



NONPOINT SOURCE SUCCESS STORY

Colorado

Removing Selenium Impacts from a Middle South Platte River Segment

Waterbody Improved

Runoff from irrigated agriculture contributes to high selenium (Se) concentrations in parts of the South Platte River due to the underlying cretaceous shale formations. In 2010, the Colorado Water Quality Control Commission (WQCC) added a 51.5-mile stretch of the Middle South Platte River to the Clean Water Act (CWA) section 303(d) list due to aquatic life being impaired by Se. Voluntary restoration efforts led by local producers to implement best management practices (BMPs) have reduced Se loading to the river from irrigated cropland activities. This segment of the Middle South Platte River now meets the Se water quality standard (WQS), and the WQCC removed the segment from the impaired waters list following the 2016 Regulation 93 hearing.

Problem

The Middle South Platte River (COSPMS01B) is protected for drinking water, aquatic life, recreation, and agriculture designated uses. The river segment running from just below the confluence with St. Vrain Creek to the Weld/Morgan County line (Figure 1) is mostly used for irrigating cropland that exists on top of shale formations that contain Se. The shale's Se is mobilized when it comes in contact with irrigation water. Due to Colorado's geology, Se impacts are prevalent in several watersheds, including the South Platte River Basin. Studies show that elevated levels of Se can cause a variety of lethal and sublethal deformities in developing fish. Data collected in 2003–2007 in the Middle South Platte River showed that Se concentrations were as high as 8.6 micrograms per liter ($\mu\text{g/L}$), which exceeds the WQS of 4.6 $\mu\text{g/L}$. Therefore, the WQCC added this segment to Colorado's CWA section 303(d) list in 2010.

Story Highlights

For about 15 years, the Colorado Nonpoint Source (NPS) program has contributed to long-term evaluations in watersheds with intensive agricultural activities on land underlain by Se-laden shale, as is the case in the Middle South Platte basin. Results of these evaluations suggest the most effective BMPs for reducing Se mobilization associated with the agricultural sector are canal piping/sealing; nutrient management; enhanced riparian buffers; fallowing of land; and irrigation efficiency improvements, which are often achieved by upgrading from flood to sprinkler irrigation. These BMPs can be used individually or in

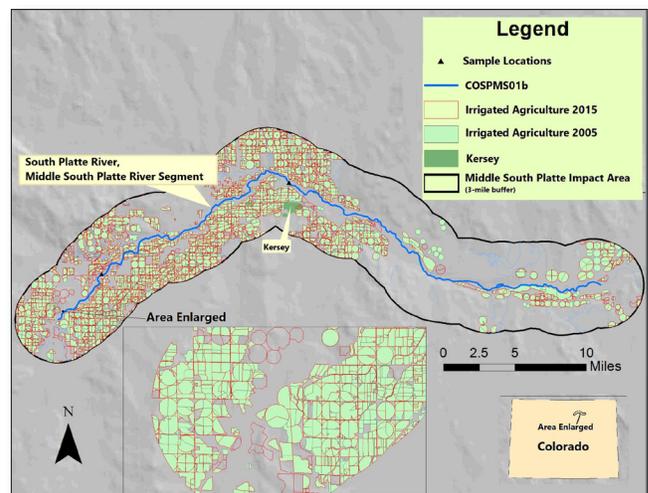


Figure 1. The Middle South Platte River study area showing 2005 and 2015 irrigated agriculture areas.

combination to reduce the likelihood for deep percolation of water into the soil, which can mobilize Se.

Over the years, local producers voluntarily implemented BMPs using Natural Resources Conservation Service (NRCS) funding (about \$25 million total in Colorado, annually) and associated cost share funding. In collaboration with NRCS and local producers, the NPS program investigated how use of these BMPs affected water quality in Middle South Platte River. The NPS program focused on irrigation method changes within a 3-mile buffered area around the river (see Figure 1). Although NRCS data show that 20 different irrigation BMPs, including sprinkler systems, piping, nutrient management and prescribed grazing were

implemented, this success story is based on an assessment of changes in irrigation methods.

Analysis showed that between 2005 and 2015, the flood-irrigated areas decreased from 49,751 acres to 42,265 acres, while the sprinkler-irrigated areas increased considerably from 24,500 acres to 41,250 acres. This increase in sprinkler irrigated areas exceeded the reduction in flood-irrigated areas. This is possibly because the sprinkler systems provide flexibility and can be used in areas where flood irrigation cannot (e.g., hilly areas).

Results

Implementing sprinkler irrigation systems in the watershed has been an ongoing process. Because the listing of the segment was based on 2003–2007 data, the baseline for the BMP implementations was set to 2005. Similarly, the removal of the segment from the CWA section 303(d) list was based on 2013–2014 data. Therefore, locational data for the irrigation systems were extracted from 2015, which captured irrigation changes from 2005 to 2015. Sprinkler installation that occurred between these years is clearly demonstrated in the “area enlarged” box on the left side of Figure 1, where five sprinkler circles are aggregated in previously non-irrigated area. In the enlarged area box, sprinkler systems were installed in areas previously flood irrigated.

Before BMP implementation occurred in this section of the Middle South Platte River, Se concentrations were up to 60 percent higher than the table value standard threshold. Monthly water samples were collected at sites near Kersey from August 2013 to November 2014. Most of this sampling was completed voluntarily by the Colorado River Watch program and Metropolitan Wastewater Reclamation District. Data at all sampling sites showed no exceedances of the 4.6 µg/L WQS for at least two consecutive years (Figure 2). Colorado Department of Public Health and Environment assessed the water quality data according to their protocols. The dissolved Se concentrations observed in 2013–2014 varied from month to month, but the maximum concentration was 2.8 µg/L, which is 61 percent of the WQS of 4.6 µg/L. During the 2016 CWA section

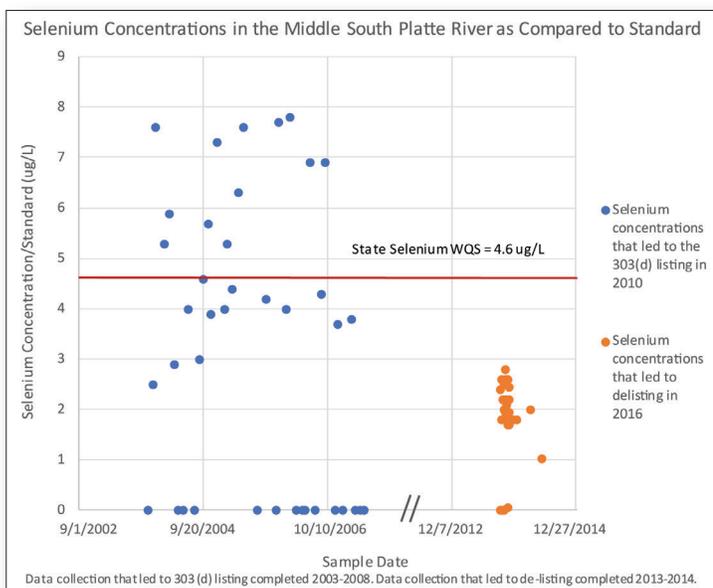


Figure 2. Selenium concentrations in the Middle South Platte River segment (2003–2008 and 2013–2014).

303(d) hearing, the assessment that demonstrated that the Middle South Platte River was in attainment of the aquatic life use-based standards for dissolved Se was submitted to the WQCC. The WQCC agreed and the Middle South Platte River was removed from the 2016 CWA section 303(d) list for attaining the Se WQS.

Partners and Funding

NRCS Environmental Quality Incentives Program funding in Weld County from 2005 to 2015 totaled \$11,588,730. The watershed area under investigation covers approximately 7.5 percent of the county; BMP funding costs were calculated at about \$878,208. The cost sharing requirement for the producers was approximately 25 percent of the BMP costs, or \$219,552, so the total funding spent in the area is estimated at \$1,095,760. This total does not include private funding spent on BMP implementation, including sprinkler systems. Based on the increase in the sprinkler-irrigated areas alone, the private funding could be several million dollars. In the end, voluntary efforts, which are essential and necessary in controlling NPS, helped to address Se pollution in the Middle South Platte River.



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