**Supplementary Figures**

S1: Topography of the Lake Quinault catchment from a 30 m DEM. Mass wasting and hillslope sediment delivery to channels is common upstream from the lake, as attested to by the distribution of shallow soil (yellow) and deep-seated bedrock (red) landslides compiled from an aerial photography inventory spanning the years 1939-1998 (Quinault Indian Nation, 1999). None of these 684 landslides were seismically triggered.

S2: Scenario shaking models depicting modified Mercalli intensity values (MMI) for representative earthquake source regions for northwest Washington State (U.S. Geological Survey, 2016) with the potential to induce both lacustrine and subaerial slope failure in the Lake Quinault catchment

S3: Evidence from seismic tracklines 42 (upper) and 27 (lower) for ongoing venting of gas from Lake Quinault sediments. Note strong reflectors in the sediments beneath the vents indicating a marked contrast in acoustic impedance and suggesting the presence of free gas. Sediment depth was calculated for an acoustic velocity of 1500 m s-1.

S4: Age-depth model for core 2 constructed using the IntCal13 calibration curve (Reimer et al., 2013) and the Bayesian modelling software Bacon (Blauuw and Christen, 2011). The calibrated 14C dates are shown in purple (pre-AD1950) and green (post-“modern” dates). Red line denotes the weighted mean age model and dotted gray lines indicate 95% confidence intervals of the modelled dates. Dark gray shading indicates likely ages, whereas lighter gray shading indicates less likely ages within the confidence limits.

S5: Bioturbation in Core 3, assessed using a visual index similar to that of Droser and Bottjer (1986) wherein a value of 1 denotes sediments that are physically stratified, with an absence of biogenic structures, and a value of 5 corresponds with thoroughly bioturbated sediments, in which evidence for physical stratification has been completely obliterated. Photos from core 3 are shown as examples of various degrees of bioturbation.

S6: Correlation of flood layers in a portion of the cores from the lake center to the delta slope.

S7: Photo of a cluster of red-brown, graded silt beds that lies at a cumulative depth of roughly 430-418 cm in cores 1 and 2 and records the Q3 disturbance event in Lake Quinault.

S8: Photo of deformed interval in core 2, inferred to record the Q2 disturbance event in Lake Quinault. The boundary between seismic facies A and B (see Figure 3) is correlated to the boundary between this interval and the overlying cluster of graded silt-clay beds, at about 38 cm depth in the core segment shown in the photo, and a cumulative depth of about 190 cm in the core.

S9: Data from core 1 showing vertical trends in magnetic susceptibility, the ratio of incoherent to coherent x-ray scattering (a proxy for density), and color (L\*=lightness, a\* = redness). Note abrupt shifts in these parameters at the boundary between Seismic Facies A and B (dashed horizontal line).

S10: Correlation of the most recent river flood deposit sampled in gravity cores from Lake Quinault. Based on average sediment accumulation rates and on calibration of a radiocarbon age for the layer at site 5 to the post-bomb calibration curve (Hua et al. 2013; Table 2), this layer could be the product of a large March 1997 river flood with a calculated recurrence interval of 100 years based on Quinault River gauging records of mean daily discharge collected since 1911.