PRELIMINARY CROSS SECTION OF ENGLEBRIGHT LAKE SEDIMENTS

USGS Open-File Report 03-397

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OVERVIEW OF THE STUDY

OVERVIEW

The Upper Yuba River Studies Program is a CALFED-funded, multi-disciplinary investigation of the feasibility of introducing anadromous fish species to the Yuba River system upstream of Englebright Dam. Englebright Lake (Figure 1) is a narrow, 14-km-long reservoir located in the northern Sierra Nevada, northeast of Marysville, CA. The dam was completed in 1941 for the primary purpose of trapping sediment derived from mining operations in the Yuba River watershed. Possible management scenarios include lowering or removing Englebright Dam, which could cause the release of stored sediments and associated contaminants, such as mercury used extensively in 19th-century hydraulic gold mining. Transport of released sediment to downstream areas could increase existing problems including flooding and mercury bioaccumulation in sport fish. To characterize the extent, grain size, and chemistry of this sediment, a coring campaign was done in Englebright Lake in May and June 2002. More than twenty holes were drilled at 7 different locations along the longitudinal axis of the reservoir (Figure 4), recovering 6 complete sequences of post-reservoir deposition and progradation. Here, a longitudinal cross section of Englebright Lake is presented (Figure 5), including pre-dam and present-day topographic profiles, and sedimentologic sections for each coring site. This figure shows the deltaic form of the reservoir deposit, with a thick upper section consisting of sand and gravel overlying silt, a steep front, and a thinner lower section dominated by silt. The methodologies used to create the reservoir cross section are discussed in the lower part of this poster.

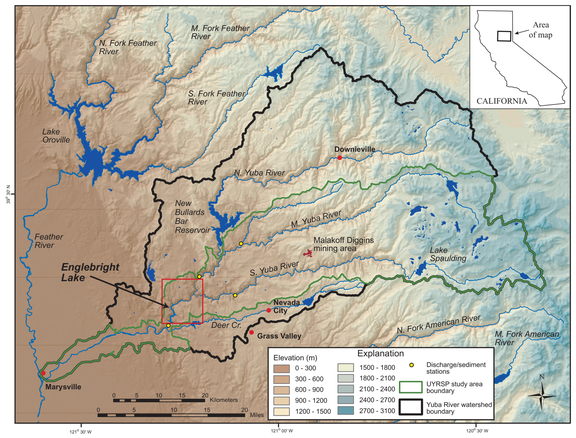

Figure 1. Elevation and hillshade map showing Englebright Lake and the surrounding Yuba River watershed. The Yuba River is a major tributary of the Feather River in the Sacramento River system. Also included is the Upper Yuba River Studies Program (UYRSP) study area boundary. The red box shows the region found in Figure 4.

Figure 2. Hydraulic mining of gold-bearing Eocene gravel deposits was done in the northern Sierra Nevada from about 1852 until the Sawyer Decision prohibited discharge of mining debris in 1884. One of the largest mines was Malakoff Diggins in the South Yuba watershed (Figure 1). This mining activity intoduced a large quanity of sediment into the rivers of the Sierra Nevada and San Francisco Bay (Gilbert, 1917). This picture was taken circa 1860 (Alpers and Hunerlach, 2000).

Figure 3. Englebright Dam was built on the Yuba River in 1941 by the California Debris Commission (part of the U.S. Army Corps of Engineers). Its primary purpose was to help mitigate flood risk around Marysville by impounding hydraulic-mining sediment in the Sierra Nevada foothills. The reservoir is now a recreation area and a source of hydroelectric power generation.

SUMMARY

- Englebright Dam is on the Yuba River, the site of extensive hydraulic gold mining in the 19th century.
- The goal of the UYRSP is to assess the feasibility of restoring anadromous fish passage to the upper Yuba River system.
- To map and characterize the sediments stored behind Englebright Dam, the USGS has done extensive surveying and sampling of the impounded material.

⇨Here we present a cross-sectional portrait of the reservoir sediments, and explain how the figure was produced by integrating historic, field, and laboratory data sets.

ACKNOWLEDGMENTS: Numerous people from the USGS, DOSECC, Inc., and the University of Minnesota helped in the field and laboratory efforts for this project. This poster benefited from reviews by Charles Alpers and Eric Grossman. This research was funded in part by the CALFED (California Bay-Delta Authority) Ecosystem Restoration Program.

REFERENCES

Alpers, C.N ., and Hunerlach, M.P., 2000, Mercury contamination from historic gold mining in California, U.S. Geological Survey Fact Sheet FS-061-00.

Childs, J. R., Snyder, N., P., Hampton, M.A., 2003, Bathymetric and geophysical surveys of Englebright Lake, Yuba-Nevada Counties, CA, U.S. Geological Survey Open-File Report 03-383.

Gilbert, G.K., 1917, Hydraulic-mining debris in the Sierra Nevada: Washington, U.S. Geological Survey Professional Paper 105, 154 p.

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ENGLEBRIGHT LAKE CROSS SECTION

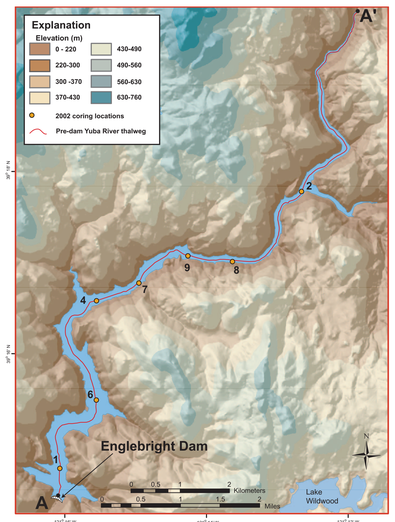


Figure 4. Hillshade and elevation map of Englebright Lake. The seven drilling sites of the 2002 coring campaign are shown as well as the main channel (or thalweg) of the pre-dam river digitized from topographic maps. Figure 5 profile transects follow the main channel from A to A'.

FIGURE 5. ENGLEBRIGHT LAKE CROSS SECTION: LONGITUDINAL TOPOGRAPHIC PROFILES AND VERTICAL GRAIN-SIZE DISTRIBUTION SECTIONS

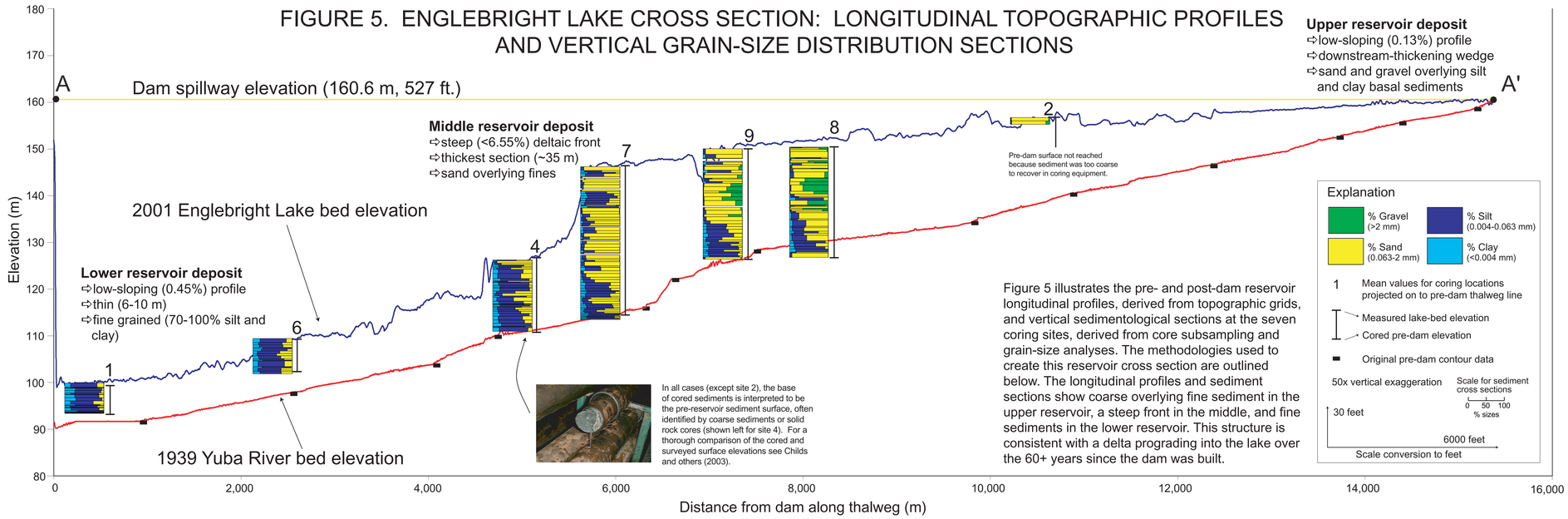
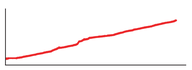


Figure 5 illustrates the pre- and post-dam reservoir longitudinal profiles, derived from topographic grids, and vertical sedimentological sections at the seven coring sites, derived from core subsampling and grain-size analyses. The methodologies used to create this reservoir cross section are outlined below. The longitudinal profiles and sediment sections show coarse overlying fine sediment in the upper reservoir, a steep front in the middle, and fine sediments in the lower reservoir. This structure is consistent with a delta prograding into the lake over the 60+ years since the dam was built.

ENGLEBRIGHT LAKE CROSS SECTION

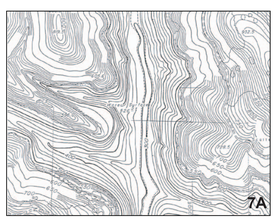
CROSS SECTION METHODOLOGIES

LONGITUDINAL PROFILES



1939 River Bed Elevation

The pre-dam reservoir topography was created using digitized contours from the U.S. Army Corps of Engineers map of the study area (Figure 7). The contours were then interpolated to create a digital grid.



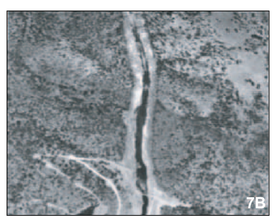
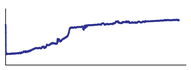


Figure 7. The pre-dam topographic map (A), and U.S. Forest Service aerial photograph (B), both from 1939. These figures show the region just upstream of the future dam location.



2001 Lake Bed Elevation

The present-day lake-floor surface was mapped during an acoustic fathometer survey in May 2001 (Figure 8). These data points were then interpolated to a continuous digital grid.

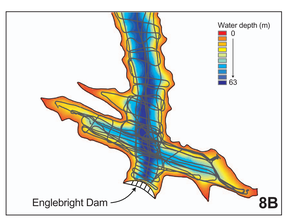


Figure 8. May 2001 acoustic fathometer survey on Englebright Lake (A), and lake-floor elevation grid overlain with the acoustic fathometer survey lines (B).

Please refer to **Bathymetric and geophysical surveys of Englebright Lake, Yuba-Nevada Counties, CA** (Childs and others, 2003), U.S. Geological Survey Open-File Report 03-383, for more information regarding data collection, gridding, analysis, and metadata (http://geopubs.wr.usgs.gov/open-file/of03-383).

ENGLEBRIGHT LAKE SEDIMENTOLOGY AND STRATIGRAPHY

Englebright Lake Coring Project

In May and June 2002, scientists from the USGS and the University of Minnesota joined a crew from the DOSECC (Drilling, Observation and Sampling of the Earth's Continental Crust) research drilling company for a campaign on Englebright Lake. Most of the cores were taken using hydraulic piston coring equipment.

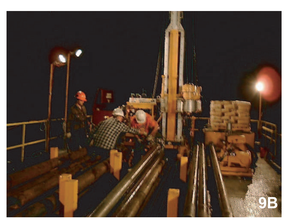
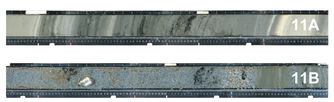


Figure 9. The DOSECC drilling rig on Englebright Lake in May 2002 (A), and the coring operation at night (B). During the coring campaign more than 300 m of sediment was collected from 7 locations in the reservoir (Figure 4).

Laboratory Analysis of Cores

Cores were analyzed in the USGS Coastal and Marine Geology Team facility in Menlo Park, CA starting in June 2002. Processing began with multi-sensor logging (P-wave velocity, bulk density, magnetic susceptibility) and splitting. The cores were then photographed and described (Figure 10, left).

Figure 11 (right) shows examples of typical silt and clay (A), and sand and gravel (B) dominated cores, respectively.



After splitting, the cores were subsampled at various intervals for grain size, water and organic content, mercury and methylmercury concentration, and geochronology (to be reported separately). Figure 12 (left) shows a technician placing a prepared grain-size subsample into the laser particle-size analyzer. Some of the results of this analysis are shown in the sediment sections on Figure 5.

CROSS SECTION METHODOLOGIES