Yellowtail Reallocation Study

Travis D. Yonts
Water Resource Engineer
U.S. Army Corps of Engineers
Omaha, Nebraska

Bighorn River System Issues Group
January 15, 2009

US Army Corps
of Engineers
Omaha District

Presentation Overview

- Project background
- Computer simulation efforts
  - Calibration results
  - Preliminary reallocation results
- Next step
- Questions

Photo: US NPS

US Army Corps
of Engineers
Omaha District

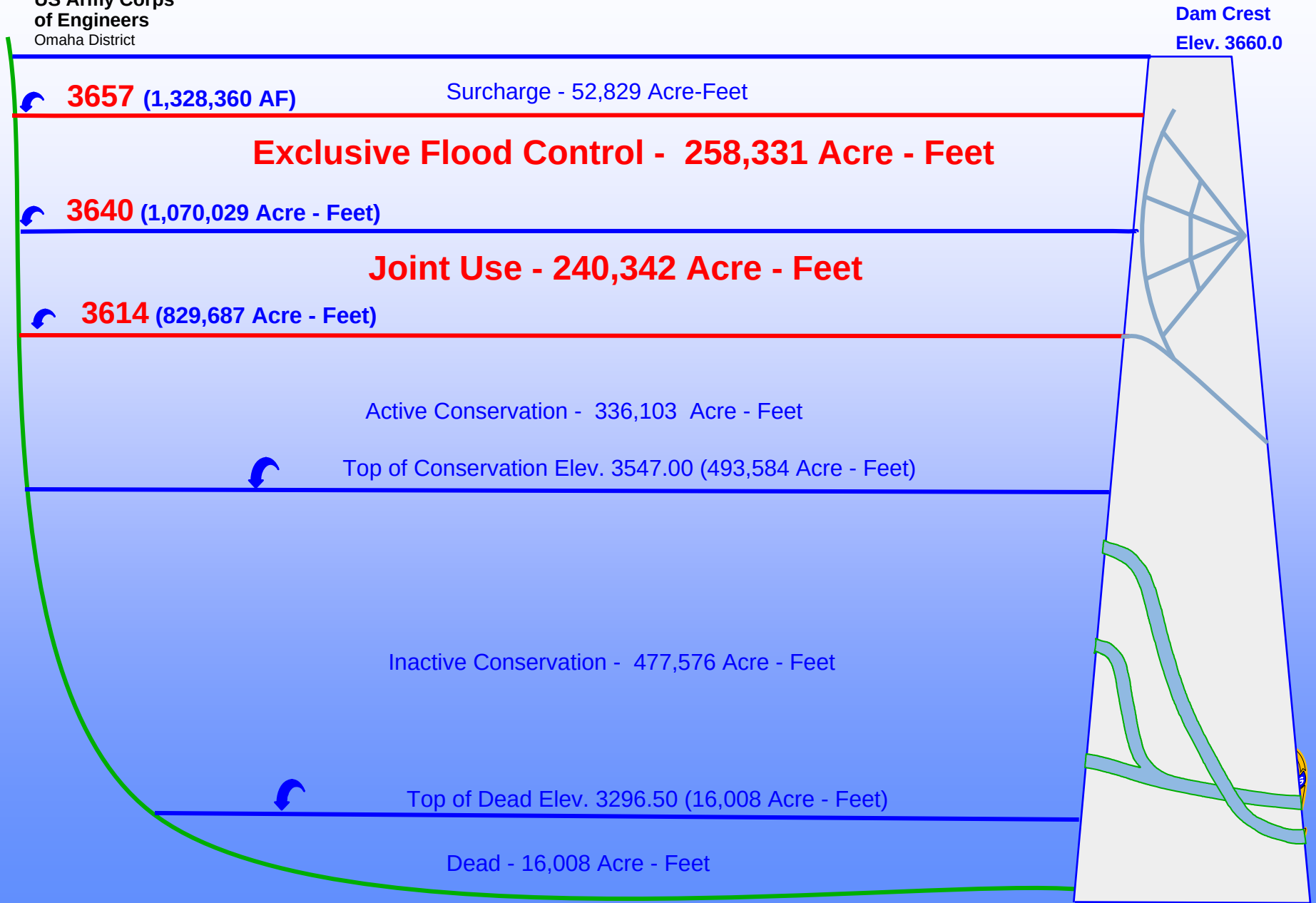
Project Objective

- **Evaluate the change in flood reduction benefits due to reallocation of flood control storage to joint use storage for Yellowtail Dam.**

Photo: US NPS

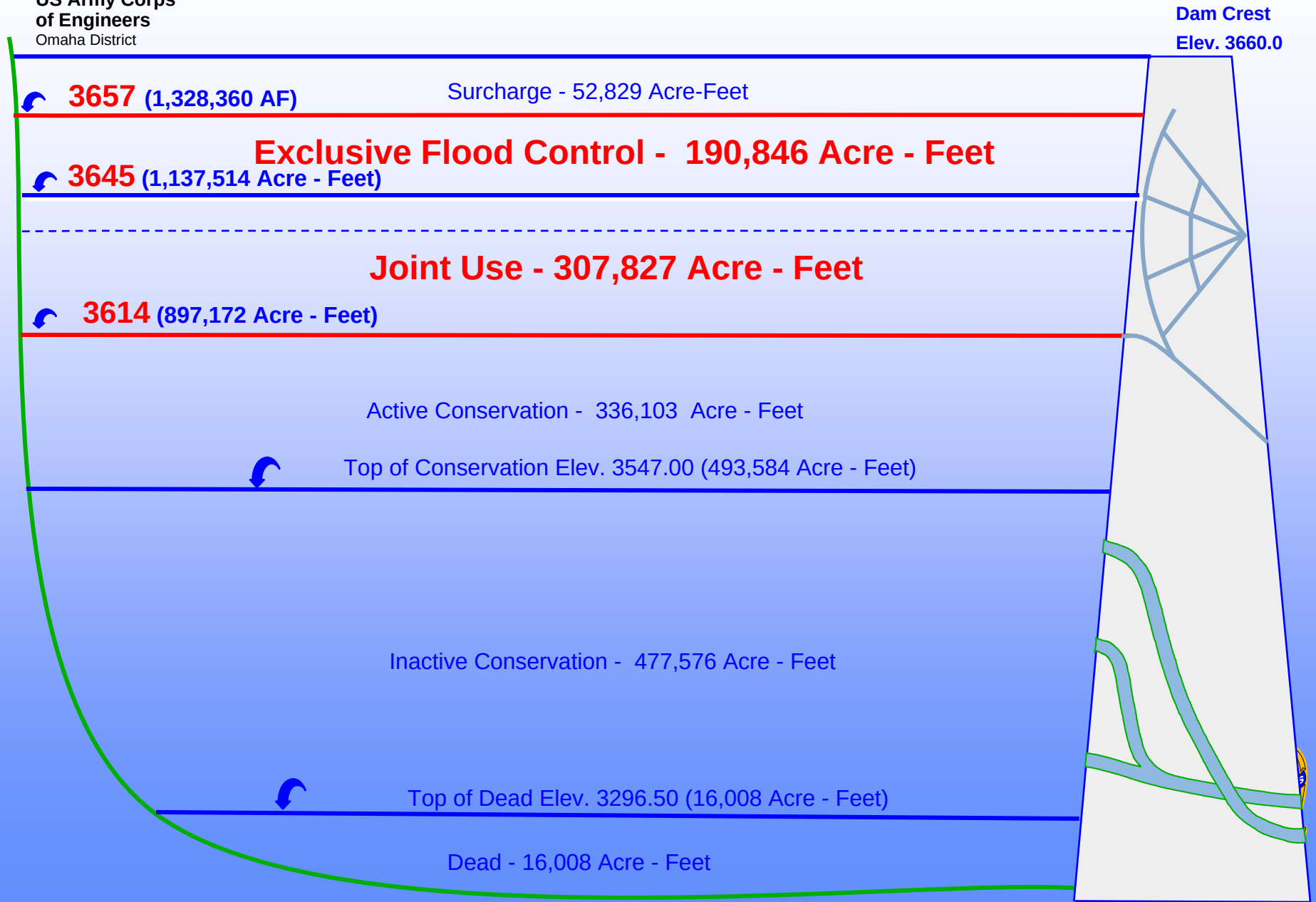
BIGHORN LAKE STORAGE ALLOCATION

US Army Corps
of Engineers
Omaha District



PROPOSED STORAGE ALLOCATION

US Army Corps
of Engineers
Omaha District



US Army Corps
of Engineers
Omaha District

HEC-ResSim

(Reservoir Evaluation System-Simulation)

- Single or multiple reservoir systems
- Flood control
- Hydropower
- Water supply (M&I, irrigation, etc)
- Diversions
- Navigation
- Flow targets (max & min)
- Period of record or event simulation

US Army Corps
of Engineers
Omaha District

Yellowtail ResSim Schematic

US Army Corps
of Engineers
Omaha District

Data Requirements

- Daily stream flow 1967-2007
- Daily reservoir inflow, outflow, storage
- Daily precipitation, evaporation
- Elevation-area-capacity relationships
- Spillway & outlet rating curves
- Downstream discharge-damage functions
- Reservoir operating criteria/storage zones
- Project design floods
- Local flow calculations

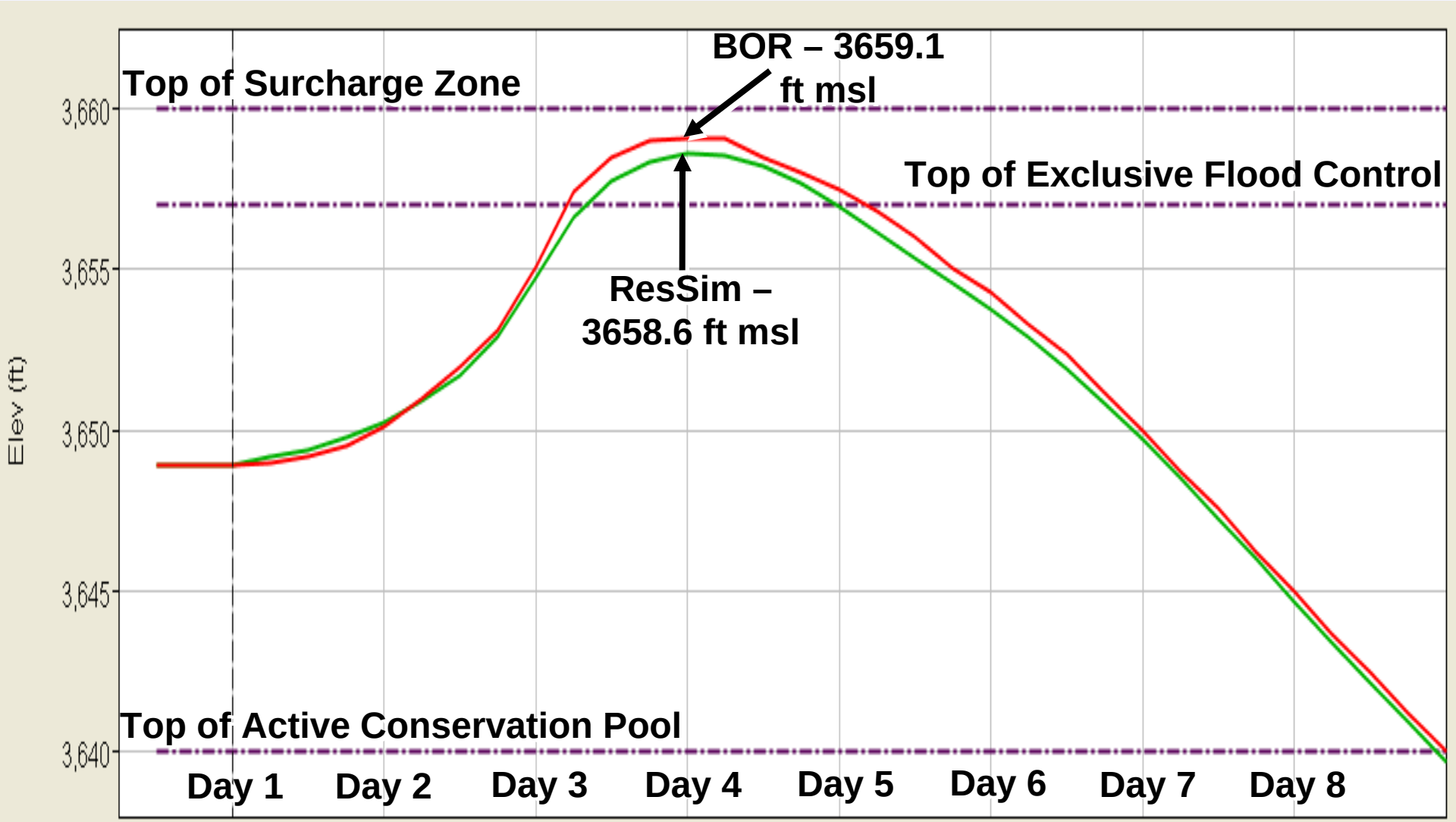
US Army Corps
of Engineers
Omaha District

Calibration Results

- **Four ResSim simulations are being developed:**
  - **Period of record (POR), inflow design flood (IDF), project design flood (PDF), and 1923 historic event**
  - **ResSim results compared to results provided in the Yellowtail Flood Control Manual**
- **Calibration for IDF and 1923 event completed**

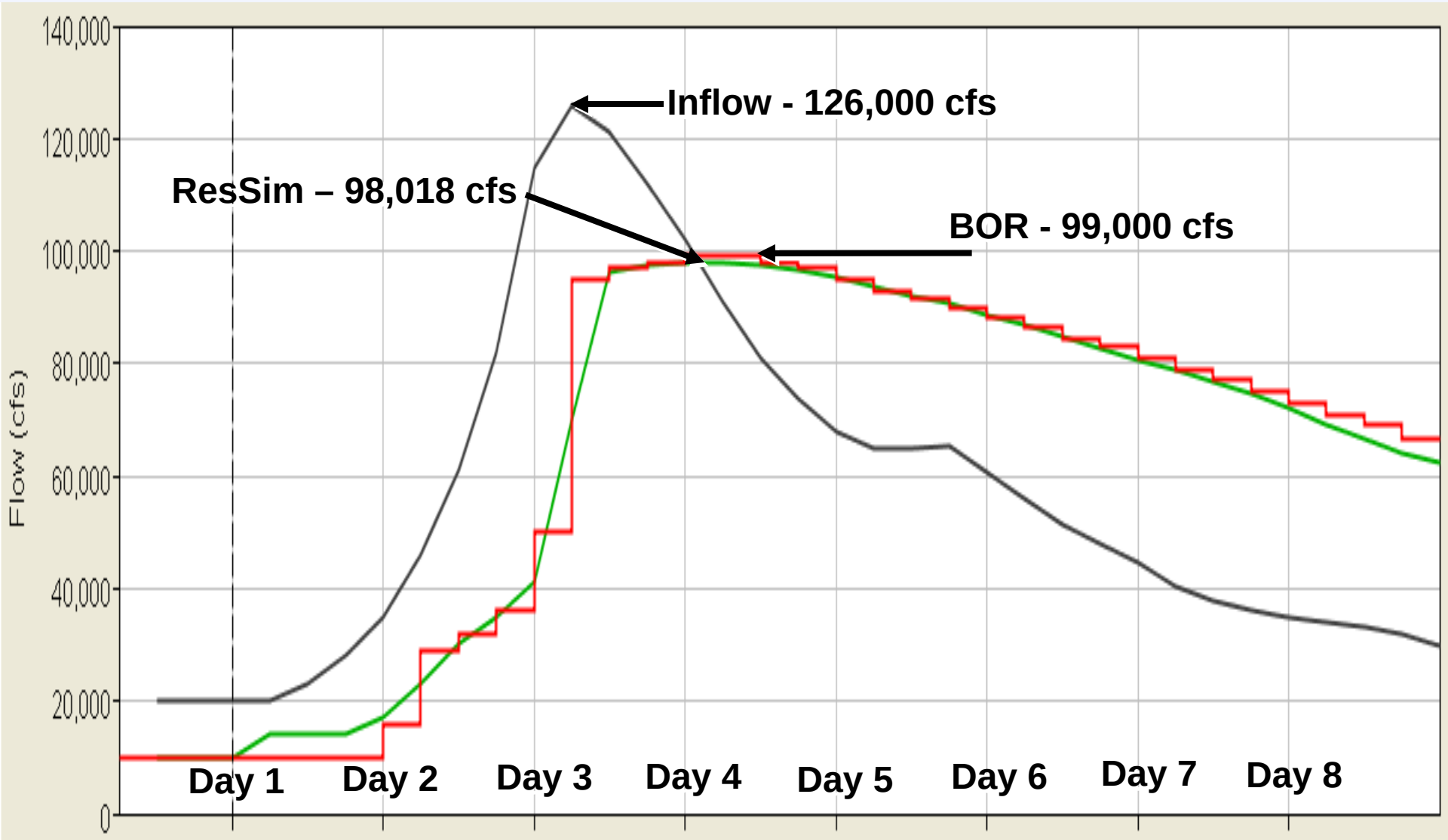
US Army Corps
of Engineers
Omaha District

Calibration Results - IDF



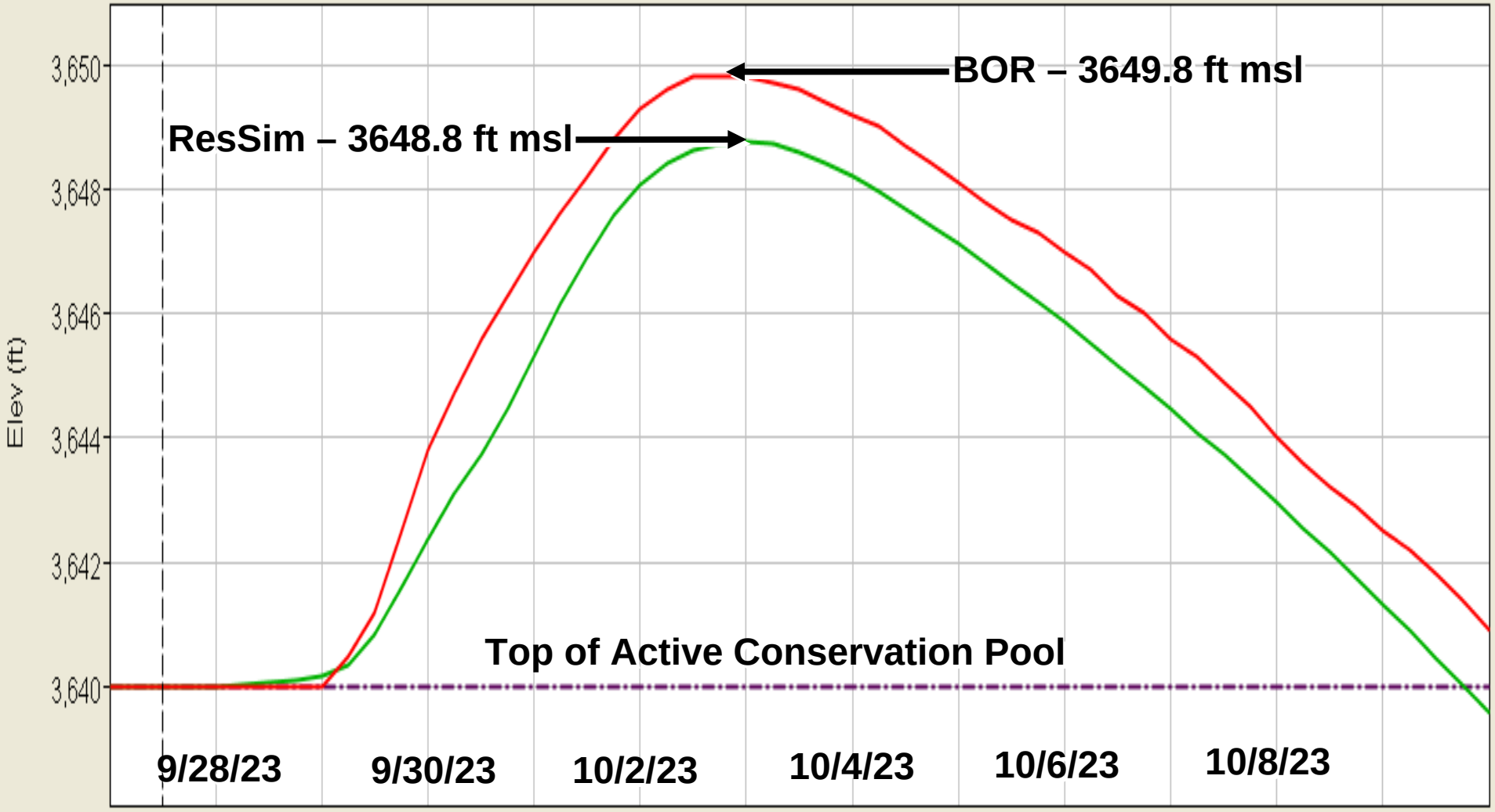
US Army Corps
of Engineers
Omaha District

Calibration Results- IDF



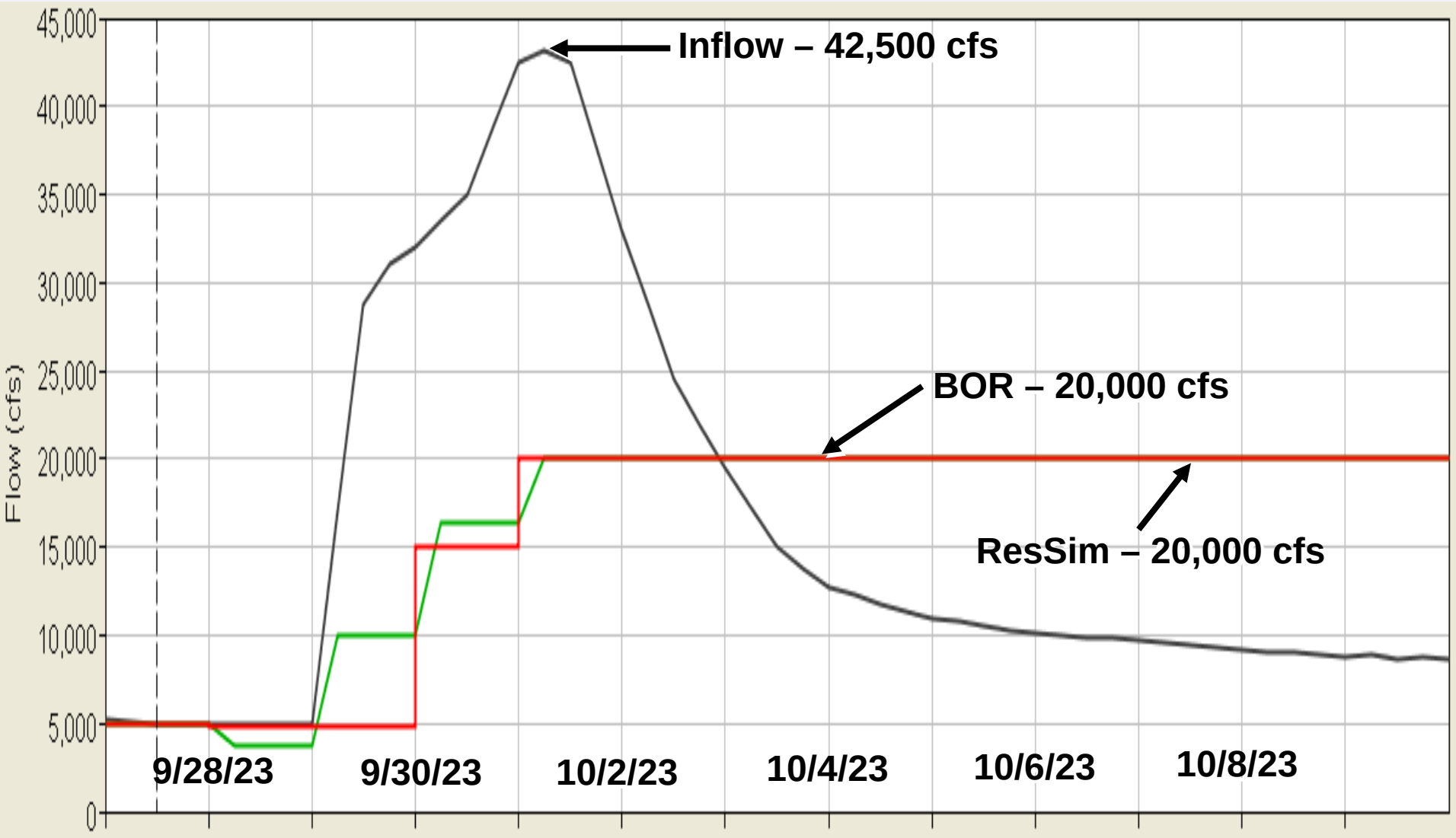
US Army Corps
of Engineers
Omaha District

Calibration Results -1923



US Army Corps
of Engineers
Omaha District

Calibration Results - 1923



US Army Corps
of Engineers
Omaha District

Calibration Results

	Water Control Manual		HEC-ResSim	
	Peak Pool Elevation (ft msl)	Peak Discharge (cfs)	Peak Pool Elevation (ft msl)	Peak Discharge (cfs)
IDF	3659.1	99,000	3658.6	98,018
1923 Event	3649.8	20,000	3648.8	20,000

	Elevation difference between water control manual and HEC-ResSim (ft)
IDF	0.5
1923 Event	1.0

US Army Corps
of Engineers
Omaha District

Preliminary Results

- **Reallocated scenarios have been simulated using ResSim**
  - **IDF and 1923 event**
  - **Results for these scenarios are preliminary and subject to change**

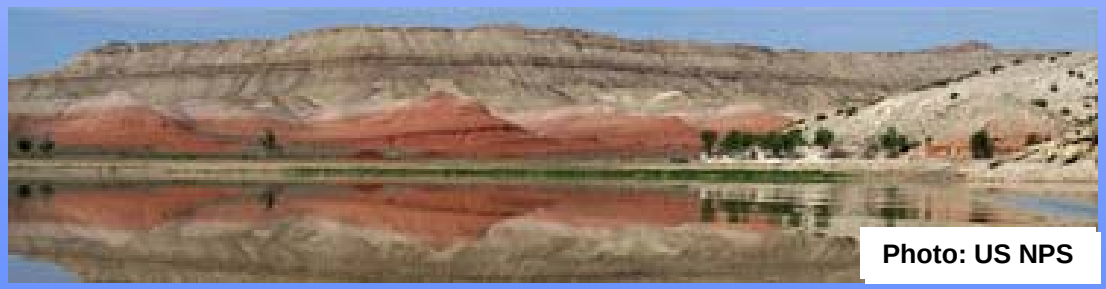
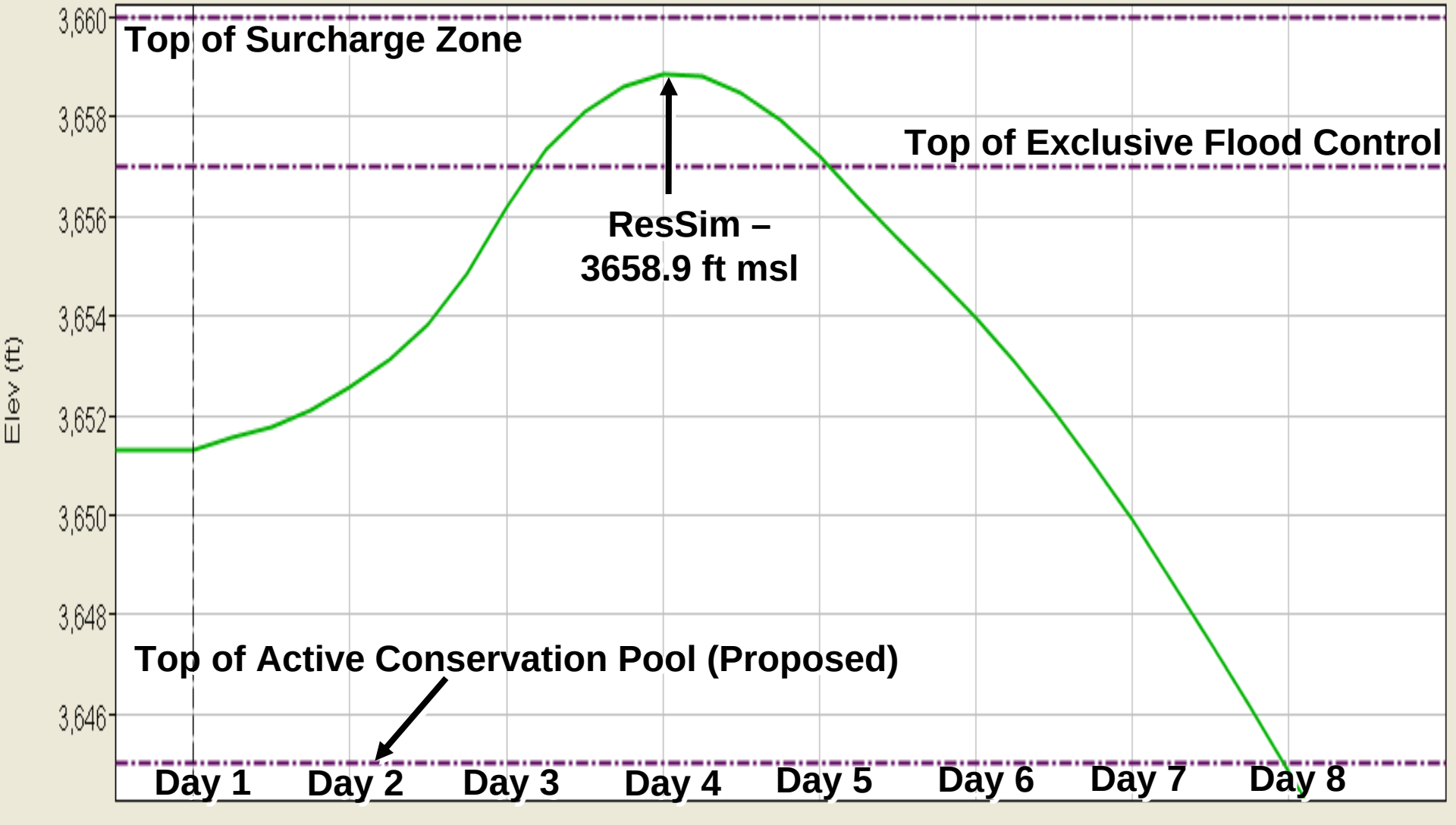


Photo: US NPS

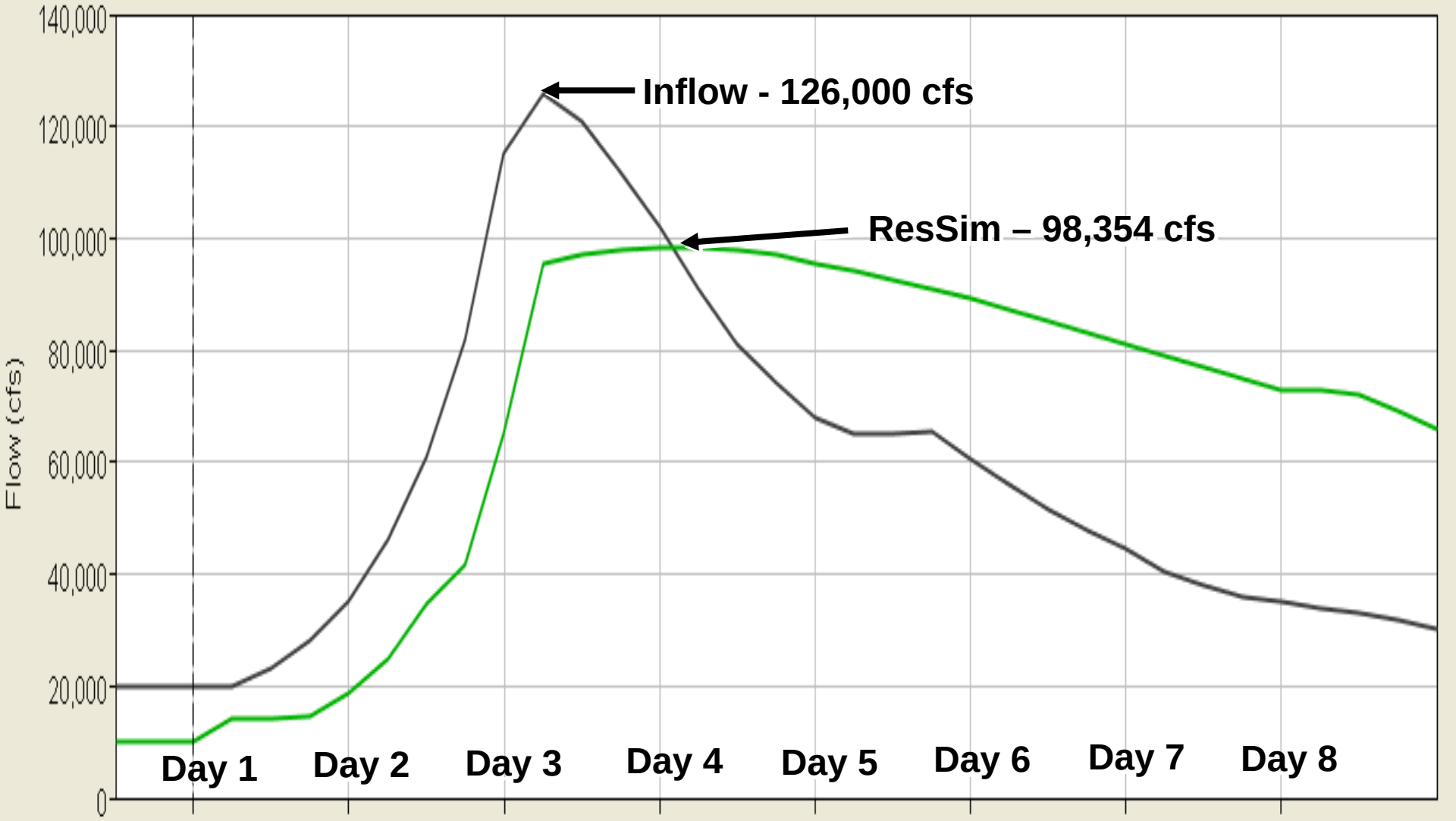
US Army Corps
of Engineers
Omaha District

Preliminary Results - IDF



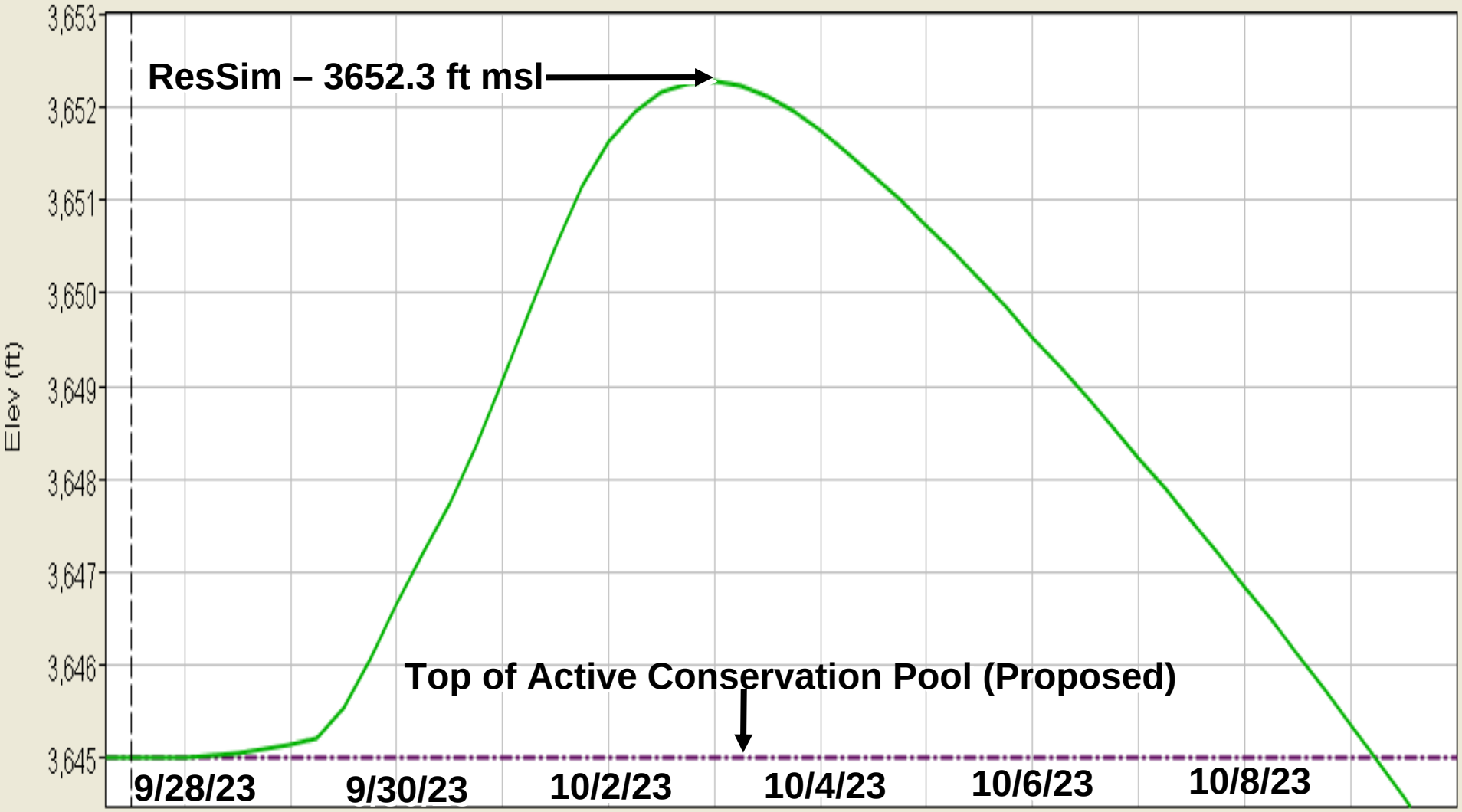
US Army Corps
of Engineers
Omaha District

Preliminary Results - IDF



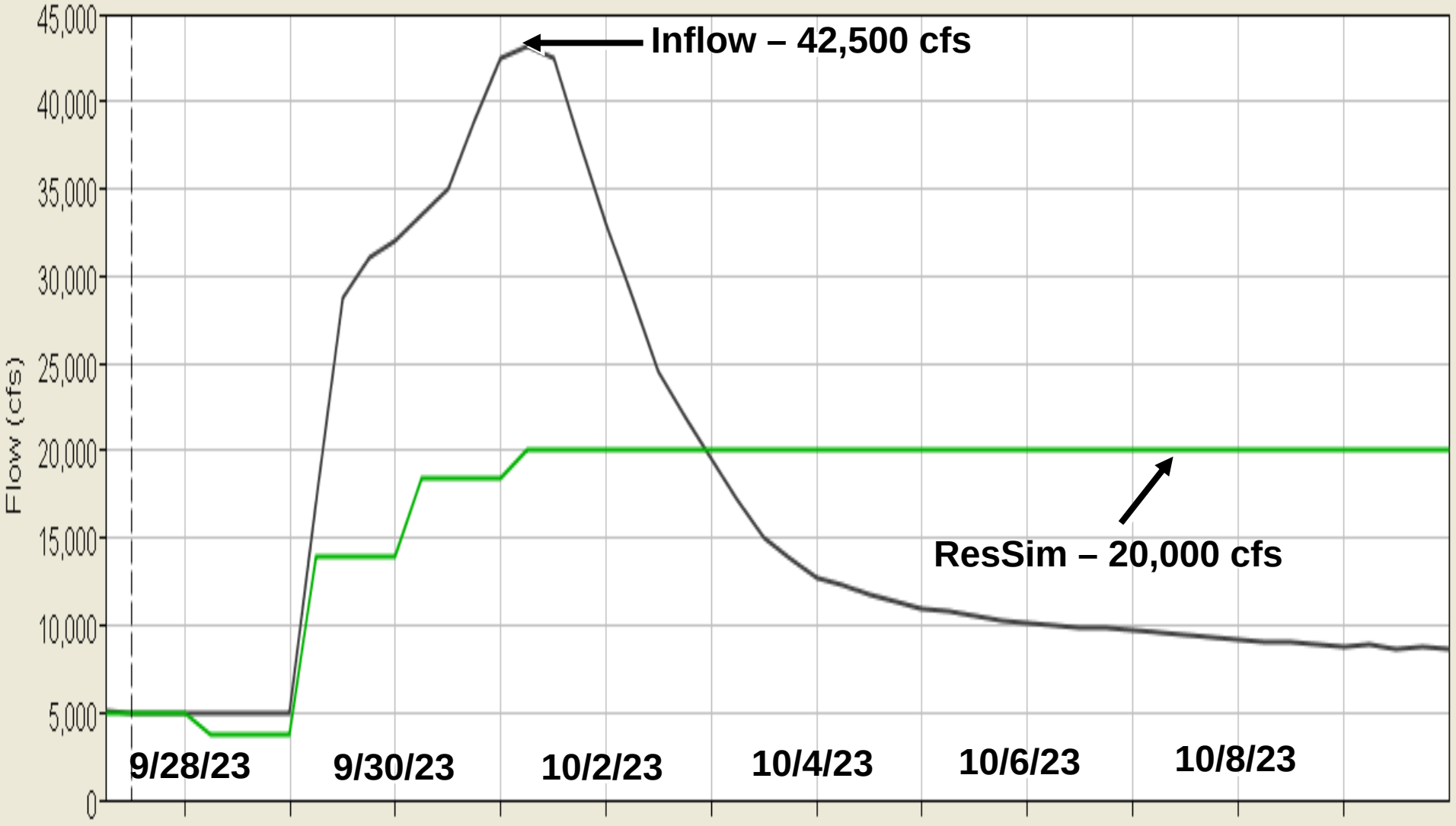
US Army Corps
of Engineers
Omaha District

Preliminary Results - 1923



US Army Corps
of Engineers
Omaha District

Preliminary Results - 1923



US Army Corps
of Engineers
Omaha District

Preliminary Results

	Baseline Simulation		Reallocated Simulation	
	Peak Pool Elevation (ft msl)	Peak Discharge (cfs)	Peak Pool Elevation (ft msl)	Peak Discharge (cfs)
IDF	3658.6	98,018	3658.9	98,354
1923 Event	3648.8	20,000	3652.3	20,000

	Elevation difference between reallocated and baseline simulations (ft)
IDF	0.3
1923 Event	3.5

US Army Corps
of Engineers
Omaha District

Next Step – POR

- Complete calibration
- Perform baseline simulation
- Perform reallocated simulation
- Develop analytical relationships for baseline and proposed simulations
  - Pool probability, pool duration
  - Flow frequency, flow duration
  - Compute net flood benefits

US Army Corps
of Engineers
Omaha District

Next Step - PDF

- Complete calibration
- Perform baseline simulation
- Perform reallocated simulation

Photo: US NPS

US Army Corps
of Engineers
Omaha District

Next Step – All Scenarios

- **Evaluate change in flood reduction benefits**
  - **Look at differences between the baseline and reallocated scenarios**
- **Prepare report outlining study findings**