Opportunities for Coordination between Dam Safety and Floodplain Managers

CASFM Lunch and Learn
Denver, CO
October 14th, 2015

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Opportunity to Improve DSE’s to CFM’s Communication

• Pre April 2013
  • Relatively unaware or unmotivated?
  • Dam safety and floodplain management rarely intersected
  • 100-yr floodplain vs PMF floods and Sunny Day failures

• Post April 2013 - FEMA CRS 630 - Dams
  • Becoming aware, motivated
  • Need information from each other

• Post September 2013 - heavy rainfall
  • Dams spilling, outlets running and some dams failing

• Post May 2015 - heavy spring rains/runoff
  • Normal Dam operation leads to flooding
  • Communication and language needed
Communication

• Dam Owners - CFMs
  • Dam outlet opened
  • Dam Spillway running

• Dam Owners - Emergency Managers
  • Dam has problems
  • Problem heads downstream

• Dam Safety in the middle
Colorado Dam Safety Branch
Dams in Colorado
Where CFM’s and DSE’s intersect

• Emergency Action Planning
• Inundation zones
• Dam releases
  • Spillway
  • Outlet
Examples

• September 2013
  • Major flooding
  • Spillways flowing
  • Dams failing

• May 2015
  • Flooding
  • Spillways running
  • Outlets opened
Spillway Flows 9/20/13
Evergreen Dam
Evergreen Dam Inundation Map

Sunny Day Failure - 90,000 cfs
Concrete Dam, Ogee-Crested Spillway
Spillway Rating Curve

2500 cfs

35,000 cfs

Evergreen Dam
Spillway Discharge Curve

2500 cfs

+/−

Spillway Crest Elevation 7277 Test

Top of Dam Elevation 7077 Test

\[ A = 1574' \]

\[ h_0 = 2.5' \text{ to } 4.0' \]
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Observed high water mark on the spillway.
2015 Spillway vs 100 yr flows

Fossil Creek Reservoir Natural Area
Fossil Creek Dam

- 100 yr flow at CR 27 Poudre River = 9,600 cfs
- PMF = 80,000 cfs, spillway flows
- Outlet released 270 cfs
Fossil Creek Inundation

South County Road 5
Peak Discharge = 96,719 cfs
Volume of Flood Wave = 13,899 ac-ft
Time of Peak Flood Wave = 0.17 hours

Interstate 25
Peak Discharge = 116,780 cfs
Volume of Flood Wave = 14,907 ac-ft
Time of Peak Flood Wave = 0.01 hours
2015 Spillway Flow
North Sterling Reservoir
Spillway Running
Outlet Releases - EAP Activation
Eleven Mile Canyon Dam
Outlet channel

Spillway channel
Eleven Mile Inundation Map

Access Road Tunnels
2.0 Miles Downstream of Eleven Mile Canyon Dam
Maximum Flow Rate (cfs) = 838,745
Maximum Water Surface Elevation (ft) = 8,410
Maximum Stage (ft) = 53
Wave Arrival Time (hr:min) = 0:18
Time to Peak Flood Stage (hr:min) = 2:50

Cove Campground
1.2 Miles Downstream of Eleven Mile Canyon Dam
Maximum Flow Rate (cfs) = 839,724
Maximum Water Surface Elevation (ft) = 8,479
Maximum Stage (ft) = 59
Wave Arrival Time (hr:min) = 0:15
Time to Peak Flood Stage (hr:min) = 2:50

Reservoir Campground
0.5 Miles Downstream of Eleven Mile Canyon Dam
Maximum Flow Rate (cfs) = 840,952
Maximum Water Surface Elevation (ft) = 8,528
Maximum Stage (ft) = 45
Wave Arrival Time (hr:min) = 0:15
Time to Peak Flood Stage (hr:min) = 2:50

Eleven Mile Canyon Dam
0.1 Miles Downstream of Eleven Mile Canyon Dam
Maximum Flow Rate (cfs) = 844,178
Maximum Water Surface Elevation (ft) = 8,539
Maximum Stage (ft) = 54
Wave Arrival Time (hr:min) = 0:12
Time to Peak Flood Stage (hr:min) = 2:45

Notes: The base map is the latest USGS Quadrangle maps as of January 2007 and the StreetMap USA database from ESRI, Redlands, CA, Aerial Photography is from the USGS/SCS Douglas, Jefferson and Teller County is dated November of 2005 and Pard County is dated February of 2007.

The flood inundation information shown is based on a computer simulated failure.
Completed Dam Crest El. 9031
Shaft Spillway Crest El. 9017
Discharge 4350 C.F.S.

Diversion Dam Crest El. 8896
Diversion Dam - Spillway Crest El. 8886 with flashboards;
Discharge 2850 C.F.S.

Intake Sill El. 8829
High Pressure Gates El. 8788.33

DISCHARGE CURVE - OUTLET WORKS
2 - 4'-0" x 5'-0" HIGH PRESSURE GATES
1 - 2'-3" x 2'-3" HIGH PRESSURE GATE
SPILLWAY DISCHARGE CURVE-COMPLETED DAM

56-FOOT DIAMETER SHAFT SPILLWAY
Flooding - Summary

- Can be caused by
  - Spillway flows
  - Outlet Releases
  - Combination of the 2

- The Dam can be fine
Next Steps

• Collaborative Efforts Needed
• Communication
• Know your dams
• Dam Failure vs Spillway Operation
• Outlet Operations that cause flooding
• Communication
• Know who to call
Questions?