Restoration of the Upper Kawuneeche Valley in Rocky Mountain National Park

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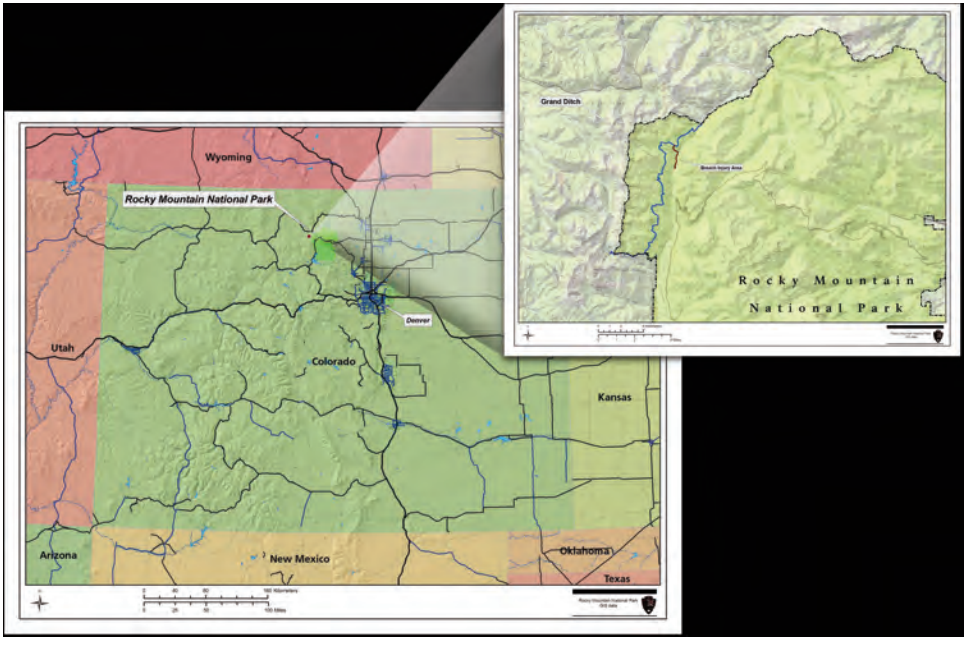
Introduction

The Grand Ditch, a trans-basin, water-diversion canal, breached its bank on May 30th, 2003, causing extensive injury to the upper Kawuneeche Valley area in Rocky Mountain National Park (RMNP), Colorado. The breach saturated an adjacent hillslope which gave way, sending a massive (~36,000 m^3) mud- and rock-slide down into Lulu Creek and the headwaters of the Colorado River, damaging upland, stream, riparian and wetland habitat over an approximately 2.4 km distance and 9 ha area. In 2008, the National Park Service (NPS) won a $9 million settlement from the Water Supply and Storage Company (WSSC), owners of the ditch, to restore the damaged resources. This is the largest settlement ever reached under the 1990 Park System Resource Protection Act (PSRPA, a.k.a. 19jj). Within days of the breach the park initiated a process to restore the injured area.

Figure 1. Location of the Grand Ditch Breach.



The breach

The actual cause of the Grand Ditch's failure is uncertain. It may have overtopped or it may have formed a seep that collapsed the ditch sidewall sending about 2.8 m^3/s (100 ft^3/s) flow of the ditch down a steep hillside, creating a flood that sent approximately 36,000 m^3 (47,600 yd^3) of boulders, trees and sediment cascading down into Lulu Creek.

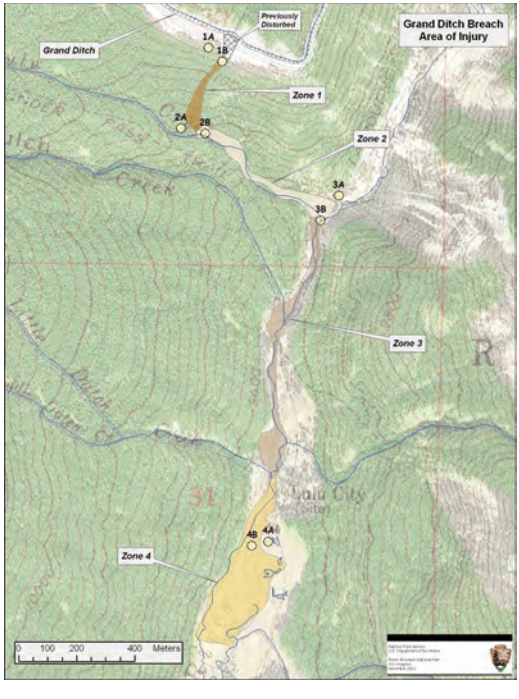
Figure 2. Grand Ditch Breach (Zone 1).

Lulu Creek flowed as a mud- and debris-filled torrent, gouging the streambed up to 2 m deep, widening the channel by as much as 10 times, and uprooting and depositing piles of trees and sediment throughout. When the torrent arrived at the low-gradient confluence with the Colorado River, it deposited sediment and debris in an alluvial fan up to 2 m thick. The sediment-filled waters continued downstream along the Colorado River clogging the channel and covering the floodplain with gravel, sand, and more debris.

About 1.6 km further downstream from the confluence, the flood arrived in the Lulu City wetland where it filled the existing channels and deposited up to 60 cm of silty sand onto the wetland, burying the existing vegetation and altering the wetland's hydrologic regime. Finer sediments were transported an additional 45 km downstream to Shadow Mountain Reservoir, where a visible delta was formed.

In all, about 9 ha (22 acres) and 2.4 km of stream, riparian, upland, and wetland habitat were injured. This includes over 20,000 trees destroyed, and approximately 50 different plant species affected.

Figure 3. Grand Ditch Breach Area of Injury ("A" and "B" indicate comparison plots in each zone).



The settlement

In 2006, the U.S. Department of Justice, on behalf of the NPS, filed a civil lawsuit against the WSSC, owners of the Grand Ditch, under the authority of the PSRPA, which provides for the payment of compensation by private parties for damages to park resources.

The court case preparations continued for another two years. In May of 2008, an out-of-court settlement was reached in which the WSSC agreed to pay RMNP $9 million in damages. This is the largest settlement ever reached under PSRPA.

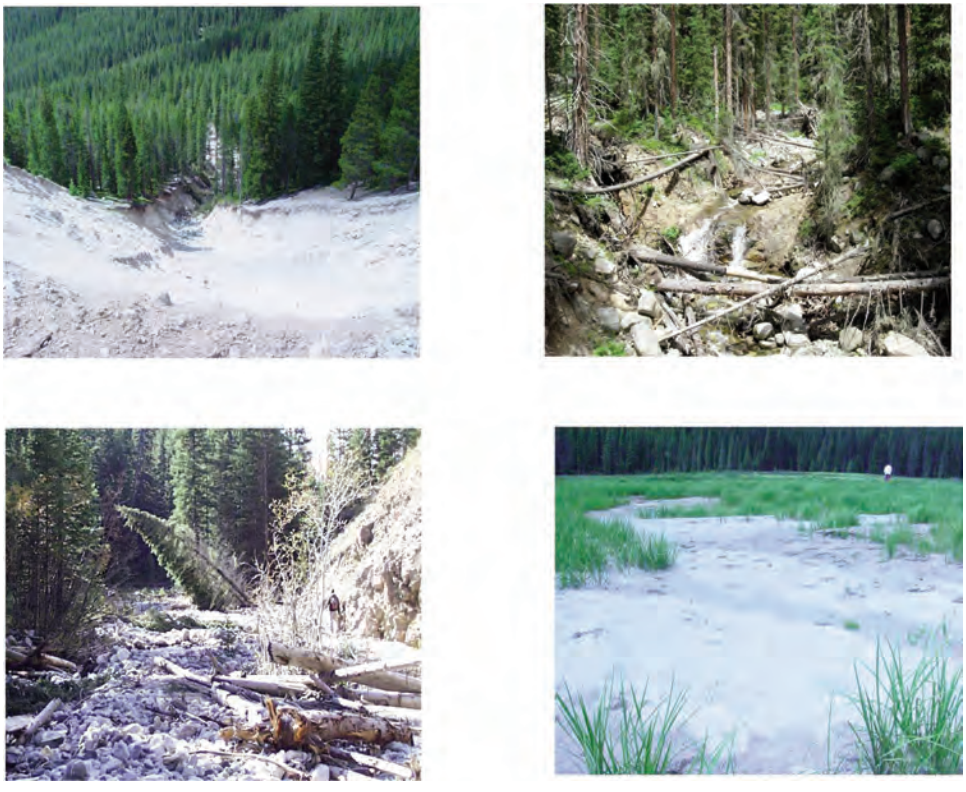


Figure 4. Breach Impacts, clockwise from top left; Zone 1 (hillside), Zone 2 (Lulu Creek), Zone 4 (Lulu City Wetland), Zone 3 (Colorado River).

Resource damage assessment

RMNP and a team of cooperating researchers conducted surveys starting in the summer of 2003 to assess the nature and extent of the injuries caused by the breach. Assessment work focused primarily on defining the footprint and the approximate depth of the deposited materials, while characterizing altered stream morphology, groundwater elevations, water quality, and impacts to wetland, riparian, and upland vegetation. The stability of the gouge in the zone one hillside was also investigated.

Following the settlement, additional assessment work was conducted by researchers from both Colorado State University and the park to refine our understanding of the area's current hydrology—this includes stream hydrology, sediment transport, surface water-groundwater interactions, and groundwater elevations. These processes are being compared with nearby reference reaches to better understand the desired future conditions for the area. Ground-penetrating radar is also being used experimentally to map sediment deposit depths. This summer we will continue this research and conduct additional field work to refine volume estimates for the deposited material, survey for sensitive plant and animal species, monitor vegetative recovery, and set up long-term photo monitoring stations.

Restoration planning and implementation

RMNP is starting a two- to four-year process to complete an environmental impact statement to guide the restoration of the breach-impacted area. We will be gathering input from park staff, other agencies, and the public, to develop a set of restoration alternatives.

Key considerations will include short- and long-term potential impacts from restoration activities to the following: wilderness values; surface and groundwater hydrology; stream channel, floodplain, and wetland morphology and function; downstream water quality; sensitive plant communities and wildlife, such as helicopter operation effects upon mountain sheep lambing; visitor experience; and archaeological and historical sites.

Possible restoration options will likely include a mixture of the following, prescribed on a zone-by-zone basis: allowing natural restoration to occur where appropriate; stabilizing steep, unstable slopes with soil nail anchors and metal mesh fabric; using controlled water releases to help reconfigure stream channels; removing deposited sediment and redistributing it through the impacted area; removing downed timber, or using it in the restoration process, or both; re-grading and re-contouring areas to restore proper morphology and function; and native plant restoration with appropriate, locally gathered plant materials.

References

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