BUREAU OF RECLAMATION

Guardians of the Reservoir Challenge

Presented by

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Guardians of the Reservoir Challenge

Sponsors

- Bureau of Reclamation

- U.S. Army Corps of Engineers (USACE)

Contractors

- NASA's Tournament Lab

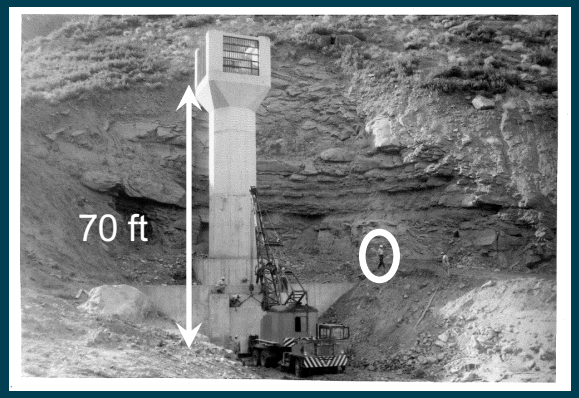
- HeroX

Challenge Goal

- Develop and demonstrate new processes and technologies.
- Looking for technologies that will annually move sediment downstream.
- Technologies that would regain lost reservoir storage capacity would be of interest if environmentally acceptable.

Background

- Part of a larger sustainability effort to maintain our nation's reservoirs, which are part of the nation's aging infrastructure.
- Raising awareness about the problem of reservoir sedimentation.



July 1961

Paonia Reservoir, CO

November 2014

Challenge Prize

- Up to $550,000 in cash prizes shared among winners.
- The authors of the most compelling submissions will have the opportunity to develop and demonstrate their technologies at increasing scales for the Challenge sponsors.
- The Challenge will be conducted in three phases.

Challenge Prize

Lake Powell Delta, UT

Challenge offers development, support, and field-testing opportunities to the most compelling ideas.

Challenge Phase 1

- Everyone is invited to participate in Phase 1.
- Submissions must be received by October 20, 2020.
- As many as 5 of the most compelling submissions will each receive $75,000 and advance to Phase 2.
  - $50,000 at the beginning of phase 2
  - $25,000 after successful completion of their mid-point check-in

Challenge Phase 2

- **Development period: December 8, 2020 - February 15, 2022**
- **Phase 1 winners have about 15 months to work according to their proposed project plans, develop their proposed approaches, perform a laboratory-scale demonstration, and submit a report.**
- **Up to 3 of the top-performing teams will advance to Phase 3 and each will receive an additional $25,000.**

Challenge Phase 3

- Demonstration period: April 5 - June 10, 2022
- Phase 2 winners have 9 weeks to prepare for a large-scale demonstration, where they will set up and run their demonstration for Reclamation, USACE, and their partners.
- At a final demonstration event, teams will present an overview of their work to Reclamation, USACE, and possibly affiliated commercial partners.
- The final winner will receive $100,000 cash award.

Limitations of Current Methods

Expense

- Dredging can cost more than $20/yd^3

Durability and reliability

- Sand and gravel can be very abrasive, causing equipment failure and downtime

Versatility

- Reservoirs have different shapes and sizes and many have depths greater than 50 ft

Water loss

- Reservoir flushing or sluicing uses valuable water storage

Ideal Challenge Solutions

- Applicable to wide range of reservoir geometries and operations.
  - Difficulties associated with access
  - Deep water (greater than 50 ft up to 200 ft)
  - Long distances to transport sediment once removed (1 to 30 miles)
  - Variable reservoir water levels (2 to 20 ft seasonally, 5 to 50 ft year to year)
  - High dams (20 to 100 ft from reservoir water surface to top of dam; 50 to 300 ft from top of dam to downstream river)

Ideal Challenge Solutions

- Applicable to a wide range of sediment types/loads
  - cohesive sediments
  - very abrasive sediments
  - Tens to hundreds of thousands of cubic yards per year
- Solutions that specifically address a targeted issue, such as sediment collection or transport
- Reclamation and USACE are interested in innovative approaches that may have additional capabilities over existing sediment removal solutions.

Solution Constraints

- Must not cause significant reservoir drawdown.
- Must be able to coexist with recreational activities, without limiting access to large areas of the reservoir or endangering visitors.
- Should not release harmful materials into the water or the air and should not endanger wildlife.

Ideas should consider the following

- Technical maturity
  - Develop and demonstrate within Phase 2 (15 months)
- Practicality and scalability
  - Able to implement within a real reservoir
- Expense
  - Cost to implement idea would be less than the cost of current methods or at least comparable
- Novelty
  - Looking for new and innovative ways of thinking about the problem

Here is How to Become a Solver

- To accept the challenge, visit https://www.herox.com/GuardiansoftheReservoir
- The prize is open to anyone aged 18 or older participating as an individual or as a team.

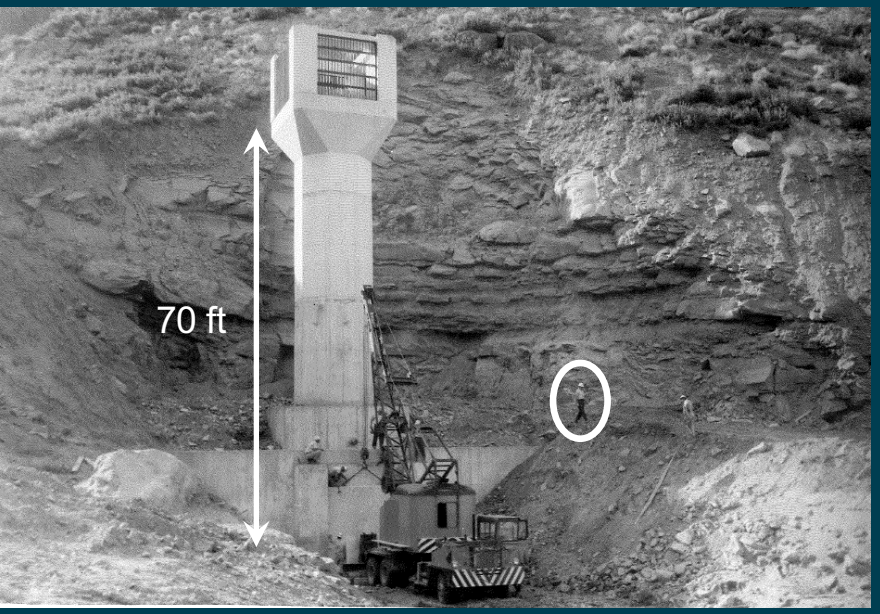
Case Study: Cochiti Reservoir

- Flood and sediment control reservoir
- 25 miles SW of Santa Fe, NM
- Access is near the dam
- Reservoir area varies between 1,200 and 9,347 acres
- 90ft maximum depth at Permanent Pool
- Inflows range from 400 to 6,000 cfs

Case Study: Cochiti Reservoir

- ~54 million yds^3 of sediment
- Silts and clays in main reservoir
- Silty sands in delta
- Increased woody debris and sedimentation following wildfires

Case Study: Paonia Reservoir



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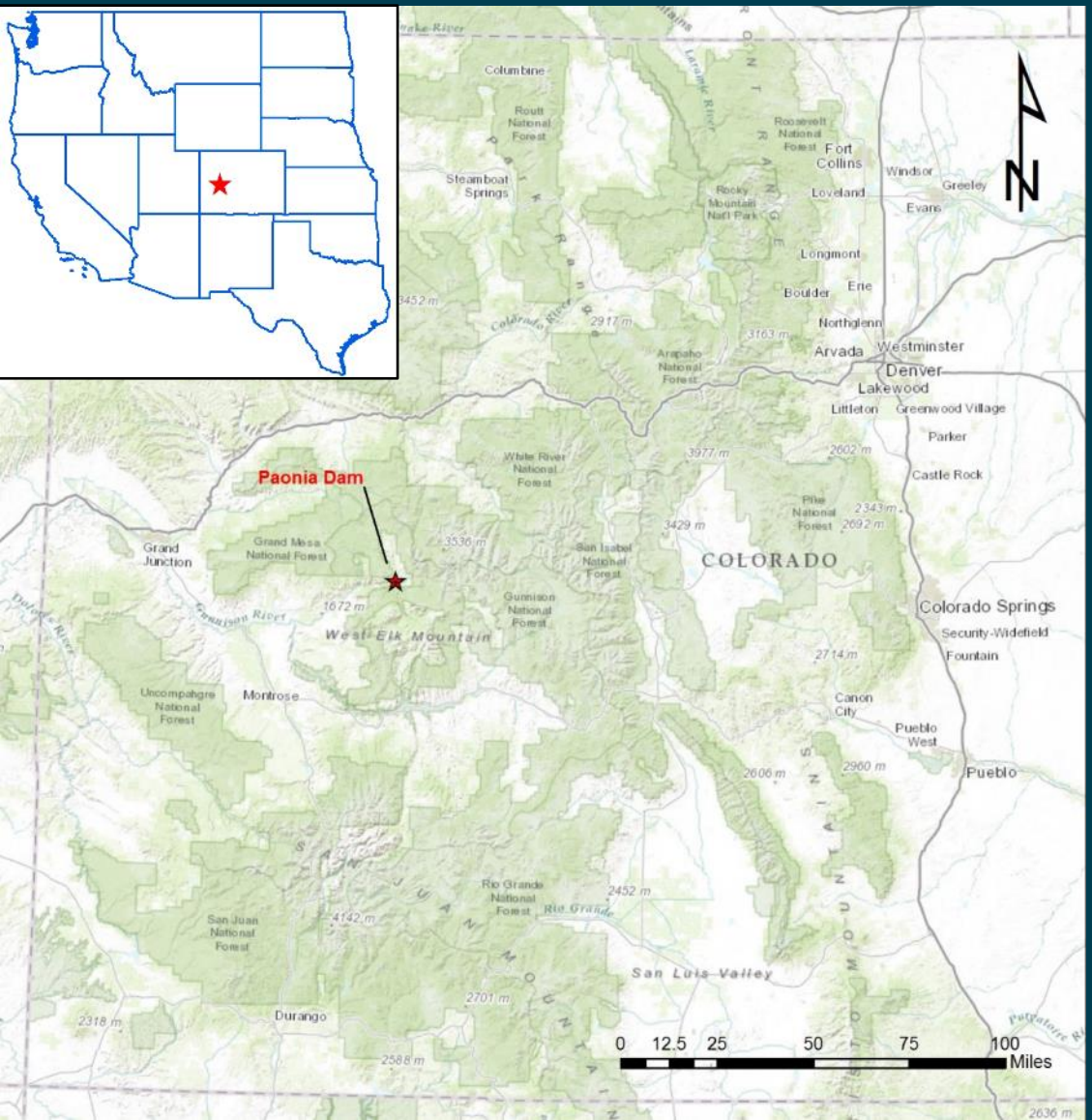
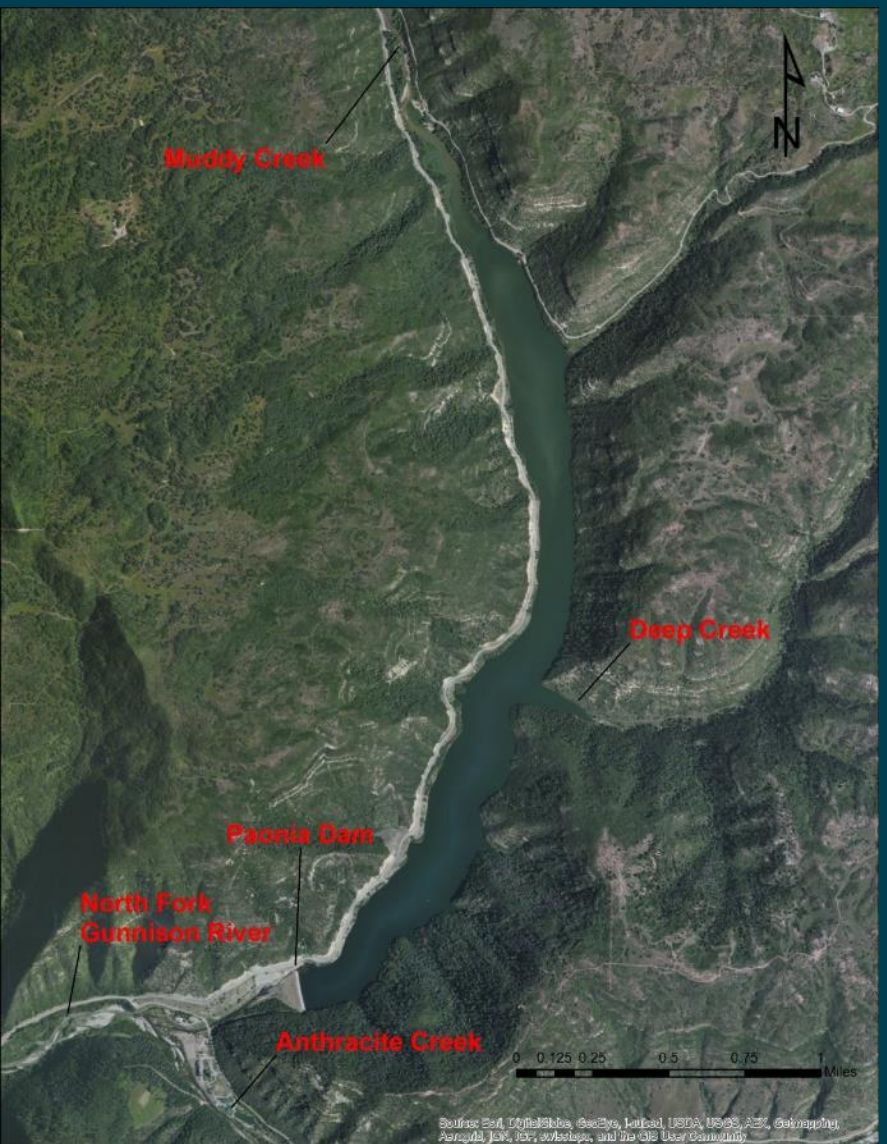
Case Study: Paonia Reservoir



- Located in Western Colorado 150 miles southwest of Denver
- Irrigation reservoir with flood control and recreation benefits

Case Study: Paonia Reservoir



- Dam closed in 1962
- Dam Crest Elevation (msl) = 6,460 feet (1,970 meters)
- Total Storage Capacity
  - Original (1962) = 20,950 AF (26 Mm^3)
  - 2013 = 15,780 AF (19 Mm^3)
- Sedimentation Factors
  - Mean Annual Runoff = 110,000 AF (136.5 Mm^3)
  - Mean Sedimentation Rate = 120 AF/yr (148,000 m3/yr)
- Full Pool
  - Length = 3.1 miles (5.0 km)
  - Width = 0.2 miles (0.32 km)

Case Study: Paonia Reservoir

- Highly variable water surface elevation
  - 90+ feet (27+ meters)
  - Empties and refills annually
  - Depth issues
  - Accessibility problems

Case Study: Paonia Reservoir

- Great variability of deposited material sizes
- Submerged/buried woody debris
- Remote Location
- No access to electricity
- High Elevation
- Landslides in upstream watershed
- Downstream deposition is a factor

Additional Case Studies

- Black Canyon Dam
- Imperial Dam

https://www.herox.com/GuardiansoftheReservoir/resources

Panel Discussion

- Tim Randle, PhD, PE, D.WRE
- Kent Collins, MS, PE
- David Varyu, MS, PE
- Travis Dahl, PhD, PE
- Paul Boyd, PhD, PE


For More Information:
https://www.herox.com/GuardiansoftheReservoir
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