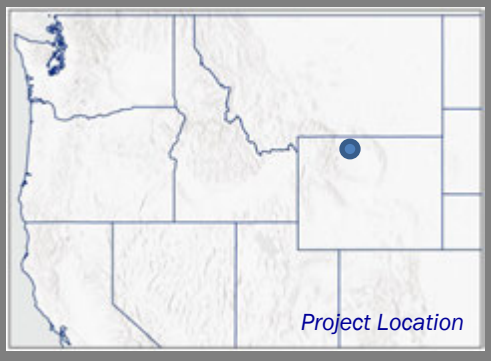
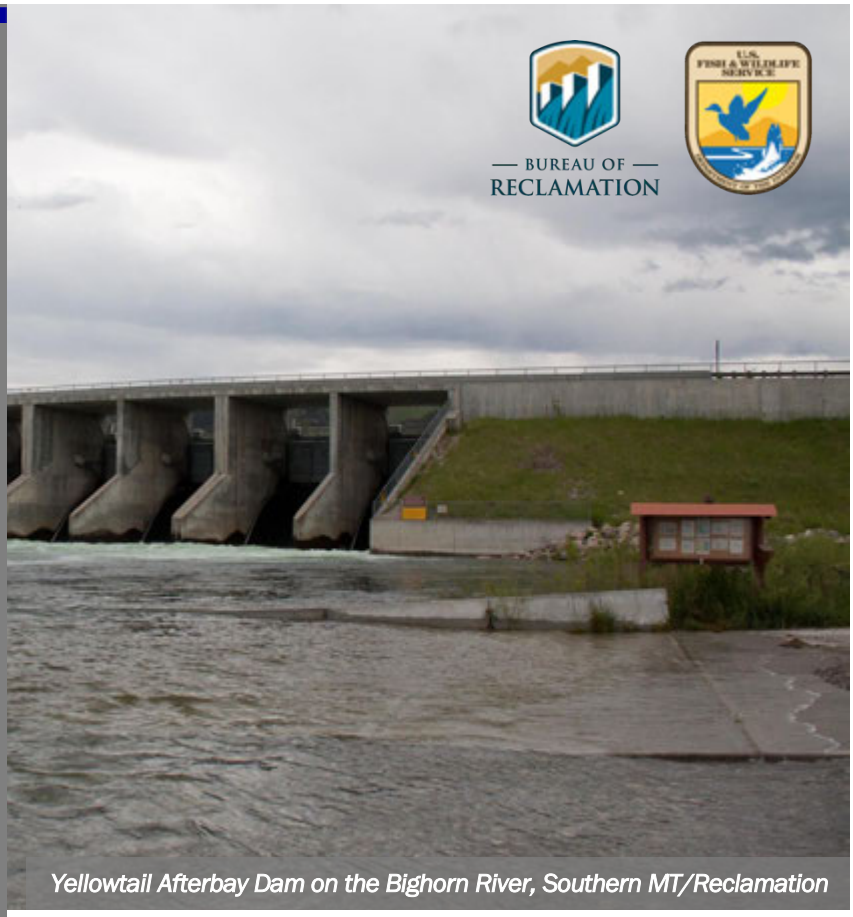
ACTIONABLE SCIENCE

Pilot Study of Reservoir Sustainability Options: Bighorn Reservoir

US Army Corps of Engineers.

The Yellowtail Dam on the Bighorn River provides water for irrigation, power generation, flood control, and recreation opportunities in southern Montana and northern Wyoming. Extended droughts and severe flooding can impact reservoir water levels by increasing in-stream sedimentation. This can influence the amount of water available for stakeholders. To improve boating recreation opportunities, the Bureau of Reclamation (Reclamation) simulated a sediment wall in the Horseshoe Bend Marina to model its potential effects on sediment accumulation within the reservoir in 2017. Results from this modeling study can support future management planning for increased sediment accumulation in other reservoirs.





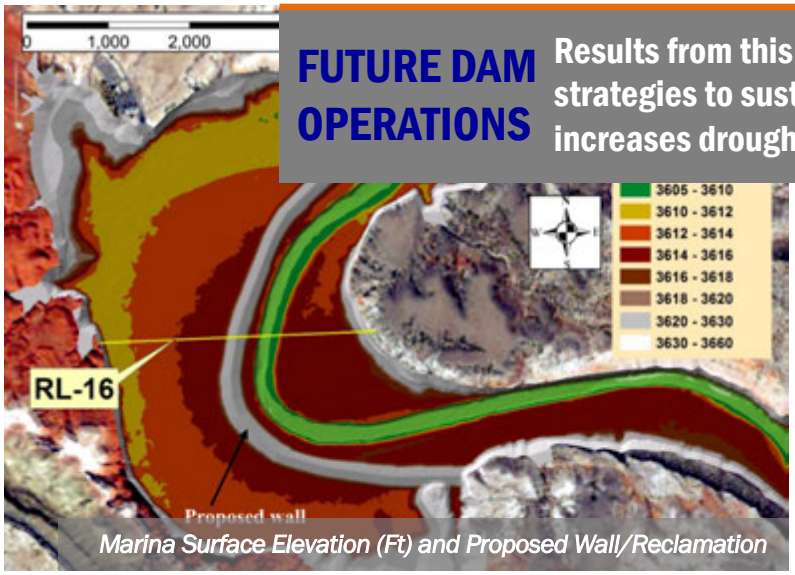
Yellowtail Afterbay Dam on the Bighorn River, Southern MT/Reclamation

KEY ISSUES ADDRESSED

Reservoirs across the United States are threatened by sediment accumulation. This limits their water-holding capacity and reduces the quality of reservoir uses such as recreation, irrigation, and water management. The creation of the Bighorn Reservoir after the Yellowtail Dam construction caused 45.5 ft of sediment accumulation in Horseshoe Bend Marina. Dam managers must consider the needs of many stakeholders when controlling water levels in the reservoir based on changing climatic conditions, such as extended droughts, which is increasingly difficult as sediment accumulates and available water resources for stakeholders decreases.

PROJECT GOALS

- Analyze potential effects of a sediment wall on sediment deposition in the Horseshoe Bend Marina
- Use model results to develop sediment management practices for the reservoir
- Utilize information from this study to inform sediment management practices and planning for all reservoirs



Marina Surface Elevation (Ft) and Proposed Wall/Reclamation

FUTURE DAM OPERATIONS

Results from this model can inform broader sediment management strategies to sustain reservoir uses, especially as climate change increases droughts and floods that affect reservoir levels.

PROJECT HIGHLIGHTS

SRH-2D Model: The SRH-2D model simulates hydraulics and sediment transport in the reservoir, and accounts for fine sediments that make up the majority of deposits in the Horseshoe Bend Marina. The simulated time period for the model was May through August, which represents the shallowest water conditions during the year, and the largest inflow period caused by spring runoff. Further, the model compared the effects of wet (2015) and dry (2016) water years on the sediment wall's ability to limit sediment in the marina. This allowed developers to evaluate the effects of drought and high precipitation periods on the sediment wall's effectiveness.

Avoiding Initial Construction Costs: Reclamation simulated a sediment wall using the SRH-2D model to determine if building the wall would be effective at reducing sediment for improved boating access. Simulation prior to sediment wall construction allowed developers to address questions of feasibility, cost, and overall effectiveness based on model results prior to costly construction and implementation.

Collaborators

- Bureau of Reclamation: Missouri Basin and Arkansas-Rio Grande-Texas Gulf Regions
- U.S. Army Corps of Engineers
- Friends of Bighorn Lake
- Bighorn River Alliance

LESSONS LEARNED

The sediment wall decreased sediment deposition in the Horseshoe Bend Marina by 0.2-0.4 ft. during high inflow, and 0.8-1.0 ft during low inflow.

The reduction in sedimentation west of the sediment wall can improve boating recreation. However, the movement of sediment can be carried downstream, which may be detrimental to long-term reservoir sustainability.

In addition, if the wall is made of sediment from the west of the Horseshoe Bend Marina, as was modeled in this study, reservoir operators would need to lower the water level to allow for construction of the wall. This is not common practice and could be difficult to implement.

Finally, model developers learned that presenting the information in this study to stakeholders earlier in the process would have given stakeholders an opportunity to provide suggestions for the study to best fit their needs.

NEXT STEPS

- Further assess the logistical and economic feasibility of constructing a sediment wall in the marina
- Conduct additional research and modeling of other sediment reduction practices
- Present the findings of this study to stakeholders to receive feedback on how to better address needs
- Use information from this study to support sustainable reservoir operations

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Kayakers off from the Horseshoe Bend Marina /National Park Service

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