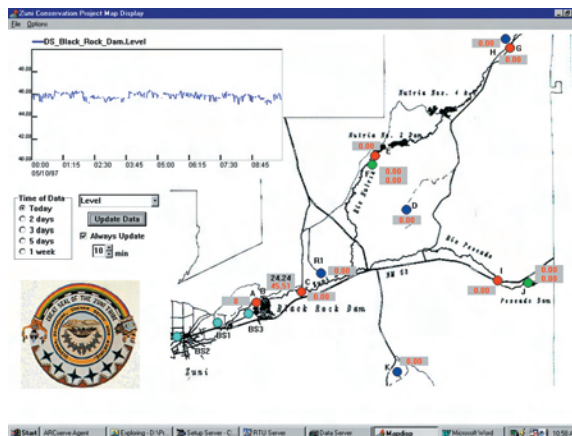


PUEBLO OF ZUNI, BLACK ROCK DAM EARLY WARNING SYSTEM



7/5/2006



The Pueblo of Zuni are located approximately 25 miles south of Gallup in west central New Mexico. Black Rock Dam was constructed on the Zuni River upstream of the pueblo in the early part of the century for flood control. In the years since its construction the dam has slowly filled with sediment, drastically reducing its capacity. Studies by the US Bureau of Reclamation and others indicate that it was no longer an effective flood control structure. The dam was classified as "high hazard" with potential for piping failure around the low level outlet, high levels of uncontrolled seepage, and a spillway capacity less than 1/3 of the probable maximum flood.

The safety of Black Rock Dam involved two concepts: First, a project was underway to remove sediments from the pool by dredging. At the same time some modifications were made to enhance spillway performance. Second, a flood warning system was being implemented to reduce the potential for loss of life for a hydrologically induced failure or overtopping of the dam.

SYSTEM CONFIGURATION

Two streams, the Nutria and the Pescado combine to form the Zuni above Black Rock Dam. The warning system area extends from the town of Black Rock to above the Nutria Diversion Reservoir on the Nutria approximately 20 miles upstream. Rainfall and water level are monitored in both stream basins through a network of five precipitation gages, three reservoir level stations, and four streamflow monitoring stations. (Two of the streamflow stations are combined with precipitation stations.) The station at Black Rock Dam also includes instruments for measurement of wind speed and direction plus air temperature.

COMMUNICATIONS

System communications are line of site radio. Two repeaters were required to provide full coverage of the area. A full duplex (two way) communications protocol is used so that stations can either be polled for data or report randomly. The two way protocol also allows uploading and downloading setup information from the base stations.

MONITORING SITES

OWNER:	Zuni Conservation Project Zuni, New Mexico
CONTACT:	Kirk Bemis
# & EMAIL:	(505)782-5852, zepid@nm.net
TOTAL:	\$180,500
DATES:	1996 - 1998 The job was completed under Zuni Conservation Project's schedule and guidelines on time and within the budget.
EQUIPMENT:	14 Remote Sites with 1 Repeater & 3 Base Stations

Monitoring sites are based on Sutron Model 8200 dataloggers equipped with internal RF modems and external LOS transmitters. The model 8210s at rain gage sites are housed in US National Weather Service ALERT-type standpipe housings supplied by High Sierra Corporation. Pressure transducers are used for water level measurement. Model 8210s are also used at the repeater sites where they provide "smart" repeating and store-and-forward capability for data.

BASE STATIONS

Sutron provided three base stations for the system. One is located at the Zuni Safety of Dams office, one is located at the Zuni Police Department, and one at the Bureau of Indian Affairs Black Rock Dam office. Sutron is also providing the capability to transfer data to the National Weather Service.

Base stations are composed of radio receiving/transmitting equipment and PCs running Windows-based communications and database software.

WARNING SYSTEM SOFTWARE

The Pueblo of Zuni selected Sutron for the warning system largely on the strength of our software. The

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Pueblo considered the traditional National Weather Service ALERT systems based on QNX (a variation of UNIX) and decided that a system based on Windows was a better choice.

Sutron developed the system around our PCBASE2 Windows communications and database package. The third-party tool WIN-911 was used to develop some of the system alarm features.

Basic system operations are conducted from a map display (Figure 1). The map provides real-time output of key system parameters (rain, water level) and provides notification of emergency conditions through color change and sound. Users can click on stations to bring up additional information when required. Near-real-time graphs of water level and rainfall are available on the main map display.

DATA HANDLING AND COMMUNICATIONS

All of the basic communications and setup are handled through the standard features of Sutron's PCBASE2 software. PCBASE2 offers the ability to support either full duplex systems using Sutron's standard protocol or one-way telemetry using NWS ALERT format messages.

PCBASE2 provides:

- System setup
- Scheduled data polling
- Handling of all communications messages
- Long-term database
- Real-time data processing (rating curves,

computation of secondary parameters such as flow)

- Graphical and text display of data

All system operations are performed using standard Windows mouse operations with a minimum of typing.

SYSTEM BENEFITS

The flood warning system will provide about 1.6 to 2.1 hours of preparation time from initial detection of a storm in the upper basin to the time that the outflow from Black Rock Dam reaches 700 cubic feet per second, the safe channel capacity. Prior to any dredging or spillway improvement it is estimated that the time from initial detection of a storm in the basin to the point at which the reservoir elevation reaches the dam crest is 3.6 hours. An additional 30 to 60 minutes of travel time are required for flood waters to go from the dam to the town of Zuni.

The US Bureau of Reclamation conducted a warning and evacuation capability assessment in conjunction with local public safety officials.

The Emergency Manager, Fire Chief, and the Chief of Police estimated that they can notify key officials of an emergency condition in 5 to 15 minutes. External organizations can be notified within 30 minutes. Approximately 4 hours will be required to notify the population at risk in Zuni.

The warning system thus provided enough time to detect a severe flood and notify affected citizens.



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