Updated Database Of The Middle Rio Grande, New Mexico

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Abstract. The Middle Rio Grande Database was initiated in 1998. The database consists of measurements of discharge, channel characteristics and sediment for the period from 1895 to the present. The data for this project was obtained through the USGS and the USBR and was used in numerous Hydraulic Modeling reports written for the USBR. The database was updated with the most recent possible data, and was compiled and consolidated. The data and analyses developed during the last several years of research were organized into an interactive database that can be accessed like a webpage. Besides the database, numerous theses and dissertations on the Rio Grande have been compiled.

1. Introduction

The Middle Rio Grande spans 143 miles in central New Mexico. It reaches from White Rock Canyon to Elephant Butte Reservoir. The river is historically a sediment laden aggrading sand bed river with extensive lateral bank movement. Restoration efforts began in the 1920's to reduce flood and safety hazards. The construction of Cochiti Dam in the early 1970's was part of a plan to control floodflows and to increase degradation in the channel.

Two endangered species make their home on the Middle Rio Grande: the silvery minnow and the southwestern willow flycatcher. With the ability to predict future river conditions, restoration efforts can be applied in a much more efficient and effective manner to preserve and protect these species habitat.

2. Background

The Middle Rio Grande has been under analysis by the US Bureau of Reclamation for many years for its sedimentation problems. Discharge, sediment, and form data have been gathered along the river for several decades. The data was analyzed for changes in bankline position, thalweg elevation, bed elevation, cross-sectional area, and bed material size. The results of this project have been analyzed in several parts.

Claudia Leon (1998) studied the morphology of the Middle Rio Grande from Cochiti Dam to Bernalillo Bridge. She also began the Middle Rio Grande database, a collection of all physical data available for the river (Leon, 2003). For her dissertation, she gave an analysis of equivalent widths of alluvial channels and their applications for instream habitat in the Middle Rio Grande. Travis Bauer (2000) followed with a study of the morphology of the river from Bernalillo Bridge to the San Acacia Diversion Dam. Gigi Richard (2001) analyzed lateral channel adjustments downstream from Cochiti Dam for

her Ph.D. dissertation. Mike Sixta (2004) studied meander migration of the river for his M.S. thesis. Jason Albert (2004) researched the river from Cochiti to San Marcial. In addition, he studied sediment continuity using double mass curves.

Figure 1. The Middle Rio Grande near San Acacia

In addition, several hydraulic analyses have been done for each reach for the US Bureau of Reclamation. The Rio Puerco (Richard, 2001) Corrales (Albert, 2003), Bernalillo Bridge (Sixta, 2001), and San Felipe (Sixta, 2003) reaches have all been analyzed in these reports. The general trend over the Middle Rio Grande seems to be a coarsening of bed material and increased bed degradation.

Current projects include an analysis of the Low Flow Conveyance Channel total load using BORAMEP, by Forrest Jay, and an update and organization of the Middle Rio Grande Database and Hydraulic Modeling Analysis by Susan Novak.

3. Middle Rio Grande Database

The Middle Rio Grande Database was created for the US Bureau of Reclamation in the late 1990s. The original database was compiled and discussed by Colorado State University's Claudia Leon in her thesis and dissertation. The database includes cross-sectional plots, discharge data, and sediment data from both USGS gaging stations and range-lines along the Rio Grande. The reach under analysis stretched from Cochiti Dam to the San Acacia Diversion Dam. This area is still under study for biological, hydrological, and geological changes.

The database was compiled in order to facilitate analyses performed to better understand the changes that are affecting the Middle Rio Grande River. Studies have been done on meander migration patterns, lateral migration, and

general morphology of the river. As more research is done, the database must be continually added to, organized, and updated.

Existing Database

The existing data consisted of several different computer disks, text files, and spreadsheets, as well as hard-copy data compiled from research projects on several reaches of the Middle Rio Grande. The existing formal database contained some data analyses done for research. Some data was raw, and was not yet manipulated.

There were several types of data collected for the MRG Database. Discharge data was measured along the river at several USGS gaging stations. Instantaneous discharge measurements were taken at some range-line cross-sections and were available in part from the USBR.

Cross-sectional measurements of bed elevation, water surface elevation, and thalweg were taken at several range-lines. Many different cross-sections were collected. The Cochiti Range-Lines (CO) are the most frequently used by MRG researchers. In addition, Aggredation/Deggredation (Agg/Deg), Abeyta's Heading (AH), Bernardo Jack (BJ), Bernalillo Island (BI), Calabacillas (CA), and Casa Colorada (CC) lines were included.

Sediment data was collected at both USGS Gaging Stations as well as at Range-Lines. Bed Material and Suspended Sediment data were collected from the USGS and the USBR. Hydraulic Summaries and Total Load Summaries were also collected from the USBR. The sediment database was expanded with analyses of sediment continuity and sediment transport. FLO Engineering also contributed sediment data for the early to mid 1990's. Some sedimentary and water quality data was received from the EPA as well.

Claudia Leon's 1998 thesis, "*Morphology of the Middle Rio Grande from Cochiti Dam to Bernalillo Bridge, New Mexico"* contains more detailed information about the exact dates and sources of available data. This thesis is available in the database.

Database Updates

New updated information was added through the USGS, the USBR, the EPA, and from hardcopy reports and files.

The USGS website provided updated discharge data for USGS gaging stations up through water-year 2002. It also provided some of the needed suspended sediment data for USGS gaging stations. Particle-size distributions were readily available for each USGS Gaging Station in service for up to 2004. These were available from the "Water Quality" section of the USGS website. Suspended Sediment Discharge data was also available through this website; however, the most recent of this data was 1996.

Cross-sectional data was provided at all available range-lines through spreadsheets and Auto-CAD drawing files from the USBR-Albuquerque office. Water-surface elevations, bed elevations, and thalweg depths were also provided by the USBR. Not every range-line was surveyed each year. The available range-lines varied from year-to-year, and also varied between

discharge, sediment, and cross-sections. CO-lines were the most commonly surveyed and the most widely available; however, even they were not surveyed each year. These cross-sections were available up to 2002 in a few cases, and at least to 2001 in most cases.

The EPA's STORET database was used to obtain a small amount of Albuquerque-area sediment data as well. Data retrieved from this data-storage facility was sparse and non-uniform. It was for the most part unusable, however, in the future, more data may become available from this source.

As recent USBR Hydraulic Modeling Analysis reports been produced, and as recent theses and dissertations by CSU graduate students have been published, more data has become available in hard-copy form. The data available in hard-copy form included sediment, discharge, and cross-sectional figures for the mid to late 90's. These reports were combed for new data that was added to the database.

Database Organization

New information was added into the existing data files. Any duplicate data was checked for consistency of numbers. In some older files, the data was based on estimates or on "real-time" data instead of official daily values. These values were used because the official values were unavailable. During the updates, the estimates or "real-time" data was replaced with the official values if they were available. This kept the database from having too many unnecessary duplicate entries.

Some data files overlap dates. It was necessary to keep these duplicate files because different analyses were performed on each set of data. In some cases, an original, raw data set was kept for further or new analyses.

After the new information was obtained, it was organized into the database by reach and then by sub reach. The entire database was then reorganized for clarity and ease of use. A webpage interface was created to tie the folders together. This interface runs from any standard web browser and is more user-friendly.

In the case that a researcher needed all discharge data for the Corrales reach, he or she could simply go directly to that folder. Any HEC-RAS data and analyses for the Bernardo reach could be easily accessed in the same way.

Finally, a "Readme" file was added to each subfolder to describe the contents of each section.

CD Layout

A CD set was created for the database. Five disks have been used to hold the vast amount of information. The first three disks consist of large, digital, aerial photos of the area. The fourth disk contains the data and analyses for each reach. The fifth disk contains all literature written on the reach, including any theses, dissertations, reports, and power-point presentations.

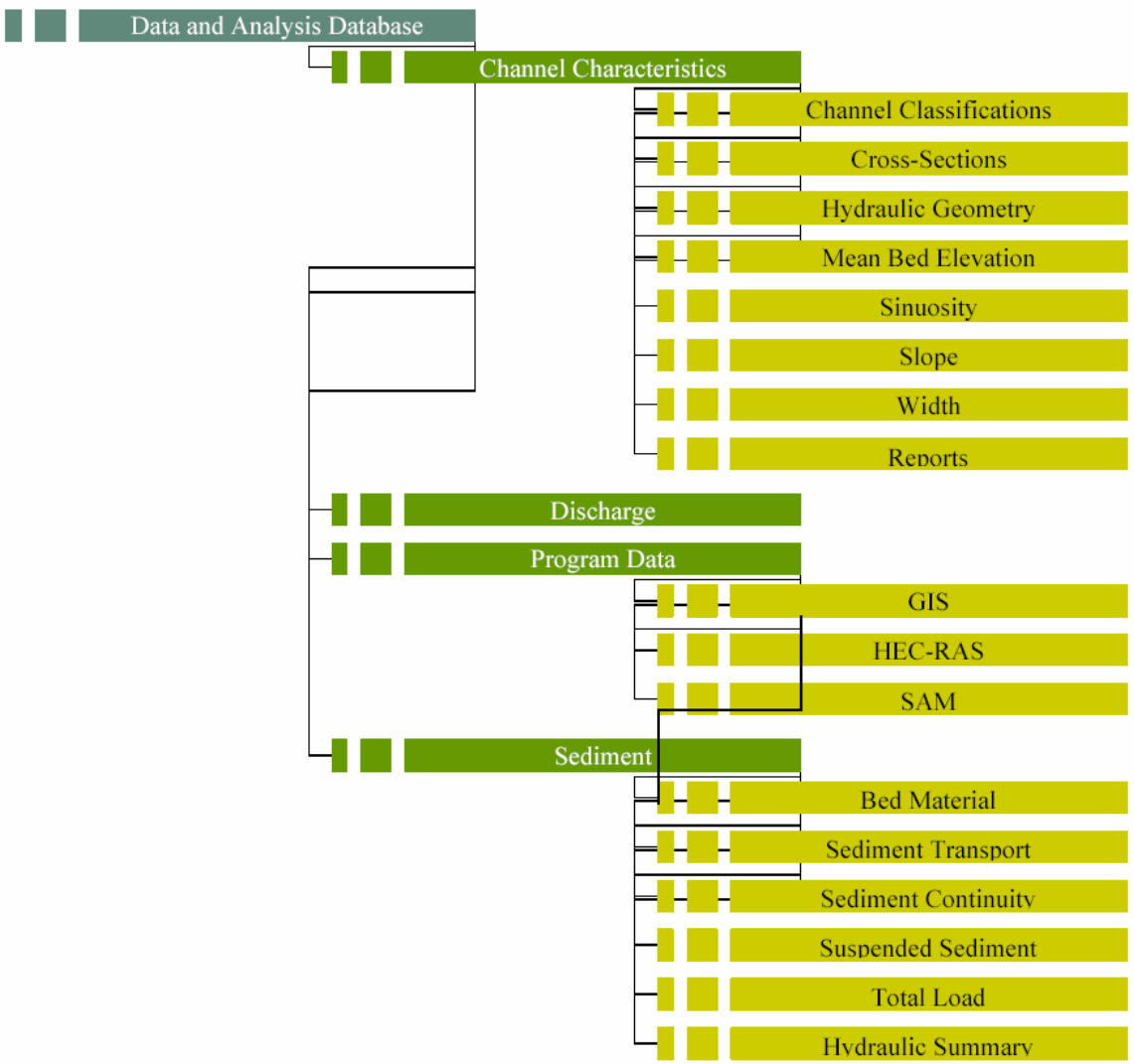

Figure 2. Layout of Disk 1, Data and Analysis

4. Conclusion

The Middle Rio Grande database was created in the late 90's and has been used extensively for research. It consisted of a collection of CD's, papers, and random files. The database was in need of reorganization and updating.

The database should continue to be updated through the next several years. This report can be referred to for data sources, and the sources may have to be updated from time to time. With an up-to-date, easily accessed database, research and reports can be done with much more ease and efficiency. With organization, the database is easily added to and understood.

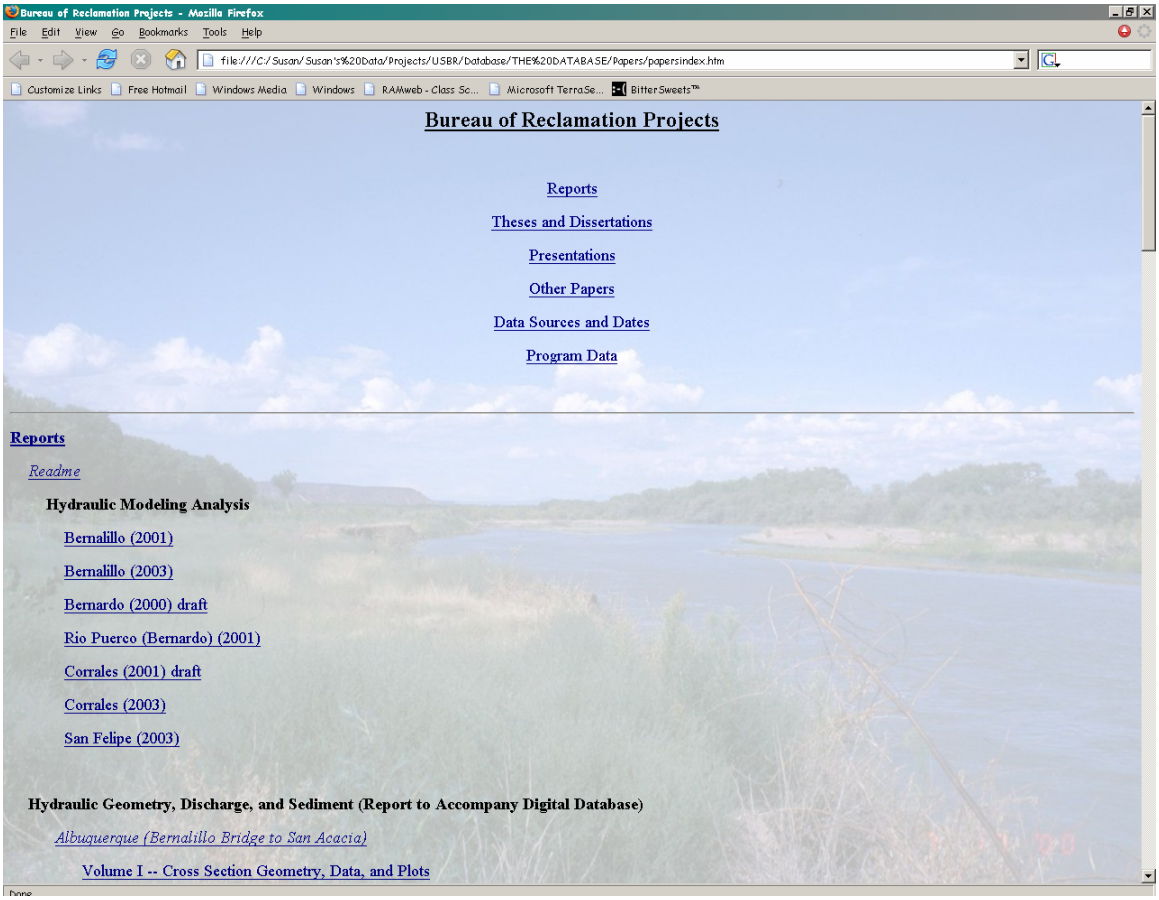

Figure 3. Screenshot example of the interface for Disk 2, Papers

5. References

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