I. Project Title: Gunnison and Green River Basin Sediment Monitoring and Evaluation Program

I. Principal Investigator

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III Project Summary:

The primary objective of this sediment-monitoring project is to address key uncertainties in priority reaches of the Colorado, Gunnison and Green Rivers relevant to the role of streamflows and sediment transport on the formation and maintenance of backwater habitats and spawning bars[1]. A secondary objective is to collect the necessary sediment data to aide in the evaluation of Service flow recommendations for the Aspinall Unit and Flaming Gorge Reservoir.

1. A retrospective analysis of historic sediment data will be done to determine the availability of historic sediment data for the key sites on the Colorado, Gunnison, and Green River near Green River Utah. This objective includes an evaluation of the data to determine their utility for developing sediment-transport equations, evaluating trends in sediment transport, and evaluating how variations (wet vs. dry years) in annual hydrographs affect sediment transport.

2. To support the evaluation of the effects of the streamflows and sediment movement on the morphometric and bed material characteristics of Gunnison and Green River.

3. Determine if there is any distinction between sediment load estimates computed from daily sediment data, sediment transport equations, and empirical bedload transport equations.

[1] While spawning bars were not emphasized by decision makers in 2003 they were ranked high in the priorities report LaGory 2003 and data collection to address spawning bar issues need to be collected simultaneously with data needed for backwater habitat studies.

4. Evaluate the dynamics of sediment movement in the study reaches by collecting and analyzing data to compute sediment load, including suspended sediment using daily samples and sediment transport equations. Water-surface slope and bed-material samples will be collected at two sites to support bedload calculations. These data will be collected at the following gages: Gunnison River near Grand Junction, Colorado (Whitewater); and the Green River near Jensen, Utah (Jensen). These sites represent the range in sediment conditions found in other habitat monitoring reaches (primarily cobble bottom in the Gunnison River at Whitewater and a sand cobble mixture, primarily sand, found in the Green River near Jensen).

IV. Study Schedule Initial Year 2004 Final Year 2008

V. Relationship To Riprap

General Recovery Program Support Action Plan I.A.3&4
Gunnison River Action Plan: 1.A. Identify fish habitat and streamflow needs
Green River Action Plan: 1.A. Identify fish habitat and streamflow needs

VI. Accomplishments for 2005:

Preliminary Retrospective Analysis of Historic Data (completed in FY 2005):

The preliminary retrospective analysis of historic data pertaining to sediment was completed for the study area (Colorado River in the vicinity of the 15-mile and 18-mile reaches of the Colorado River in the Grand Valley and downstream to the confluence of Green River; the Gunnison River downstream from the confluence of the North Fork of the Gunnison River; and the Green River near Green River, Utah) to determine the availability and utility of sediment data. These data were used to develop preliminary sediment-transport equations, to the extent possible, similar to those developed for the Yampa River, Little Snake River, Green River near the Gates of Lodore, and the Green River near Jensen, Utah. These analyses were used to identify available data, and to help identify data gaps that could be addressed by sediment sampling done in the support of habitat evaluations. Data were summarized and presented to the Sediment Sampling Workgroup in March, 2005.

After data collection efforts that began in 2005 are completed in 2007, analysis of the effects of annual streamflow on sediment transport will be evaluated and trend analyses will be performed for sites where adequate data exists. An evaluation of the effects of monsoonal rain events on sediment loading and a comparison of two methods used to calculate daily sediment loads, computation using sediment-transport equations verses daily sediment sampling, will also be included in the final publication (FY 2008).

Data collection FY 2005:

To better understand the sediment loading dynamics in the Gunnison and Green River Basins, along with other river basins with similar characteristics, data collection began in FY 2005 with the installation of sediment automatic-pump samplers at Gunnison River near Grand Junction, Colorado (Whitewater); and the Green River near Jensen, Utah (Jensen). Suspended-sediment samples were collected at Whitewater and Jensen from early April through October. Sample collection intervals were based on variations in streamflow as well as time between samples, prior to and during the snowmelt runoff peak. Recurrence intervals for the snowmelt runoff peaks observed in 2005 were 4.75 years for Whitewater (based on peak streamflow for water years 1968-2004) and 3 years for Jensen (based on peak streamflow for water years 1965-2004).

Following the snowmelt runoff peak, an emphasis was placed on monitoring sediment transport during monsoonal rain events. Use of a turbidity sensor at Whitewater facilitated the collection of suspended-sediment samples indicative of monsoonal rain events where minimal increases in streamflow coincided with substantial increases in suspended-sediment concentrations. No turbidity sensor was installed at Jensen because hurricane Katrina delayed the delivery of the equipment needed from the USGS Hydrological Instrumentation Facility located in Mississippi. An increase in the frequency of the samples collected at Jensen was incorporated in the sampling strategy for FY 2005 to adequately cover the monsoon season. Turbidity triggered sampling will be incorporated into sample collection at Jensen in FY 2006. At least a dozen monsoonal rain events were sampled in FY 2005.

In order to determine the daily suspended-sediment load for each site, a combination of pump samples and cross-sectional samples were collected. Pump samples define suspended-sediment concentrations at one location in the stream cross section; cross-sectional samples define the average concentration of the entire cross section. Use of both samples in conjunction, allows for a relation to be defined between the pump-sample values and the cross-sectional sample values. Suspended-sediment sample collection at the two sites consisted of about 400 pump samples collected at Whitewater along with 7 equal-width interval cross-sectional samples; about 300 pump samples were collected at Jensen along with 8 equal-width interval cross-sectional samples. Grain-size analysis was computed for 6 of the Whitewater cross-sectional samples and 6 of the pump samples. Grain-size analysis was computed for 7 of the Jensen cross-sectional samples and 6 of the pump samples.

To estimate the bed-load portion of the total sediment load at these sites, data collection was begun this FY through the surveying of water-surface slope for use in incipient motion calculations at various streamflows. These data will provide perspective regarding percent of the total sediment load represented by bed load and the mechanics of sediment movement (maximum grain size entrained for a

given streamflow), over a range of streamflows. Bed-material samples and depth- and width-integrated suspended-sediment samples for full-size analysis will be collected at each site, where possible in FY 06-07, for use in the modified Einstein, Meyer-Peter Muller, or Parker equations to estimate bed-load transport. If the collection of bed-material is not possible, pebble-count data will be substituted into these equations.

VII Recommendations:

In March, 2005, the Sediment Sampling Workgroup discussed the need to better understand the mechanisms controlling channel-morphology progression as it relates to changes in streamflow. The adaptation of the Multidimensional SWMS Model, an existing hydraulic model produced from the USGS National Research Program, was discussed as a possible method to meet this need. Collaboration between personnel from this project and the USGS National Research Program personnel began in 2005 and efforts to produce a demonstration project for the Whitewater area will continue in FY 2006.

The original application of turbidity sensors in this project was for the triggering of pump samples during monsoonal rain events. Observation of the turbidity record during the monsoonal season demonstrates the utility of expanding the role of turbidity monitoring in this project. The incorporation of a more closely maintained and quality-controlled turbidity record, in conjunction with the ongoing sampling, may better define the suspended-sediment loading characteristics of these events; however, additional funding is necessary to expand the scope of the turbidity-record computation and sensor maintenance.

VIII Project Status

The Project has completed the preliminary retrospective analysis of historic data and a summary was presented to the Sediment Sampling Workgroup in March, 2005. A revised handout from the meeting will be sent out by the end of December, 2005.

The first year of data collection is complete and the sediment automatic-samplers have been shutdown for the winter. The final set of FY 2005 suspended-sediment samples were shipped for laboratory analyses earlier this month and results are expected to be returned from the laboratory in the coming weeks. The sediment record for FY 2005 will be computed and reviewed this winter so that any findings that suggest modifications to the sampling strategy are needed can be incorporated into FY 2006 sampling work plan. Efforts are currently underway to improve the efficiency of the automatic-samplers though computer programming.

IX. FY 2005 Budget Discussion

Due to the delay in processing the FY 2004 funding agreement, the retrospective analysis and sediment sampling outlined in the scope of work for FY 2004 did not begin until FY 2005. The bulk of the funding received in FY 2004 was carried over into FY 2005, (table 1). The funding carryover from FY 2004, along with the FY 2005 funding received from the Recovery Program was used to complete and present the preliminary retrospective analysis of historic data to the Sediment Workgroup in FY 2005, and also to complete the first year of suspended-sediment sampling at the two sites. A portion of the FY 2005 funding was carried over into FY 2006 to cover the cost of computing the FY 2005 daily suspended-sediment records during the first quarter of FY 2006.

Table 1.

Funding Source	FY 2005 Total
FY 2004 Recovery Program Carryover	$107,879
FY 2005 Recovery Program	$93,103
USGS DOI Cost Share	$16,800
Total	$217,782

X. Status of Submissions N/A

XI. Signed _____ _____
Principal Investigator Date