Monitoring Streamflow, Water Levels, and Water Quality in the Wapato Lake National Wildlife Refuge, Oregon

Introduction

Wapato Lake near Gaston in northwestern Oregon has been a productive resource for fish, wildlife, and human populations for hundreds of years. Historically, seasonal high flows in the upper Tualatin River filled the lowland area comprising Wapato Lake. In the 1930s, a network of levees and canals was constructed to minimize seasonal flooding, facilitate the drainage of the lake in springtime for farming during summer, and convey water during summer to farmland in and around the lakebed. To augment tributary inflows during the summer dry season, a diversion canal from the Tualatin River to the Wapato Lake canal system was constructed to bring water around the lake to adjacent agricultural lands. Since the construction of the levees, streams that previously flowed into Wapato Lake no longer do so, leaving rainfall, groundwater seepage, and leakage through the levees as the only hydrologic inputs to the lakebed.

Recently, the U.S. Fish and Wildlife Service (USFWS) purchased most of the lakebed inside the leveed area, with the goal of managing the area for birds, fish, and other wildlife as the Wapato Lake National Wildlife Refuge. To optimize the future management of the lakebed, a variety of data were collected to provide a better understanding of the hydrology of the area and the quality of the water moving through the system.

In partnership with the USFWS, the U.S. Geological Survey (USGS) began monitoring streamflow, water levels, and water quality in the Wapato Lake area in September of 2011. Two streamflow gages, four water-level gages, and one water-quality station continuously collected data at key sites upstream, within, and downstream of the lake (see locations on map) through April of 2013. Several times each day, the data were transferred via satellite to the USGS database and made available to the public from USGS websites. One water-level gage is still operating today, providing real-time information on the amount of water in the lake.

The streamflow and water-level stations collected data that are being used to better understand the hydrology of the system and quantify its water budget. In combination with high-resolution topographic data collected by USFWS, the data were used to construct a water-budgeting spreadsheet tool that predicts flows and water levels under future management scenarios.

The water-quality station measured water temperature, pH, conductance, dissolved oxygen, turbidity, chlorophyll, and blue-green algae levels at the outlet of the lake, providing important information on the quality of the lake and canal water as well as the water exported downstream to the Tualatin River.

Flow, Water-Level, and Water-Quality Monitoring

Most of the USGS monitors collected data from September 2011 to April 2013; the lake water-level gage is still deployed. Data from the telemetered sites can be viewed and explored online using the USGS Data Grapher website at: http://or.water.usgs.gov/cgi-bin/grapher/graph_setup.pl?basin_id=tualatin

Data from the lake water-level gage also are available from the USGS National Water Information System website at: http://waterdata.usgs.gov/or/nwis/uv?site_no=14202630

The Data Grapher website allows users to interactively explore the available data, creating customized graphs and tables of various types, including comparisons of data from multiple sites, such as the graphs shown below.

Streamflow was measured at the Ayers Creek site by the USGS with a pressure sensor, then converting that measurement to streamflow through a discharge relation determined from flow measurements collected over a wide range of conditions. Streamflow at the Wapato Creek outflow site was measured with an acoustic velocity meter that used sound waves to measure the velocity of water; the velocity data combined with water-level data were used to calculate streamflow. The water-level sensors at various sites used underwater pressure sensors to measure the water depth.

Water quality at the Wapato Creek outflow site was measured with an instrument equipped with seven different probes. The probes were maintained and calibrated every 3-4 weeks, year-round, to keep them operating properly.