Monitoring Water Quantity and Quality to Help Manage Quivira National Wildlife Refuge

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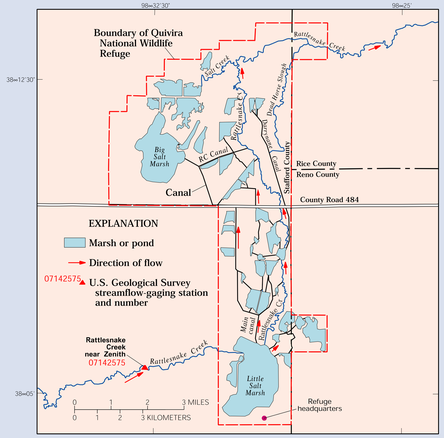
Introduction

The Quivira National Wildlife Refuge, located in the Rattlesnake Creek Basin of south-central Kansas, was established in 1953 to provide food, water, and a resting place for waterfowl, including several endangered species, during their annual migration. To provide the proper type of feeding and resting areas for wildlife, water is being diverted from Rattlesnake Creek into a system of about 30 marshes, ponds, and canals. The U.S. Geological Survey (USGS), in cooperation with the U.S. Fish and Wildlife Service (USFWS), Kansas Geological Survey, and Big Bend Groundwater Management District No. 5, are providing the timely information necessary for USFWS to manage both water quantity and quality at the refuge.

Water Quantity



Location of marshes, ponds, and canals at Quivira National Wildlife Refuge in south-central Kansas.

- In 1997, USGS developed a computer-based water-budget and flow-routing model to assist USFWS with water management at the refuge.
- The model and graphical user interface was developed to help determine the outcome of possible water-management options and to determine the optimal operation of canals and control ponds on the refuge.
- Results indicated that lowering target pond water levels reduced water-surface evaporation, resulted in more water stored in ponds at the north end of the refuge, and caused a substantial decrease in the final volume of water stored in Little Salt Marsh.
- The USFWS currently uses this model to manage the water quantity in the canals and basins in the refuge to provide the proper type of feeding and resting areas for wildlife.

Water Quality

Continuous Real-Time Monitoring

To assess the quality of the source water, a continuous in-stream water-quality monitor was installed at the USGS streamflow-gaging station to provide real-time measurement of specific conductance, pH, water temperature, dissolved oxygen, and turbidity.

Manually Collected Samples

Periodic water samples are collected manually throughout the range of expected hydrologic conditions and analyzed for alkalinity, dissolved solids, total suspended solids, nutrients, chloride, sulfate, atrazine, fecal coliform bacteria, and other constituents of concern.

Real-Time Data Transmission

Data collected with the water-quality monitor are transmitted from the USGS gaging station, through a satellite, to the computers in the USGS office every few hours and displayed on the Internet.

Regression Analysis

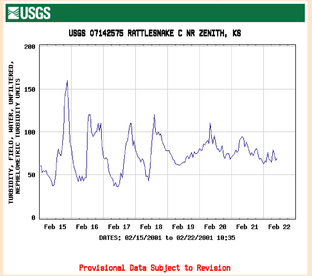
Regression equations are developed on the basis of the relation between water-quality monitor measurements and the chemical analysis of manually collected samples.

$\log_{10} Tp = 0.00165\ Turb - 0.000108\ SC + 0.217\ WT - 1.06$

Load Conversion

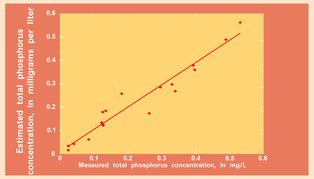
The regression equations are applied to the real-time water-quality data to estimate constituent loads. Excellent results were possible with alkalinity, total phosphorus, total nitrogen, chloride, and sulfate. Total suspended solids, atrazine, and bacteria were estimated with larger errors.

Real-Time Data from NWIS Web on the Internet
(water.usgs.gov/ks/current/?type=quality)

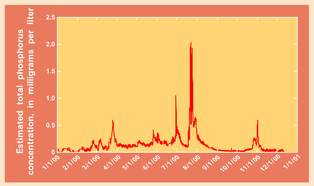


Provisional Data Subject to Revision

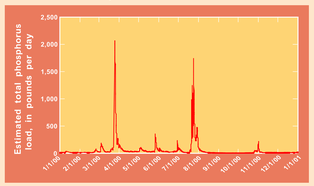
Comparision of Estimated to Measured Phosphorous Concentration



Estimated Phosphorus Concentrations



Estimated Phosphorus Load



Benefits and Conclusions

- Provides a useful tool for estimating the effects of possible water-management options for the Refuge.
- Adapts to any flow-network configuration to solve the operational water-management problem.
- The increasing public interest in TMDLÕs and water quality in general make this study of regional as well as national importance.
- Compliments many other studies, particularly when historical data are available to help develop the regression equations.
- Utilizes the existing USGS streamflow-gaging network.
- May reduce analytical costs.
- Even for those constituents with a large error, this approach provides valuable information.
- There are few or no gaps in the data.
- May provide more accurate load estimates for developing total maximum daily loads (TMDL's) because of the continuous nature of the data.
- The increasing public interest in TMDL's and water quality in general make this study of regional as well as national importance.

For more information on real-time water quality visit the USGS Web site at:
http://ks.water.usgs.gov/Kansas/qw/

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