

## **NONPOINT SOURCE SUCCESS STORY**

Colorado

# Reducing Selenium Impacts in a Segment of the Lower South Platte River

Waterbody Improved

The Lower South Platte River is susceptible to water quality impacts caused by selenium. Nonpoint sources of selenium in this area

include erosion and agricultural irrigation drainage of cretaceous soils. In 2010, the Colorado Water Quality Control Commission (WQCC) added the mainstem of the Lower South Platte River—from the Weld County/Morgan County line to the Colorado/Nebraska border—to the Clean Water Act (CWA) section 303(d) list due to aquatic life impairments caused by selenium. Voluntary restoration efforts led by local producers to implement best management practices (BMPs) have reduced selenium loading to the river from irrigated cropland activities. Recent data show this segment of the Lower South Platte River now meets the selenium water quality standard; in 2020, the WQCC removed it from the CWA section 303(d) list of impaired waters.

### **Problem**

The Lower South Platte River, from the Weld County/ Morgan County line to the Colorado/Nebraska border (COSPLS01a and COSPLS01b) (Figure 1), is an important water resource protected for drinking water, aquatic life, recreation, and agriculture uses. Selenium (primarily from nonpoint sources) affected water quality and threatened aquatic life. Mobilized selenium can bioaccumulate through the food chain, sometimes reaching levels that are toxic to fish and wildlife and resulting in deformities in developing fish. Selenium pollution is commonly associated with agricultural irrigation activities that lead to selenium entering groundwater and surface water. The Lower South Platte watershed is irrigated through ditch delivery of diverted river water and alluvial irrigation wells in an area influenced by selenium-releasing Cretaceous deposits of Pierre Shales. Based on 2003–2008 data from the Lower South Platte River, the 85th percentile of selenium concentration was as high as 12.36 micrograms per liter (μg/L)—exceeding the standard of 4.6 μg/L. Therefore, based on the results of an assessment conducted, the WQCC added this segment of the South Platte River to Colorado's list of impaired waters in 2010.

### **Story Highlights**

The Colorado Nonpoint Source (NPS) program has contributed to addressing statewide impacts from intensive agricultural activities on land underlain by selenium-laden shale, as is the case in the Lower South Platte basin. The basin's point source advancement provided only limited water quality improvements

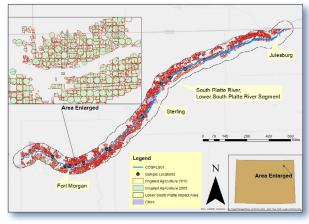


Figure 1. Map of the Lower South Platte River study area with overlaid 2005 and 2015 irrigated agriculture. As shown in the box at the top left, sprinkler pivot systems near Fort Morgan were installed in areas previously flood/furrow irrigated.

overall. The implementation of multiple NPS BMPs are considered to play a significant role in water quality improvements in the COSPLS01a and COSPLS01b segment as recommended by assessments and watershed plans. Watershed plans published in 2005 (for Beaver Creek, a Lower South Platte River tributary) and 2012 (for the Lower South Platte River) identified projects to address water quality concerns from irrigated croplands. Since then, local producers voluntarily implemented the recommended BMPs using Natural Resource Conservation Service (NRCS) funding (about \$28.4 million on the average in Colorado, annually) and the cost sharing that is required to receive NRCS assistance.

For example, NRCS awarded 58 land treatment contracts, including about 30 contracts converting furrow irrigated land to sprinkler pivots under the 2005 Beaver Creek Watershed Plan. The NPS program, in collaboration with NRCS and local producers, investigated how use of these BMPs affected water quality in Lower South Platte River (COSPLS01).

To identify the BMPs that are potentially influencing water quality, the NPS program focused on irrigation method changes. 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 method because locational data are only available for irrigation BMPs from the Colorado Division of Water Resources (DWR) database. DWR data from 2005 and 2015 were used to represent listing and delisting timeframes, respectively. Locational information for the sprinkler systems were extracted from the DWR data provided every five years. The NPS program conducted analyses for a 3-mile buffer around the river that showed the area with the greatest potential effect on water quality (see Figure 1).

Based on DWR data, sprinkler irrigated areas increased considerably between 2005 and 2015, from 79,412 acres to 108,209 acres, while the flood-irrigated areas decreased from 85,258 acres to 53,591 acres. Increase and decrease in the respected irrigated areas were a result of a near–linear relationship (R2 of 0.97 for both relationships) between the two during this 10-year timeframe. Data also showed that about 2,870 acres of agricultural land were removed from irrigation.

#### Results

Before BMP implementation in this section of the Lower South Platte River, selenium concentrations were as much as six times higher than the table value standard threshold (4.6  $\mu g/L$ ). The WQCD, the voluntary Colorado River Watch program, and the Metropolitan Wastewater Reclamation District continued collecting data at several monitoring stations during 2014–2018. Although there were two exceedances in the data, the 85th percentile of the

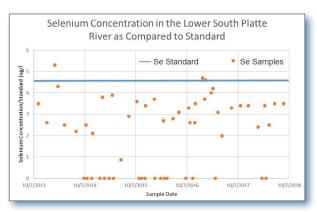


Figure 2. Selenium (Se) concentration of the Lower South Platte River segment after restoration.

57 samples was 3.75  $\mu$ g/L, which is below the 4.6  $\mu$ g/L standard threshold (Figure 2). Because data showed that the Lower South Platte River segment was attaining the aquatic life use-based standards for dissolved selenium, the WQCC removed it from the 2020 list of impaired waters for selenium.

## **Partners and Funding**

The area directly impacted by these projects is spread over varying percentages of four counties: from approximately 1% of Washington County up to 30% of Sedgwick County. The NRCS Environmental Quality Incentives Program, Wildlife Habitat Incentives Program, Conservation Reserve Program, and Conservation Stewardship Program funding in each county were summed and multiplied by the impacted area percentage for the county to estimate total spending for each county. Total NRCS funding for 2005–2015 was \$28,382,438, with another \$7,095,609 in cost-share provided by producers, for a total of \$35,478,047. Watershed planning funds totaled \$355,000, which included \$100,000 in CWA section 319 funds. These totals do not include private funding spent on BMP implementation, including sprinkler irrigation. Based on the increase in the sprinkler irrigated areas alone, the private funding could be several million dollars. In the end, voluntary efforts by the stakeholder and NRCS, which are essential and necessary in controlling NPS, helped to address selenium pollution in the Lower South Platte River.



U.S. Environmental Protection Agency Office of Water Washington, DC

EPA 841-F-22-001X November 2022

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