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Releasing sediments while reconnecting rivers: how do channels respond and how long does it take?

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Sediment management is an important aspect of river reconnection projects, often driving costs and influencing community acceptance. At sites with uncontaminated sediments, downstream release is an attractive option because it is often the cheapest and most practical approach and the sediment can be ecologically beneficial to downstream areas deprived of it for years by the dam. To employ this option, project proponents must estimate the sediment quantity to be released and, if substantial, estimate how long it will take to erode, where it will go, and how long it will stay there. We investigated these issues for sediments released by the 2018 removal of Bloede Dam on the Patapsco River in Maryland, USA. The dam was about 10 m high and its impoundment filled with sand and mud. Taking the surface elevations of these sediments surveyed immediately before removal and subtracting estimates of the pre-dam valley elevations derived from 21 cores and post-removal surveys of exhumed pre-dam surfaces, we estimate there was approximately 186,600 m³ of stored sediment composed of 70% sand and 30% mud. These proportions match estimates made during pre-removal engineering studies, but our total stored sediment estimate is about 20% less. The difference between estimates reflects a real change in stored sediment quantity between 2018 and 2012 when the engineering studies were completed, additional data available to us after removal, and different estimation methods. After removal, using elevation surveys generated by traditional methods as well as UAS-based aerial imagery and structure-from-motion (SfM) at high temporal resolution, we documented rapid erosion of the stored sediments in the first six months (~60%) followed by greatly reduced erosion rates for the next couple of years. A stable channel was developed in the impoundment during the rapid erosion phase. These results are similar to a two-phased erosion response reported for sediment releases at dam removals around the world across a range of dam and watershed scales, indicating what practitioners and communities should expect when reconnecting rivers in similar settings. Downstream, repeat surveys combined with discharge and sediment gaging show rapid transport of eroded sediments through a 5 km reach, especially during the first year when discharges were above normal, and little overbank storage.

