Figure S1. Aerial photo of the study area at Hance Rapid. Seismic and infrasonic recording location is indicated by the black triangle (Lat. 36.0457, Lon. -111.9214). The site is 38 meters from the channel boundary at low discharge (about 240 m^3/s), and about 100 m downstream from the Red Canyon confluence. Aerial photo taken in May 2009 (www.gcmrc.gov). Local channel width varies from 45 – 100 m. The drainage area of the Red Canyon tributary is 11 km^2 and the drainage area of the Colorado River upstream of Hance Rapid is about 335,000 km^2, however about 290,000 km^2 of this drainage area is upstream of Glen Canyon Dam (Pederson and Tressler, 2012). The average gradient in this section of Grand Canyon, which incises Proterozoic Supergroup rocks, is 0.0022 m/m (Pederson and Tressler, 2012). Stream gages are located 27 km upstream (#09383100) and 16 km downstream (#09402500), and the data are available at www.gcmrc.gov. During peak CFE discharge <1% of discharge came from tributaries so the gage records primarily reflect dam output. Linear interpolation of the upstream and downstream gage records is subject to error on account of attenuation of the CFE discharge peak as it travels downstream, but the consistency of the hydrograph shapes from the upstream and downstream gages (which are both >100 km downstream of the dam) indicates that errors in discharge estimates at Hance Rapid are too small to affect the results reported here.

Reference:
Pederson J.L., Tressler C. (2012), Colorado River long-profile metrics: The hunt for knickzones and their meaning: Earth and Planetary Science Letters, v. 345–348, p. 171–179, doi:10.1016/j.epsl.2012.06.047.

Figure S2. Comparison of raw and residual vertical seismic spectrograms. Correlation between power and discharge is visible in the raw spectrogram, but difficult to see compared to the residual spectrogram because of the large range in background power levels between 0.3 – 100 Hz at the study site. In particular, a constant spectral peak is observed in the raw spectrogram at ~17 Hz. This likely represents a quarter-wavelength resonance that is commonly observed for seismometers on thin sedimentary layers overlying bedrock [e.g., Hough et al., 1992]. The 17 Hz maximum would be consistent with a shear velocity of 500 m/s and alluvial thickness of 8 m. Exact alluvial thickness beneath the site is not known, but the site elevation is about 10 m higher than nearby bedrock exposures, thus values mentioned above are reasonable approximations of the local structure. After subtracting the median spectrum during low discharge (200 – 240 m^3/s) prior to the CFE, such site effects are normalized out, and the spectral response to discharge variations is more readily visible.

Reference:
Hough, S. E., L. Seeber, A. Rovelli, L. Malagnini, A. DeCesare, G. Selvaggi, and A. Lerner-Lam (1992). Ambient noise and weak motion excitation of sediment resonances: results from the Tiber Valley, Italy, Bull. Seism. Soc. Am. 82,1186 –1205.

Figure S3. Residual horizontal seismic spectrogram and data gaps during the CFE. Horizontal represents the mean of the north and east spectra. Times of anomalously low power correspond to glitches in recording for the east channel, and these time segments were excluded from the estimates of the horizontal spectrum shown in Figure 3. The two black dashed lines label the specific time periods that were excluded from calculation of the median spectrum during the plateau phase of the CFE. In order to allow comparison between the horizontal and vertical spectra during the plateau phase, these time segments were omitted for estimation of both horizontal and vertical 'plateau' spectra presented in Figure 3. The data gaps represent less than 10% of the plateau phase so the median power spectrum presented in Figure 3 still provides a good representation of the signal during sustained peak discharge.