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Multibeam Survey of the Lower Granite Reservoir, Idaho and Washington

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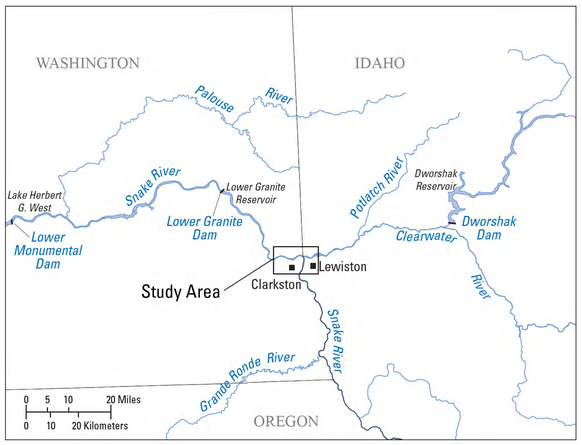

Figure 1. Study area

Introduction

The U.S. Geological Survey (USGS) in cooperation with the U.S. Army Corps of Engineers (USACE) conducted a bathymetric survey using a multibeam echo sounder on the Lower Granite Reservoir, near Lewiston ID and Clarkston, WA (fig. 1). The confluence of the Snake and Clearwater Rivers is a transitional area where the rivers change from a free flowing environment to one of increased backwater effects created by the Lower Granite Dam. The survey was conducted as part of the USACE's effort to understand and predict sediment depositional patterns in the reservoir.

The result of the survey was a digital elevation dataset in ASCII coordinate positioning data (easting, northing, and elevation) which provided a continuous digital elevation dataset of the reservoir within the project limits. When viewed using geographic data software, the data are useful in rendering a 3ft x 3ft point grid showing bed elevation and reservoir geomorphology such as scour holes, rock outcroppings, and bedforms like ripples and dunes (fig. 3b).

Based on this data, the USGS will publish a data series report and the USACE will develop 1- and 2-dimensional flow and sediment transport models. Resource managers will used these products in an effort to improve commercial navigation and to increase reservoir capacity

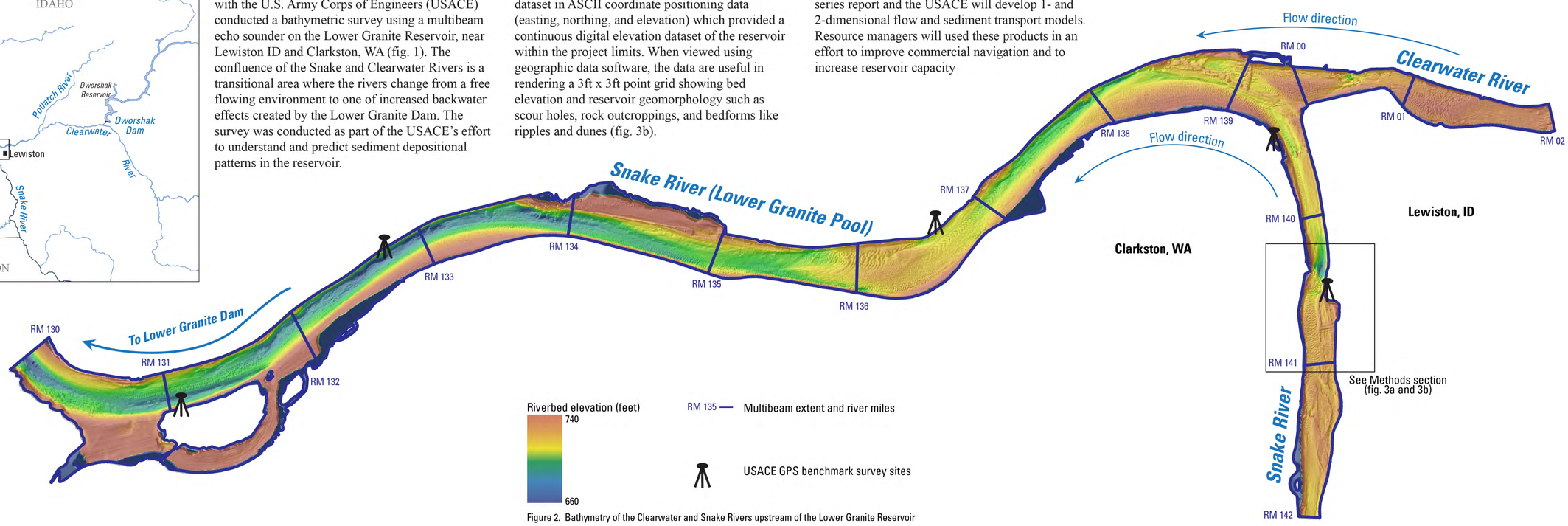

Figure 2. Bathymetry of the Clearwater and Snake Rivers upstream of the Lower Granite Reservoir

Methods

Figure 3a. Imagery of conditions at river mile 140

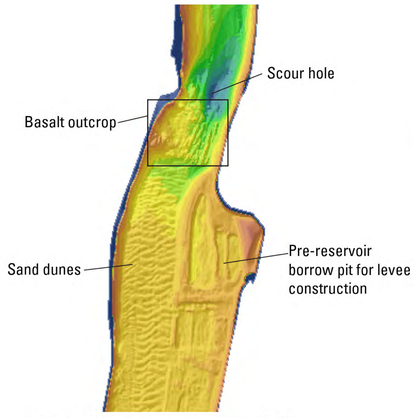

Figure 3b. Multibeam bathymetry at river mile 140

During the fall of 2009 and the winter of 2010, the USGS surveyed the full width of the Snake and Clearwater Rivers in the study area: 12 river miles of the Snake River, and 2 river miles of the Clearwater River upstream from the confluence with the Snake River (fig. 2). River banks and other very shallow areas were excluded.

Scientists surveyed the rivers in one-mile segements with a multibeam echo-sounder system mounted to the side of a 25-foot jet boat (fig. 4a) that is designed for hydrographic surveys. The elevation points in the dataset were unaffected by reservoir stage changes because the points are referenced to the USACE-established benchmarks via the real-time kinematic-global positioning system (RTK-GPS) (fig. 2 and 4c).

The raw echo sounder data from the one-mile segments was collected and processed using HYPACK™ and HYSWEEP™ hydrographic survey software to eliminate backscatter distortion and false sounding data.

Figure 4a. USGS jet boat with survey equipment on side

Figure 4b. Multibeam echo sounder mounted to side of jet boat

Multibeam Echo Sounder

The hydrographic survey equipment included an Odom Hydrographic Systems™ ES-3 multibeam echo sounder transducer capable of producing 480 beams; an International Industries™ DSM-10 TSS dynamic motion sensor used to measure vertical displacement and attitude; and an Odom DIGIBAR-Pro profiling sound velocimeter to provide continuous near-surface velocity data (fig. 4b). A Hemisphere™ VS110 heading and position receiver using two GPS antennas mounted over the echo sounder transducer provided precise heading data.

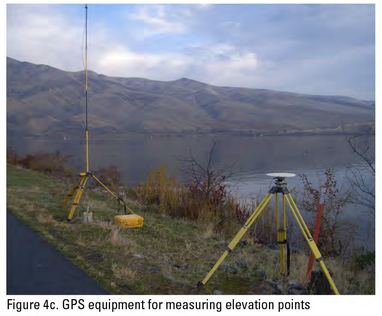

Figure 4c. GPS equipment for measuring elevation points

Global Positioning System

Horizontal and vertical positioning was accomplished using a Trimble™ R8/5800 GPS receiver mounted over the echo sounder transducer and radio linked to a Trimble™ 5700 static base-station receiver using a Zephyr™ Geodedic GPS antenna positioned over USACE-established survey benchmarks within the study area (fig 1, 2, and 4c).