SUMMARY

A geomorphic study of the Rio Grande between San Acacia Diversion Dam and Escondida Bridge (San Acacia Reach) found that physical channel features, sediment discharge, sediment size and channel morphology have changed significantly from historic conditions, and that these changes will continue to evolve in the future. The total length of the reach is approximately 10.5 miles (17 km).

A series of storage reservoirs built in the 1950's-1970's, upstream from this study site, control spring runoff flows and decrease the sediment load. As precipitation generally increased in the 1980's, annual spring runoff volume also increased, however, any flows approaching floodstage were retained in the reservoirs to be released at slower rates throughout the subsequent months. The current volume of suspended sediment at San Acacia (1980-1999) has decreased to approximately 20% of sediment levels measured prior to the closure of Cochiti Reservoir in 1975.

Although major channel modifications in the San Acacia area began in the 1930's with the building of the diversion dam and a railroad line along the west (right) side of the river channel, significant modifications were made to the floodway in the 1950's and 1960's with the building of the Low Flow Conveyance channel (LFCC). Modifications to the floodway during the 1950's and 1960's included channel straightening, narrowing through re-alignment and jetty jacks, riparian vegetation management, and riverbed grading/in-channel debris removal. A levee on the west side of the river that extends the entire length of the reach was created from the LFCC channel spoils.

The San Acacia Reach is divided into 4 sections or sub-reaches with sub-reach 1 starting at the San Acacia diversion dam and sub-reach 4 ending at Escondida Bridge. Sub-reach 1 (1.3 mi or 2 km) is a narrow, straight, tightly confined, single threaded channel. The second sub-reach (2.2 mi or 3.5 km) is also narrow and single threaded, but also exhibits a slightly meandering morphology where point bars have developed on the inside of the meander bends. The third sub-reach (5.7 mi or 9.2 km) has a relatively wide channel and is dominantly a braided morphology at low flows. Sub-reach 4 (1.4 mi or 2.1 km) is similar to sub-reach 1, in that it is a straight, single threaded channel which is confined by terraces and levees.

Although channel straightness has not changed significantly since 1918, channel pattern has. In 1918, almost the entire reach was wide and braided at low flows. Sub-reaches 1, 2 and 4 were modified significantly during the channelization period of the 1950's; sub-reaches 1 and 4 are now very narrow straight channels. Sub-reach 2 is less confined than sub-reaches 1 and 4, and is meandering slightly. Sub-reach 3 was modified less than the other reaches and has maintained a wider channel, but it has begun to convert to a meandering form as found in sub-reach 2. Along with these larger-scale pattern changes, the width of the channel has decreased 60% since 1918, depth has doubled since 1962 and the channel bed elevation has decreased from 8-13 feet.

The channel forming flow was determined using three methods: effective flow, recurrence interval analysis, and bankfull measurements. Effective discharge calculations indicate that the most sand is transported at 2,800-3,200 cfs. The recurrence interval analysis for wet periods (1979-1997) and for dry periods (1959-1979), indicated that a flow of 5,000 cfs had a recurrence of 1.5 and 2.5 years respectively. Bankfull estimates found that a flow with a mean daily discharge of approximately 5,000 cfs just filled the active channel. Since the channel has a bimodal sediment size, the channel forming flow used in this assessment is 5,000 cfs, for the general channel form and the gravel bed, while a flow of 3,000 is used for channel form relating to the sand sized sediment.

A series of terraces define two distinct periods of degradation (i.e., channel bed lowering due to limited sediment supply): 1918-1949 and 1985-1995. Terraces from the first period of degradation are 8-12 feet above the current channel, while the second set of terraces are 3-6 feet. Since the 1962 survey data (the earliest survey data collected), the channel bed has decreased in elevation approximately 13 feet near the dam, and 8 feet near Escondida Bridge. Along with the levee, the terraces increase the extent of channel confinement.

Consistent with degradation, the size of sediment lining the channel bed has also increased. In approximately 1988, gravel sized sediment was sampled at the San Acacia gage, and appears to mark the transition of sub-reach 1 from a historically sand bedded river to a gravel bedded river. Although the channel bed and its physical characteristics are now controlled by the gravel sized sediment, sand sized particles still cover portions of the bed. Gravel is found in all sub-reaches, however, a continuous layer has only formed in sub-reaches 1, 2 and part of 3. Sediment transport models and field observations indicate that sand sized sediment is transported at most flow regimes (>300 cfs), while the gravel is mostly transported at channel forming flows (>5,000 cfs). At these channel forming flows, transport models show that the sand is rapidly transported out of the reach, in fact, the average spring runoff alone is estimated to fully scour the current deposits of sand found in sub-reaches 1 and 2.

Estimated future condition analyses indicate that sub-reaches 1 and 2 will probably not change significantly in the near future with the current supply of sediment and flows, however sub-reaches 3 and 4 will likely continue to evolve. The channel of sub-reach 3 appears to be in the most transient state of the sub-reaches. The upstream section of sub-reach 3 is currently converting to a meandering channel pattern similar to sub-reach 2, grain size on the channel bed is coarsening to gravel, and the bed continues to degrade. Sub-reach 3 will likely evolve to a meandering channel pattern that will produce an even narrower, deeper and longer channel with a decreasing slope. With this evolution (sub-reach 3), the timing of sediment transport will change from the current year-round transport at low to moderate flow towards sediment transport of gravel sized sediment during channel forming flows. Other than channel bed elevation, channel features in sub-reach 4 have changed very little since it was channelized in the 1950's. The recent protrusion of Arroyo de la Parida's sediment fan into the Rio Grande's channel, near the end of this sub-reach is creating a natural grade control feature in the main channel. Once the grade control feature is fully established (estimated within 2 years), modest aggradation is expected upstream throughout sub-reach 4, thus breaking the degradation pattern and establishing a more stable channel bed elevation.