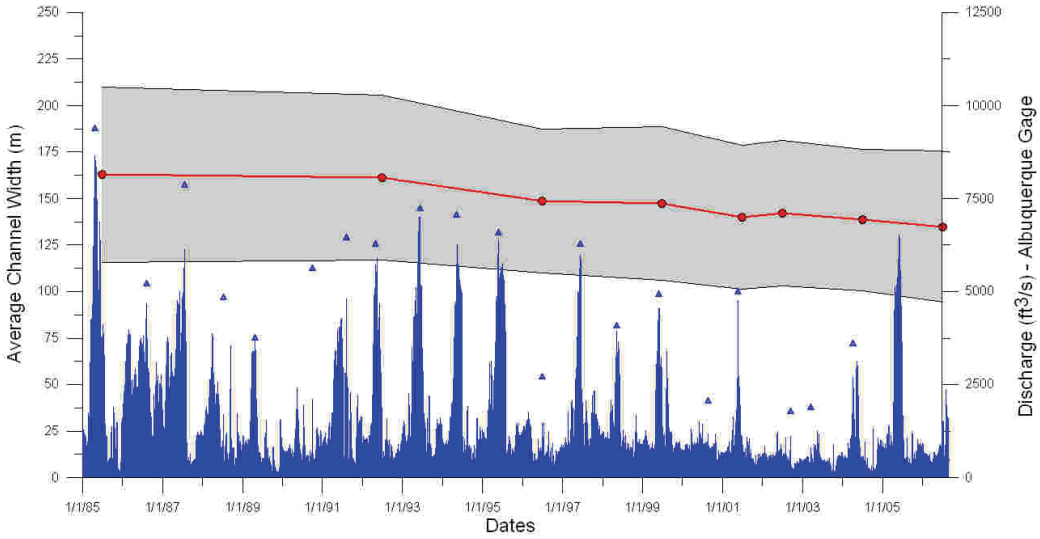
US Army Corps of Engineers®

Coupling of Hydrologic/Hydraulic Model and Aerial Photos Through Time



Change in average channel width (red) along Rio Grande, 1985-2006. Blue triangles are peak discharge magnitudes and grey area depicts +/- 1 standard deviation of channel widths

Products

Average and peak flows from U.S. Geological Survey (USGS) stream gauges in the Albuquerque reach compared with changes in channel width and sand bar configurations measured on sequential aerial photographs (1985-2006).

Benefits

Tracking changes in sediment movement and storage along the Rio Grande will provide river managers a means to project changes in channel morphology into the future, and can help guide restoration activities along the Albuquerque reach. In addition, tracking deposition and erosion through the reach will allow for the evaluation of Cochiti Dam operations, as well as other upstream water and sediment management practices. Finally, the data and results will be useful in validating sediment transport models employed by the Sandia National Laboratory (Jesse Roberts) and researchers at the Desert Research Institute.

Issue

Human interactions with the Rio Grande, including irrigation development, construction of flood-control structures, and channel straightening have resulted in alterations in sediment storage along the Middle Rio Grande. Previous analyses by the U.S. Bureau of Reclamation indicate a reduction in channel width by at least half (Makar et al. 2006), accompanied by local bar growth and channel incision. These changes impact both floodplain and aquatic ecosystems, especially in relation to the endangered Rio Grande silvery minnow (*Hybognathus amarus*). Increased vegetation on bars and the floodplain exacerbates the channel changes and also may lead to increased evapotranspiration along the river, which is a concern for water managers in the rapidly expanding Albuquerque metro area. In addition, sediment deposition has hampered management of a newly

constructed drinking water diversion, as well as impacted attempts at floodplain restoration within the study reach. For example, the Albuquerque Overbank Project (AOP) consisted of cutting down the floodplain surface to encourage overbank flow. In doing so, large amounts of bank erosion took place and a sand bar formed downstream of the project. This type of channel change and sediment movement can be traced with aerial photography. Although studies have been undertaken to look at channel change over the last century, including bar configurations and channel width, these investigations have not employed all of the recent photographs collected by Bernalillo County and others (1992-2006), often taken annually or biannually, and little work has examined the magnitude and duration of peak flows or low discharges in droughts that lead to these changes.

Description

The purpose of this work is to couple fluvial system changes that can be documented in aerial imagery with hydrologic/hydraulic models of the system. The main goal of the first year of study is a comparison of average and peak flows to changes in channel widths, and sandbar and island widths/locations for each USGS stream gauge in the Albuquerque reach of the Middle Rio Grande. Existing aerial photo-derived data on Rio Grande channel change have been compiled, and aerial photographs covering the Albuquerque Reach of the Rio Grande have been collected from various agencies. A spreadsheet describing photo characteristics, including the contact agencies, format, dates, extent, resolution, and the USGS discharge data associated with the photo dates has been constructed. Channel banks, vegetated islands, and bars have been digitized from recent aerial photographs (1992, 1996, 1999, 2001, 2002, 2004, 2005, 2006) in ArcGIS, and their widths have been measured at cross sections set 200 ft apart. Island area has also been measured over this time period. Finally, timelines showing discharge versus channel width, island width, and island area have been constructed for varying the study reach and subreaches of the river.

Sponsor

Southwest Urban Flood Damage Program (SWDP).

Points of Contact

Grant Meyer, University of New Mexico, Department of Earth and Planetary Sciences
Email: gmeyer@unm.edu
Phone: 505-277-5384

Lisa Hubbard, Program Manager, ERDC, Coastal and Hydraulics Laboratory
Email: Lisa.C.Hubbard@usace.army.mil
Phone: 601-634-4150

Partners

Desert Research Institute; USACE, Albuquerque District.