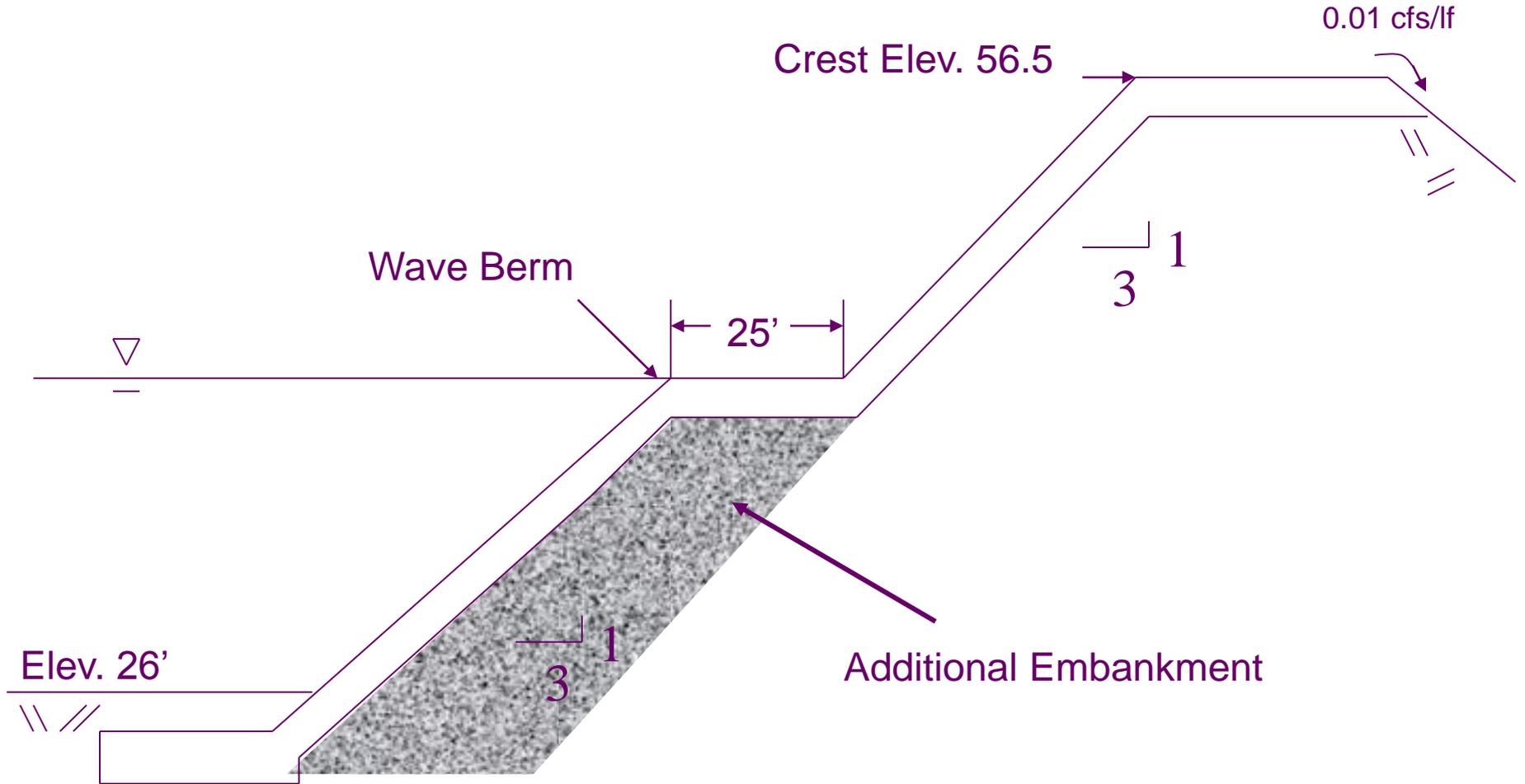




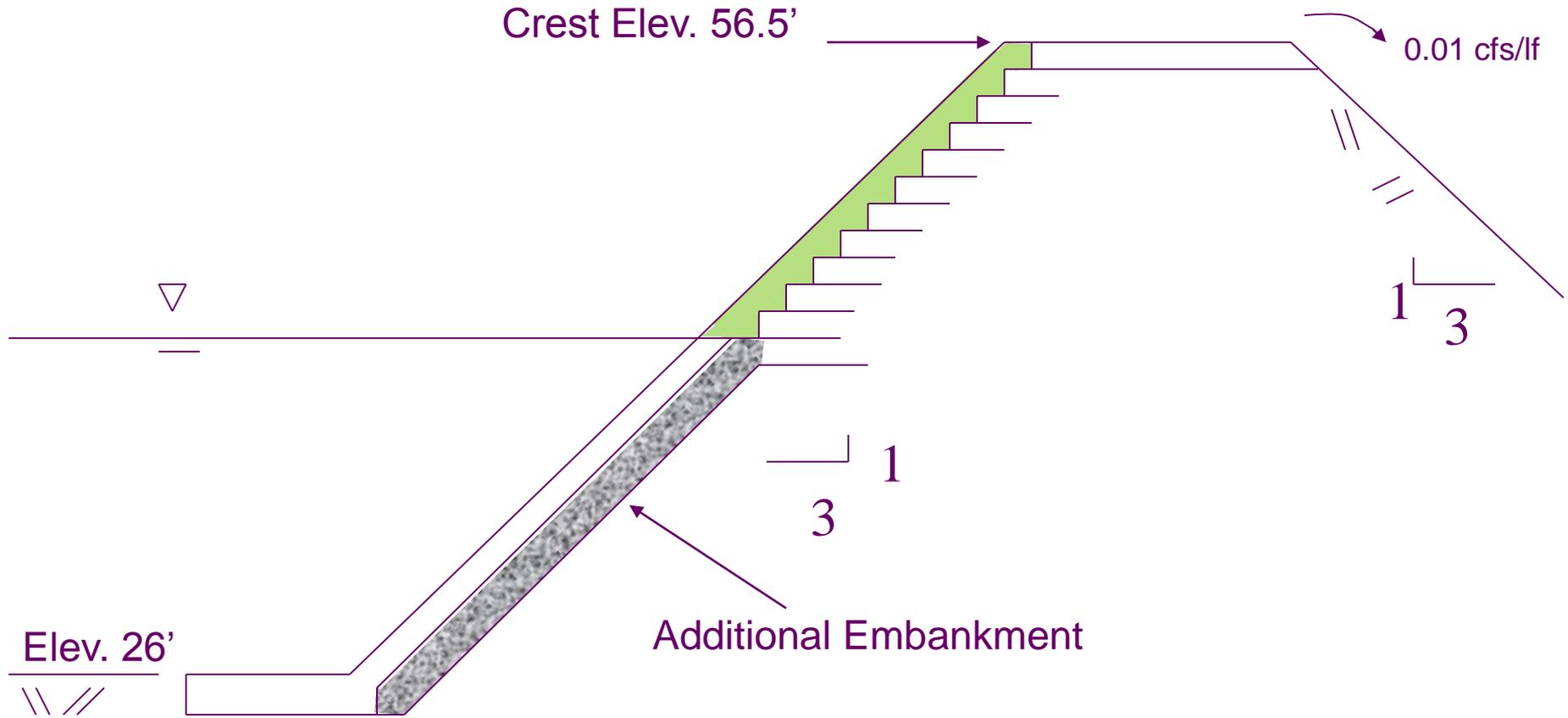
# Full Flat Plate with Increased Overwash – No Entrapment



# Flat Plate with 25' Wave Bench – No Entrapment



# Stair Step with Vegetation – No Entrapment



# Site 1 Impoundment

- USACE is designer of impoundment
- Flat plate with higher over-wash used along embankment between impoundment and refuge (low hazard section)
- Alternative design of wave bench or higher over-wash with downstream protection for embankment along populated area
- Cost projected to be within the project's budget

## C-44 Reservoir Summary of Reservoir Embankment Costs Only

Embankment Treatment	Additional Construction Cost	Total Construction Cost	Life Cycle Cost	Present Worth	Entrapment Opportunity
ORIGINAL DESIGN - Flat Plate w/ Stair Step (elev. 56.6')	Base \$	107,000,000	\$ 14,900,000	\$ 121,900,000	Yes
Full Flat Plate (elev. 60.5)	\$ 16,000,000	\$ 123,000,000	\$ 0	\$ 123,000,000	No
Full Flat Plate w/ Increased Overwash (elev. 56.5)	\$ 13,000,000	\$ 120,000,000	\$ 2,000,000	\$ 122,000,000	No
Flat Plate w/ 25' Wave Berm (elev. 56.5')	\$ 12,000,000	\$ 119,000,000	\$ 0	\$ 119,000,000	No
Stair Step w/ Vegetation (elev. 56.5')	\$ 8,000,000	\$ 115,000,000	\$ 3,000,000*	\$ 118,000,000	No
Stair Step w/ Gravel Fill in Steps (elev. 56.5')	\$ 4,000,000	\$ 111,000,000	\$ 2,000,000*	\$ 113,000,000	Yes

## C-44 Reservoir

- USACE is redesigning with wave bench to replace steps
- No entrapment monitoring required by U.S. Fish and Wildlife
- Operation Enhancements
  - Inspection platform inside reservoir
  - Work platform for repairs, if required
    - With steps to access from top (14 at one foot wide )
    - Wave bench provides 25-foot work platform

## **C-43 West Reservoir**

- **Current Status**
  - **South Florida Water Management District completed 100% Design of reservoir in 2007**
  - **Includes stair-step soil cement in the interior for protection**
- **Items for Discussion**
  - **Wildlife entrapment issue**
  - **USACE repackaging of plans and specifications**

## C-43 West Reservoir Recommendation

- SFWMD and USACE are recommending redesign of reservoir to eliminate stair steps
- Recommendation based on the following factors
  - Cost differential for modifying design/construction approach (~ \$25 million)
  - Cost of monitoring (~ \$26 million)
  - Potential risk of retrofitting
  - Public/stakeholder/congressional perception

## C-43 West Reservoir Next Steps

- Request concurrence on the following;
  - USACE to repackage plans into USACE format
  - USACE to develop alternative design to eliminate wildlife entrapment
  - USACE to update communications package to latest requirements
- Provides flexibility of either organization to begin construction when funding becomes available

Questions?

