

Progress Report
Hydrology Study and Mitigation Plan for Aztec Ruins National Monument

Colorado Plateau Cooperative Ecosystem Studies Unit
Project CA H1200-04-0002

Submitted to

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Aztec Ruins National Monument
National Park Service
Aztec, New Mexico

by

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Project Objectives

The CESU project *Hydrology Study and Mitigation Plan for Aztec Ruins National Monument* is in its second and final year. The project is focused on identifying the sources of water impacting the major ancestral Pueblo ruins group at Aztec Ruins National Monument, and at designing mitigation measures that, when implemented, will provide protection of the ruins from continued deterioration. Planning for the project began in May 2005, and on-the-ground project activities have been continuously ongoing since August 2005.

Completed and Ongoing Tasks

Activities completed and/or ongoing at present include the following:

- Development of monitoring plan and equipment purchasing (May-August 2005)
- Hiring and training of student interns
- Field installation of monitoring hardware and collection of soil borings (August 2005) (Photographs 1, 2 and 3)
- Weekly (8/2005-10/2006) and biweekly (10/2006-2/2007) monitoring of water level at six wells and piezometers across the monument (Photograph 4)
- Weekly (8/2005-10/2006) and biweekly (10/2006-2/2007) monitoring of soil water pressure at 16 sensor locations; maintenance and servicing of soil water pressure sensors (Photograph 5)
- Incorporation of monitoring results into spreadsheets and graphs (Figures 1, 2 and 3)
- GPS location of project-relevant features at the monument
- Surveying of wells and other key features at the monument (November 2006)
- Development of park GIS coverages and basemaps relevant to project (ongoing)
- Orthorectification of historical and recent aerial photographs of the park
- Acquisition of climate data from the National Climate Data Center and incorporation into spreadsheets and graphs (Figure 4)
- Water quality sampling and analysis for surface water and groundwater at the park; preliminary analysis of resulting data (Figure 5, Photographs 6 and 7)

A laptop computer was purchased by the park for use on the project and hydrologic monitoring equipment was also purchased, including a water level sounder, tensiometers and a meter needed to read them. All of these will remain with the park for its use following completion of the project. The following paragraphs provide a synopsis of activities that have been completed, are underway or are planned.

Fort Lewis College

Under the direction of Fort Lewis College geosciences professor Dr. Scott White, a senior-level Fort Lewis College geology major (Serene Wardinsky) at was hired in August 2005. Serene eventually left the project to complete her senior thesis and a second senior-level student, Heather Hormell, was hired. Both of these students have shown the commitment and skills needed to conduct the necessary field work and keep

the monitoring, a critical part of this project, on track. Weekly monitoring of water levels and soil water pressures was conducted from August 2005 through September 2006, and on a biweekly basis since then to the present. These data have been compiled and plotted over this period by NPS hydrologists Colleen Filippone and Larry Martin.

GPS/GIS

A Trimble GeoXT submeter GPS receiver was loaned and ArcGIS software was provided to the project by the Intermountain Region Geographic Resources Information Management Team. The Fort Lewis College students learned to use the GPS instrumentation with the assistance of Rich Friedman, GIS supervisor for the City of Farmington. This state-of-the-art hardware proved invaluable to the project as it allowed accurate mapping of hydrologic and drainage features at the park and provided the students with an opportunity to broaden their technical skills.

Data collection with GPS units was completed in the Fall of 2006. Point, line, and area data for Aztec Ruins NM cultural sites, buildings, utilities, facilities, ditches, hydrologic monitoring sites, and roadways were collected and converted into vector GIS data sets. These data sets are being converted into a geodatabase, which will facilitate data storage and future editing. In addition to the features mentioned above, GPS data for the pear orchard on the Aztec Ruins NM property have also been collected. These are being added to the geodatabase to form a comprehensive geospatial data collection for Aztec Ruins NM.

City of Farmington

In addition to providing start-up guidance to the FLC student, Mr. Friedman has developed a basemap of the park area showing topographic contours on a 1.5-ft interval and orthorectified aerial photographs of the park in 1950 and 2003. These products are invaluable in the interpretation and analysis of the hydrologic system at the park.

Natural Resources Conservation Service assistance-field program

The monitoring plan included installation of tensiometers as a means of measuring soil water pressure, a proxy for soil moisture, around the exterior walls of the ruins. Tensiometers and a tensimeter (for measuring the pressures inside them) were purchased from Soil Measurement Systems, Inc. and installed with generous assistance from the USDA Natural Resources Conservation Service New Mexico District Conservationist Allen Maez, and Colorado Resource Conservation and Development Coordinator Doug Ramsey. Mr. Maez and Mr. Ramsey each made a substantial contribution of their time, labor and equipment to the project. Larry Martin, NPS Water Resources Division, and Colleen Filippone, NPS Intermountain Region, participated in the planning and fielding of the soil monitoring instrumentation. During the installation of the tensiometers, soil boring logs were retrieved and two piezometers were installed for monitoring of water levels in areas where no preexisting water level monitoring was available.

Field survey

A field survey of the monitoring wells, soil moisture sites, and some of the drainage and ruins features was conducted in November 2005 by NPS Intermountain Region surveyor

Clayton Frazier. The hydrology project contributed \$250 toward Mr. Frazier's travel expenses but otherwise obtained this service at no charge from the NPS Intermountain Region Facilities Management Office.

Water quality sampling and analysis

As monitoring results accrued during Year 1 it was determined by the principal investigators that water quality testing at the groundwater monitoring wells and piezometers would provide valuable information to the project. In keeping with this change in the scope of work, a revised scope of work was submitted to the CESU and approved. A program of field sampling and laboratory analysis was planned by NPS hydrologists, a scope of work was developed and quotations for the work were solicited in August 2006. A winning bidder was identified and the field sampling was conducted in September 2006 with the assistance of Stephen Monroe, NPS Southern Colorado Plateau Inventory and Monitoring Network hydrologist. Results of the laboratory testing were received in October 2006.

Future activities

The following activities are yet to be completed by the time we anticipate delivering the final report for this project, June 2007.

- Identify cutoff date for end of field monitoring by Fort Lewis College student
 - a. Train park staff to continue water level measurements
 - b. Determine what will be done with tensiometer installations
- Develop draft GIS products and review with project key official Gary Brown
 - a. Incorporate survey results into GIS coverages
- Determine how to efficiently extract information from soil borings
- Possibly sample two additional water or soil locations for laboratory analysis
- Conduct integrated analysis of data and GIS products
- Develop interpretation and recommendations to park
- Complete and submit final report

This concludes our progress report for the project. Please do not hesitate to contact us if you should have questions or concerns about the activities reported here.