C O L O R A D O P A R K S & W I L D L I F E

Dam Maintenance and Safety

COLORADO PARKS & WILDLIFE DAMS

In addition to managing state parks and wildlife areas, outdoor recreation opportunities, and Colorado's wildlife, CPW owns and operates many dams throughout the state. With an inventory of over 115 dams, CPW is the largest dam owner in Colorado. The water impounded by CPW's dams is used for downstream irrigation, fish hatcheries' operations, and a multitude of recreational activities including fishing, boating and swimming.

CPW's reservoirs are some of the most popular places to visit in the state. However, public infrastructure and population centers are often located downstream, which increases the likelihood of devastating consequences in the event of a dam failure. As such, maintenance and rehabilitation of CPW's dams is paramount for upholding its commitment to public safety.

Public Safety is CPW's First Priority

Who takes care of CPW's dams?

CPW has three full-time Dam Safety Engineers who, with the help of other dedicated staff located around the state, manage all the work and monitoring on CPW's dams. They perform regular dam safety inspections on all CPW-owned dams and maintain current Emergency Action Plans for First Responders.

CPW is making dam rehabilitation a priority by allocating capital construction funds to dam improvement projects ahead of any other capital construction projects. Prioritizing the financial needs of CPW's dams has allowed for significant improvements to be made in dams' operating conditions over the last few years.

The average age of CPW's High and Significant Hazard dams is 73 years, including six dams that were constructed over 100 years ago. Most of these dams were built between 1950 and the mid-1970s.

Hazard Classification of CPW's Dams

CPW owns over 115 dams, of which 90 are jurisdictional. A dam is considered jurisdictional once its size is large enough to threaten human life and/or property downstream if it should fail. A jurisdictional dam is given one of four hazard classifications, based on the criteria below. As a dam's assigned hazard level increases, so too do the regulations and degree of resiliency required of the dam's operations and its appurtenant structures.

Classification (Based on Colorado Dam Safety Standards)	Number of CPW's Dams
Non-Jurisdictional A dam having less than or equivalent to: 10 feet in height, 20 acres in surface area and 100 acre-feet in storage	27+
Jurisdictional A dam exceeding any of the following: 10 feet in height, 20 acres in surface area, 100 acre-feet in storage	90**
High Hazard Loss of human life is expected to result in the event of a dam failure	22*
Significant Hazard Significant damage is expected to result in the event of a dam failure, although no loss of human life is expected	15
Low Hazard and No Public Hazard Minor damage is expected to result in the event of a dam failure, and will be confined to non-critical infrastructure (Low Hazard) or CPW property only (No Public Hazard); no loss of human life is expected	55**
Total number of CPW dams	117+

* Since 2016, five dams have been reclassified from Low or Significant Hazard to High Hazard, following a change to public safety conditions downstream

** Includes 2 additional dams that have been identified as jurisdictional in size

Tarryall Dam, Park County

Funding CPW Dams

By State statute, Parks funding and Wildlife funding must remain separate; therefore, CPW cannot use Parks funds to fix dams in State Wildlife Areas, and vice versa. Funds are strictly monitored when completing these projects.

What is CPW doing about its dams?

As dams age and their structures deteriorate, more involved activities are needed to bring them back into compliance with safety regulations. Given the significant costs associated with those necessary repairs and maintenance, CPW performed a Screening Level Risk Analysis (SLRA) study in 2014 to provide an overview of its dams' risk profiles and assist in the prioritization of future projects. The SLRA study identified only the most major rehabilitation needed on CPW's High and Significant Hazard dams.

The SLRA gaged potential risk of CPW's High and Significant hazard dams based on the following criteria in the event of a dam failure:

Primary consideration

- Loss of human life downstream

Secondary consideration

- Environmental impact
- Economic impact
- Recreational impact

Based on these measures, the SLRA identified 11 dams in CPW's portfolio that posed a higher risk than the others. Since the 2014 release of the SLRA's findings, 4 additional dams were added to that list when their routine safety inspections revealed conditions that surpassed an acceptable level of risk. Of these 15 dams, 3 are Parks-owned dams and 12 are Wildlife-owned dams. There is also a cost to maintaining and rehabilitating the dams posing a less critical risk. The current maintenance and repair estimate for all of CPW's dams is approximately $120.7 million. Most of this cost will be incurred by the wildlife part of the agency, as the majority of the dams are wildlife-owned.

Funding for CPW dams

The majority of parks dams are funded with Colorado Lottery and GOCO money, while the majority of wildlife dams are paid for with wildlife cash funds (money gained through license sales), federal match dollars, and more recently, GOCO funds. By funding a 50 percent reduction to the backlog of CPW's dam maintenance and repairs, the 2018 Future Generations Act will allow CPW to further reduce risks to life and property and sustain water-based recreation opportunities.

Since July 2015, CPW has further allocated funding for routine dam maintenance. The availability of this maintenance funding allows for proactive attention to care for these assets in an effort to reduce the need for large scale, costly rehabilitation that can result from prolonged deferred maintenance.

Over the last five years, CPW has experienced at least one emergency dam repair annually. Projects of this nature require a quick response and reallocation of available funds, including dam maintenance funds, to stabilize rapidly developing, adverse conditions.

CPW Successes

All 3 of the parks' highest risk dams have been allocated funding for repair. This work should be completed by 2022. (Willow Creek Dam Shown)

CPW was awarded: ASDSO's 2016 National Dam Rehabilitation Project of the Year - Beaver Park Dam (Beaver Park Dam construction shown)

CPW Challenges

The total maintenance and repair estimate for all CPW Dams is $120.7 million. CPW has allocated over $61.5 million for this work; $59.2 million in funding needs remain*.

***The majority of this is for work on wildlife owned dams**

Williams Creek Dam, Hinsdale County

Summary of CPW's Highest Risk Dams as of January 2021

Dam	Remaining needs as of January 2021	Status as of January 2021
Alberta Park (W) High Hazard Area 17 - SW Mineral County	• Spillway engineering and construction to address inadequate flow capacity • Rehabilitate deteriorating outlet conduit and outlet gate • Internal filter for seepage control • Set monitoring instrumentation as required by SEO for High Hazard Dams	Unforseen emergency repair work was needed July 2017 during Phase I work for outlet rehab design. Phase II work is currently underway, which includes a Hydrology Study, Geological Study, Dam Rehab Alternatives Analysis, and preliminary design for full rehab. Phase II work will be completed by Summer 2021. Phase III work will continue development of the rehab design and will commence in late 2021 or 2022.
Willow Creek (P) High Hazard Steamboat Lake State Park Area 10 - NW Routt County	• Troubleshooting the controls system related to the outlet works • Addressing seepage monitoring concerns	Construction was completed in Fall 2018: Fully Repaired (with minor adjustments needed)
Rito Hondo (W) Significant Hazard Area 17 - SW Hinsdale County	• Address loss of seepage control on embankment and abutments • Evaluate and address spillway flow rate capacity requirements • Set monitoring instrumentation as required by SEO	The outlet works rehab construction was completed in late 2019 and the reservoir was refilled in Spring 2020. Unforeseen emergency drawdown of the reservoir was required in Summer 2020 due to loss of seepage control following refilling after the outlet works rehab. Future project phases are currently in the planning phases to address the loss of seepage control at the dam and and evaluate rehab options.
Trujillo Meadows (W) High Hazard Area 17 - SW Conejos County	• Spillway modification to prevent backwater of outlet and erosion encroachment on dam due to current alignment • Set monitoring instrumentation as required by SEO	Construction to address deteriorated outlet works was completed as of October 2018. No further work is projected at this time.
Big Meadows (W) High Hazard Area 17 - SW Mineral County	• Seepage monitoring and /or mitigation on main and saddle dams • Video inspection of the outlet conduit to investigate if there is a crack in the outlet gate leaf • Set monitoring instrumentation as required by SEO	Video inspection of outlet works completed in 2018 revealed potential crack in the outlet gate leaf. CPW plans to further investigate the condition of the gate during Summer 2021 and repair/replace if needed. CPW plans to begin instrumentation installation and seepage investigation efforts in Summer 2021.
Spring Creek (W) High Hazard Area 16 - SW Gunnison County	• Rehabilitate deteriorating outlet conduit • Investigate and repair deteriorating concrete service spillway • Set monitoring instrumentation as required by SEO	Phase I outlet rehab design anticipated completion Spring 2021. Construction to rehab the outlet conduit and improve dam monitoring instrumentation planned Summer/Fall 2021.
Sylvan Lake (P) High Hazard Sylvan Lake State Park Area 8 - NW Eagle County	• No further repairs are needed at this time	Construction was completed in Summer 2020: Fully Repaired
Black Lake #2 (W) Significant Hazard Area 8 - NW Eagle County	• Set monitoring instrumentation as required by SEO • Update inundation mapping	Nothing to date.
Haviland Lake (W) High Hazard Area 15 - SW La Plata County	• Rehabilitate undersized spillway • Set monitoring instrumentation as required by SEO	Construction for the outlet rehab was completed in Fall 2020. Future project phases will address other deficiencies.
Chief Creek #4 (W) Significant Hazard Area 3 - NE Yuma County	• Rehabilitate deteriorated and undersized spillway • Rehabilitate outlet conduit and gate • Repair deteriorated concrete on upstream slope • Abandon obsolete conduit through dam • Set monitoring instrumentation as required by SEO	Construction is underway to rehab the outlet conduit, replace the gate, repair the upstream concrete slope protection, abandon the obsolete conduit, and improve dam monitoring instruments. Construction completion anticipated Winter 2021.
Tarryall (W) High Hazard Area 1 - NE Park County	• Spillway improvements (deficient due to structural and capacity issues) • Structural Analysis to estimate dam's ability to withstand heightened hydrologic loading • Fix spalling concrete at joints • Hydrology Study to determine degree of potential dam overtopping • Inundation Analysis and Maps for downstream reach • Repairs to resolve waterstop leakage	Phase II analyses underway that include Structural Analysis, Hydrology Study, Inundation Analysis, and Alternatives Analysis. The Alternatives Analysis will highlight proposed repairs to address dam deficiencies. Phase II planned to be completed Summer 2021.
Two Buttes (W) High Hazard Area 12 - SE Baca County	• Replace two outlet gates and rehabilitate intake tower • Spillway evaluations and/or construction to determine and/or address flow capacity • Set monitoring and early warning instruments as required by SEO	Construction is underway to replace the outlet gates and is anticipated to complete in January 2021. Design is complete to rehab the intake tower. Funding is available for the intake tower rehab and construction is planned for 2021. Engineering evaluations are underway for the spillway capacity. Outlet works and spillway deficiencies must be remedied to remove current SEO storage restriction.
North Michigan Creek (P) Significant Hazard State Forest State Park Area 10 - NW Jackson County	Construction needed (Phase II): • Replace deteriorated spillway • Internal filter system at right abutment and under spillway to address significant seepage problem • Outlet conduit rehabilitation • New outlet gate and intake structure to replace deteriorated systems • Set monitoring instrumentation as required by SEO	Phase I is approximately 90% complete, and covers final engineering design and preconstruction planning for a full rehab. To reduce construction risks, early contractor involvement is being used for the rehab project. Construction (Phase II) planned for Spring 2021. (Will be fully repaired after completion of this work)
Skaguay (W) Significant Hazard (Potential for reclassification to High Hazard) Area 13/14 - SE Teller County	• Investigate, design, and rehabilitate upstream steel plating based on deteriorated condition and increased deflection • Rehabilitation needed for spillway and outlet works, including structural analysis of current retaining wall • Hazard Classification Study • Set required monitoring instrumentation as required by SEO	Gate stem replaced and inspection of outlet works completed in Spring 2018. Hazard Classification Study beginning in 2021. Additional monitoring beginning in 2021. Vegetation maintenance planned Spring 2021.
Beaver Park (W) High Hazard Area 17 - SW Rio Grande County	• Site work needed to eliminate inundation of adjacent, low-lying area when the reservoir is at full storage • Troubleshooting the integrated controls systems related to the outlet works	Construction was completed in 2016: Fully Repaired (with minor adjustments needed) Road improvements are planned for Summer 2021 to address low-lying areas adjacent to the reservoir.

(W): Wildlife-owned dam
(P): Parks-owned dam
SEO: Colorado Dam Safety Branch (Regulatory authority under the CO State Engineer's Office)