LOWER CIENEGA CREEK RESTORATION EVALUATION PROJECT:

An Investigation into Developing Quantitative Methods for Assessing
Stream Channel Physical Condition

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ABSTRACT

This project was funded by the Arizona Water Protection fund to evaluate a 10-mile reach in the Lower Basin of Cienega Creek, in southeast Arizona, for potential stream stabilization projects, and to develop and test quantitative techniques for assessing the physical condition of stream channels. A land survey of the geomorphology of the stream channel in the Upper and Lower Basins was conducted during the period December 2000 through April 2002. Two samples sites were located in each of the basins from which water quality, macroinvertebrate, and diatom samples were retrieved. One of the two sites in the Upper Basin was chosen as the reference condition to which the two sites in the Lower Basin were compared. Differences in water quality between the two basins are likely due to exposed marine sedimentary rocks in the Lower Basin. Macroinvertebrate and habitat assessment data revealed that habitat complexity was significantly less at the Lower Basin sites. Diatom taxa and abundance were correlated with water quality but not habitat complexity.

The land survey showed that ephemeral and perennial reaches of the creek responded to the same hydrological processes. A local watershed area/cross-section area curve was constructed from over sixty cross-sections measured along the creek. Ephemeral cross-sections plotted closely to the regression line, which had a high correlation coefficient. The local curve was congruent with two regional curves, indicating its consistency with regional hydrological processes. These results gave validity for combining morphological data from both ephemeral and perennial reaches for streambed morphological analyses.

Streambed feature analysis revealed morphological differences between the two basins. A Linear Habitat Complexity Index, developed from survey data, isolated a least impaired reference reach in the Upper Basin. A comparison of the reference reach to the channel in the Lower Basin showed the channel in the Lower Basin to be dominated by runs with few pools or riffles, indicative of an unstable channel. A pool facet slope analysis revealed that pools in the Lower Basin have shallow slopes, indicative of shallow pools. Pool facet slopes in the Lower Basin were significantly different than pool facet slopes in the reference reach. Reach slope departure analysis identified twenty-one ephemeral tributaries contributing sediment to the Lower Basin channel. Four of the contributors have supplied massive amounts of sediment to the lower channel.

Several quantitative techniques for assessing the physical state of stream channels were developed and successfully employed to evaluate the morphological data collected during the project

It was concluded that the additions of sediment to the Lower Basin channel have been long in duration and massive in extent throughout its entire length, and any stream stabilization projects constructed in the near future would be without merit. The presence of the sediment and several active headcuts indicate an unstable channel, not conducive to long-term successful restoration projects.

A series of recommendations were made to federal, state, county, and private land-holders for watershed study and improvement actions.