

- I. Project Title: Hydrophone Study of White River Bedload Transport
- II. Bureau of Reclamation Agreement Number(s): N/A
- III. Principal Investigator(s):

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- IV. Abstract:

The White River is a major tributary to the Upper Green River, and important to the conservation and recovery of native fishes in the Upper Colorado River Basin. A management plan for the White River is under development, with a programmatic biological opinion to be issued on that plan. White River flow recommendations, still under development, will be crucial for evaluating that Plan. Annual high flow recommendations will be an important component, as these are crucial to the maintenance of the complex river channel morphologies that create a diversity of habitats important to fish, including riffle habitat relatively free of surficial and interstitial fine sediments. Draft recommendations for spring peak flows were developed for the Recovery Program based on geomorphic analyses by Schmidt and Orchard (2002). To date, however, those recommendations have not been formally adopted by the Program.

This project attempts to provide additional insight into the dynamics of coarse sediment transport in the White River to further inform the Program's understanding of the flows necessary to maintain healthy channel habitats. This effort was designed to identify if and where bedload sediment transport would occur along the White River within two study reaches and at selected discharges during the 2017 spring runoff season. A mobile hydrophone was used to make audio measurements for evaluating the dynamics of coarse bedload sediment transport. The detection of sound generated by cobble- and gravel-sized particles moving along the riverbed via hydrophones can serve as a surrogate technology to identify discharges at which bedload sediment transport is initiated.

- V. Study Schedule:

Field work occurred during the 2017 spring runoff period in May and June, with

processing and interpretation of the audio and other field data in FY 2018. A second season of field data collection might have been implemented in 2018 had unusually high spring runoff occurred in the White River. However, basin snowpack conditions were poor, and mean daily flow at the Watson, Utah gage in 2018 peaked at just 1,360 cfs, or only 57% of the long-term average.

VI. Relationship to RIPRAP:

Green River Action Plan: White River

I.B.2 Identify flows.

I.D.1 Review scientific basis, dependent on development of flow recommendations by FWS.

VII. Accomplishment of FY 2018 Tasks and Deliverables, and Initial Findings:

In May and June 2017, Dr. Minear and assistants conducted three longitudinal hydrophone surveys, each of approximately 16 to 28 miles of the White River, to continue developing techniques for bedload sediment transport detection. Unfortunately, peak flow in the White River this year was of much lower magnitude than had been anticipated in February when the field effort was planned. Nevertheless, sampling of the lower White River (Bonanza Bridge to Enron) was performed at around 800 cfs and 1,400 cfs, and of the upper White River below Kenney Reservoir at around 1,850 cfs.

While there was almost no detectable bedload movement at these flows, a substantial amount of channel survey work was completed in sufficient detail to create a 1-D model of the 38-mile reach. These channel data, together with the measured velocity and depth data and available grain size data, were used to help the Program better understand the conditions in the White River under which bedload becomes mobilized.

In FY 2018 the audio data were processed and analyzed using methods developed previously by Marineau *et al.* (2015) and with a novel noise interferometry technique by Justin Ball, CIRES post-doctoral researcher. GPS and ADCP data also were processed in FY 2018. Preliminary results from processing and interpreting the audio and other field data were presented in early 2018 at the Annual Researchers Meeting. In June 2018 input was provided to the USFWS regarding their proposed White River peak flow recommendations and our associated bed mobilization observations.

VIII. Additional noteworthy observations: N/A

IX. Recommendations: Consider continuing the Recovery Program's support for hydrophone research and development efforts, to the extent hydrophone techniques offer promise as a cost-effective tool for understanding bedload sediment mobilization in the rivers of the upper Colorado Basin.

X. Project Status:

FY 2017 field work is complete and processing was completed in FY 2018. Preliminary results were presented at the Annual Researchers Conference in January 2018. The FY 2017 data and results were used to help guide interpretation used in feedback for USFWS for flow recommendations relevant to bed mobilization on the White River.

XI. FY 2018 Budget Status

A. Funds provided:	\$ 3,076
B. Funds expended:	<u>\$ 3,076</u>
C. Difference:	\$ 0

XII. Status of Data Submission (Where applicable):

The present study is now considered complete and an avenue will be found to house the data collected and processed in this study. The USFWS has a copy of the presentation given at the Annual Upper Colorado Researchers Meeting in January 2018.

XIII. Signed:



<u>Toby Minear</u>	<u>2/4/2019</u>
Principal Investigator	Date

References

Marineau, M.D., J.T. Minear, and S.A. Wright, 2015. Using Hydrophones as a Surrogate Monitoring Technique to Detect Temporal and Spatial Variability in Bedload Transport. In Proceedings of the 'SedHyd' conference, the 5th Federal Interagency Hydrologic Modeling Conference and the 10th Federal Interagency Sedimentation Conference, Reno, Nevada, April 19-23, 2015.

Schmidt, J.C., and K.L. Orchard (2002). Flow Recommendations for the White River, Utah-Colorado: Geomorphic analysis in support of a channel maintenance flow recommendation for the White River near Watson, Utah – DRAFT. Report prepared for Upper Colorado River Basin Recovery Implementation Program, Project No. 5D. 135pp.