



# Long-term Monitoring of Stream Ecological Integrity in Rocky Mountain National Park

## 2016 Progress Report



Since 2010, Rocky Mountain Inventory and Monitoring Network (ROMN) scientists and collaborators have been monitoring the ecological integrity of streams in Rocky Mountain National Park. A comprehensive protocol guides stream ecological integrity (SEI) monitoring in the park, and an earlier brief from 2014 provides a detailed overview of the project (see references). This resource brief is a progress report on monitoring efforts and includes an example of preliminary results.

### Stream Ecological Integrity

Understanding stream ecological integrity involves measuring a complex suite of conditions, including the health of aquatic invertebrate and diatom (algae) communities, as well as stream habitat and water chemistry. Between 2010 and 2015 ROMN began measuring these conditions at 51 sites in the park, representing three different sampling strategies (Fig. 1). Thirty-eight survey sites across all the park's accessible waters were randomly selected to provide an unbiased statistical estimate of stream condition that could be inferred to a larger area. Four sentinel sites were hand-picked in areas of specific park interest, such as Big Thompson River and the Colorado River at Baker Gulch. Ten gradient sites, including Paradise and West Creeks, were also established at sites on the edges of anthropogenic disturbance or in areas with marked environmental gradients, such as elevation.



Sampling stream habitat at Timber Creek in Rocky Mountain NP, 2015.

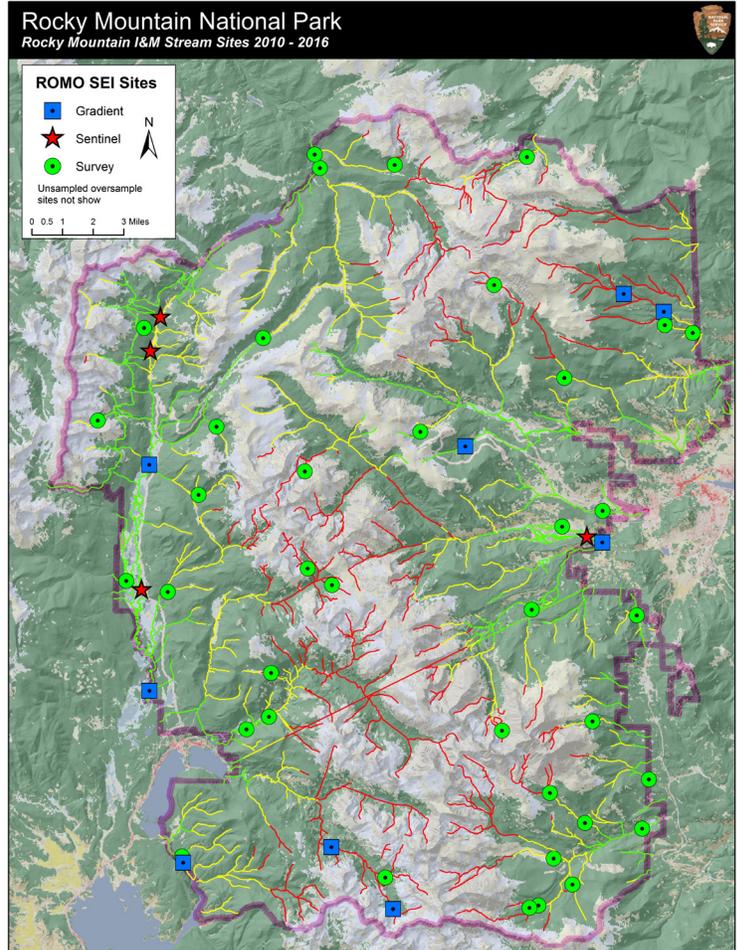


Figure 1. Sampled stream sites 2010–2016. Survey sites were sampled 1–6 times from 2014 to 2016. Gradient sites were sampled once from 2014 to 2016. Sentinel sites were sampled 4 times a year beginning in 2010. Streams are color coded by accessibility: red reaches are hard to access and green reaches are more readily sampled.

## Preliminary Results

ROMN provides data to Rocky Mountain National Park in support of its Grand Ditch Breach Restoration Project. Draft preliminary results from paired sentinel sites above and below the 2003 Grand Ditch breach on the upper Colorado River are available to help guide restoration (Fig. 2). Since 2010, up to 60 different parameters measuring water and sediment chemistry, stream flow, aquatic insects, algae, and physical habitat have been collected at these paired sites. Figure 2 highlights differences in water temperature and dissolved oxygen above and below the breach. Because water temperature controls many stream processes, the warmer temperatures below the breach, which exceeded state thresholds several times, are concerning. Aquatic insects and cutthroat trout need adequate dissolved oxygen to thrive, but higher water temperature and organic pollution can lower the oxygen below threshold levels, as shown in the figure as well. Similar differences between the upper and lower reaches were seen in other measures of

stream ecological integrity, including pH and turbidity. Together, these data lead to better understanding of the river's condition at this site.

## Future Plans

Analyses of the 2014–2016 survey data continue, and parkwide estimates of stream condition will be published in late 2016 or 2017. Multiple types of information will feed into these estimates of stream condition, including water chemistry, the biotic integrity of aquatic macroinvertebrates and diatoms (algae), and various measures of physical habitat, such as sediment and riparian vegetation.

The Network will continue its valuable collaboration with the park, USGS, EPA, and academic partners, focusing on stream temperature dynamics, metal concentrations, and patterns in the condition of the park's aquatic biological communities, including unique or new species in its diatom flora.

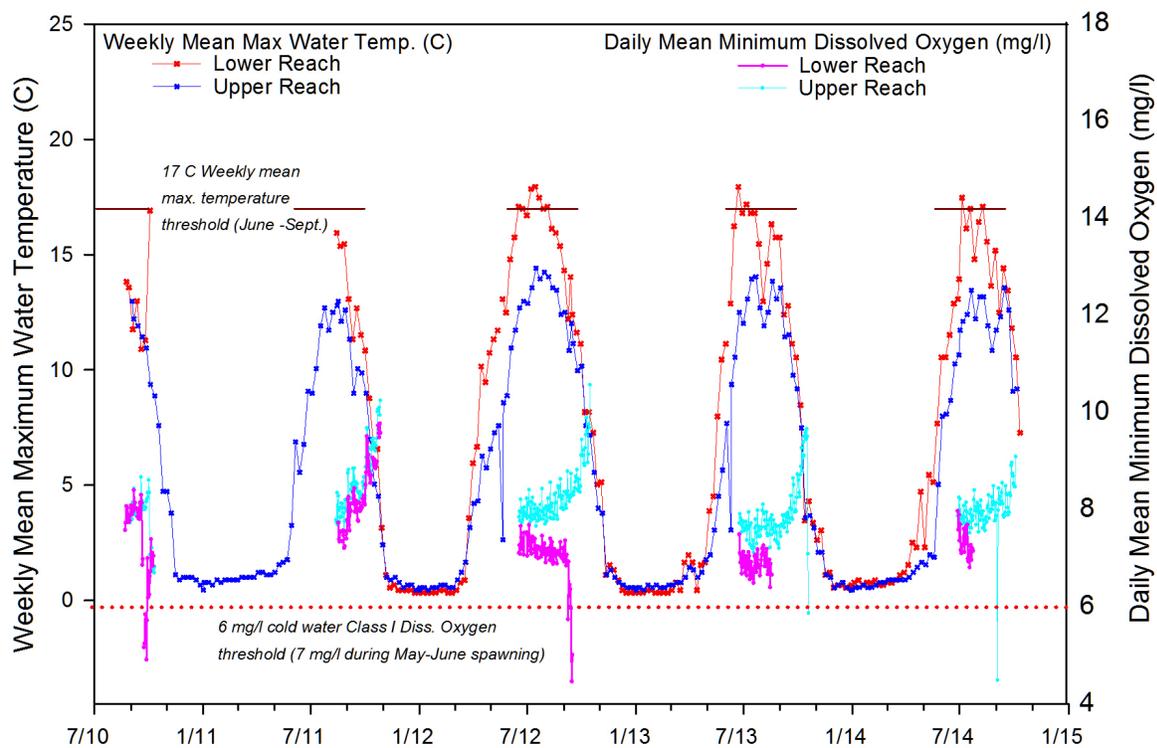


Figure 2. Mean maximum water temperature and mean minimum dissolved oxygen from July 2010 to October 2014 at the Colorado River sentinel site in Rocky Mountain National Park. The lower reach is within the area damaged by the 2003 Grand Ditch breach; the upper reach is above the breach. Thresholds are from the State of Colorado Department of Public Health and Environment published in 2013 and are specific to the upper Colorado River in Rocky Mountain National Park.

## References

Britten, M., and B. Schweiger. Long-term monitoring of stream ecological integrity in Rocky Mountain National Park. 2014. Information Brief. Rocky Mountain Network Inventory and Monitoring Program, Ft. Collins, Colorado.

Schweiger, E. W., L. O'Gan, E. Borgman, and M. Britten. 2015. Rocky Mountain Network stream ecological integrity monitoring protocol: Narrative, version 1.0. Natural Resource Report NPS/ROMN/NRR—2015/1101. National Park Service, Fort Collins, Colorado.

Schweiger, E. W., L. O'Gan, E. Borgman, M. Britten, and D. Shorrock. 2016. Rocky Mountain Network stream ecological integrity monitoring protocol: Standard operating procedures, version 1.0. Natural Resource Report NPS/ROMN/NRR—2016/1132. National Park Service, Fort Collins, Colorado.

## More Information

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