Monitoring water quantity and quality from natural and supplemental sources on Benton Lake NWR

FY14

PROJECT DESCRIPTION

Since 1990, the US Geological Survey (USGS) has measured the daily mean water flows into Benton Lake refuge via Lake Creek, the primary refuge inlet. These data are used by refuge staff to calculate annual flow volume into the refuge from both natural run-off and supplemental pumping from Muddy Creek. These data are then used in long-term and annual water management decisions (USFWS 2012).

In addition to water *quantity*, the USGS flow gauge is critical for evaluating water *quality.* Using historic mean concentrations of selenium in natural run-off and pumped water (Nimick et al. 1996), together with total water volume from the flow gauge, refuge staff can estimate the annual selenium load entering the refuge via Lake Creek.

The Regional Water Resources Division is no longer able to cover all of the cost to maintain the gauge. Refuge staff is working with the Division of Water Resources and USGS to find a cost-effective, long-term solution to refuge water monitoring needs.

METHODS AND PROTOCOLS

The USGS flow gauge is typically operational from April – November (the ice-free season). The gauge continuously measures flow in cubic-feet/second (cfs) across the wide variety of flows that can occur in Lake Creek (historically 0-180cfs). From these data, USGS calculates a mean hourly and daily flow that is given to the refuge in an annual data summary.

To calculate the total volume of natural run-off entering the refuge basin each year, staff use a combination of the flow data from the USGS gauge and readings from staff gauges in the wetland units. Since all pumped water enters the refuge via Lake Creek, the USGS gauge is used to measure flow volume and is compared to pumping effort (pump capacity, electrical charges, etc.) to estimate quantity delivered.

The mean concentration of selenium in natural run-off (based on historical data) is 14µg/L and 3µg/L in pumped water (Nimick et al. 1996). These values are combined with flow data, and the appropriate conversion factors, to estimate annual selenium load.

DATA ANALYSIS / MODELS

At the time of this progress report, the flow data has not been finalized by USGS for 2014. Based on preliminary data, the natural run-off for 2014 was 1604 ac-ft (Mar-Aug) and the refuge pumped 1928 ac-ft (Sept-Oct), for a total of 3532 ac-ft of water.

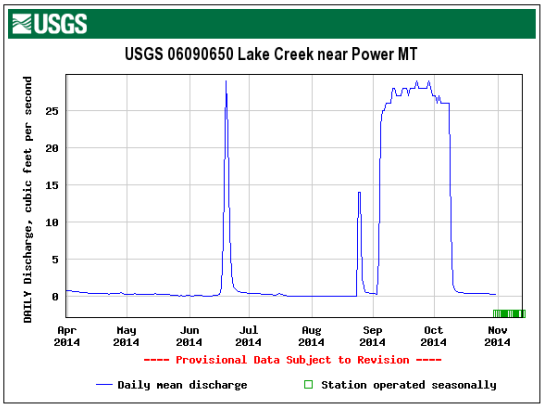

Figure 1. Daily discharge at the Lake Creek gauge, 2014.

We estimate that 65 pounds of selenium entered the refuge via natural run-off in Lake Creek and pumped water contribute 26 pounds.

DATA MANAGEMENT

Data are available nearly in real time (1 day lag) on the internet, which facilitates access to the data and analysis by refuge staff. USGS provides the refuge with an annual data summary once per year. USGS also conducts quality assurance/ quality control protocols to verify the data.

The water quantity data is summarized in an annual water use report. A copy of the water use report is submitted to the Regional Water Resources Division and stored in refuge files.

Jo Ann Dullum, Region 6 I&M program, has developed a preliminary Access database to store the flow and specific conductance data for the refuge. The database will provide rapid calculations of total flow volume and selenium loads as well as annual summary reports.

SOURCES OF SUPPORT

In FY2014, the Region 6 I&M program provided $10,000 to support this project. The Regional Water Resources Program also provided $5000 towards the USGS gauge maintenance contract. We directed $5000 of the I&M money to Kathi Irvine, with USGS, for statistical support. Several people have provided their time and expertise including Meg Estep and Peter Striffler with the Regional Water Resoures Program, David Nimick, David Naftz, Wayne Berkus and Norm Midtlyng from USGS and Karen Nelson from the FWS Contaminants program. Their help is greatly appreciated.

CURRENT STATUS

Refuge staff are currently working with David Naftz, USGS water scientist, and Kathi Irvine, USGS statistician, to improve our estimates of selenium load by using hourly specific conductance readings. We are updating a previous regression model that estimates selenium concentrations from specific conductance with more recent data (Nimick et al 1996, also see Naftz et al 2008).

CHALLENGES

We originally planned to work with the Regional Water Resources Division to install a water flow gauge that the refuge staff could maintain, which would save us the annual maintenance costs of the USGS gauge. However, after extensive discussions and a site visit, we could not find a better option than the USGS gauge. The wide range of flows in Lake Creek and the configuration of the channel makes taking reliable, consistent and accurate flow readings a significant challenge. The refuge has decided to continue using the USGS gauge.

MORE INFORMATION

Contact Vanessa Fields, Refuge Biologist, for more information on this project (406) 727-7400 Vanessa_Fields@fws.gov
The USGS Lake Creek gauge can be found at: http://waterdata.usgs.gov/mt/nwis/dv/?site_no=06090650&referred_module=sw

LITERATURE CITATION

Naftz, D.L., T.D. Bullen, B.J. Stolp, and C.D. Wilkowske. 2008. Utilizing geochemical, hydrologic, and boron isotopic data to assess the success of a salinity and selenium remediation project, Upper Colorado River Basin, Utah. Science of the total Environment 392:1-11.

Nimick, D.A., J.H. Lambing, D.U. Palawski and J.C. Malloy. 1996. Detailed study of selenium in soil, water, bottom sediment, and biota in the Sun River Irrigation Project, Freezeout Lake Wildlife Management Area and Benton Lake National Wildlife Refuge, west-central Montana, 1990-92. US Geological Survey Water-Resources Investigation Report 95-4170. Helena, MT. 120pp.

U.S. Fish and Wildlife Service. 2012. Comprehensive Conservation Plan, Benton Lake National Wildlife Refuge Complex, Montana. Lakewood, CO: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 305p.