

## Let's dump beach sand into the Grand Canyon

**By: Mikeala Provost**

Sand is one of those things that can get into everything, especially after a long beach day. Sand is super abundant: it's the main ingredient in concrete, glass, and brick, we use to cover icy roads, landscape golf courses, and of course beaches and riverbeds are covered with it. Despite the world's abundance of sand, the Grand Canyon is in desperate need of a lot of sand, soon.

Sand seems mundane to the common eye. But these tiny little specks are responsible for carving giant landforms as large as yellow school buses and sometimes as long as a multi-story building. Along the Colorado River, flowing through the Grand Canyon in northwestern Arizona, giant rock formations line the edges of the river giving the river its unique character and personality that attracts river rafters from all over the world.

Think of these landforms as "building blocks" of rivers. And each landform is associated with a river process, or 'function' in other words. Landforms can create rapids, pools, riffles, sometimes 'runs' where the river flows pretty straight, or slow meandering curves or tight hairpin turns. From a geologist's perspective, the relationship between landform and function (e.g., creating rapids or pools) can be used to interpret and help understand river behavior.

Why would anyone want to know more about river behavior? Well Jason Wiener, a University of California, Davis graduate student, explains that when rivers are dammed landforms no longer create the same function and this becomes a huge problem for maintaining natural river habitat, but also for those of who like to raft and enjoy the river up close.

The Colorado River, once a wild beast that was thought never to be tamed by humans, is now relatively slow and shallow. Hundreds of dams have been built throughout the entire Colorado River Basin, but it is Glen Canyon Dam and the Hoover Dam that box in the Grand Canyon. The Colorado River flowing through the Grand Canyon is no longer the river it once was. Pre-dam flows peaked with spring snowmelt floods and sediment, that is the sand carried in the water, was also variable. Large amounts of sand were carried from upstream as floods gorged through the canyons. But today, only 6-16% of the sand that once flowed now passes through the canyon since most sand builds up behind dam walls. The sand that flows comes from other river that feed into the Grand Canyon, the Paria and Lower Colorado Rivers.

So, why should we care about less sand (or sediment) flowing through the Grand Canyon? Consider how sandpaper works to smooth out surfaces, scraping and scouring. Rivers that carry sand do the same thing to the riverbed and walls of the canyon. Soft rocks are eroded away and degraded. After long periods of time, sand carves away to create landforms, the building blocks that define a river. Jason Wiener explained that these building blocks, landforms, end up having a very specific spatial organization.

Aerial photos show a peculiar pattern along the river. First a rapid, water jets through a narrower section of the river, then a pool forms just below the rapid as the river widens. And then, in this pool, a recirculation eddy forms – where water circles back on itself. All along the Colorado River through the Grand Canyon this pattern repeats: rapid, pool, eddy. What causes the river to narrow to create such a rapid? Well, in the Grand Canyon where the walls are nearly vertical, most of the time it is a boulder or

large debris left after earlier floods that makes the canyon narrower. It is almost like a mini dam has been formed by the boulder which means sand begins to fill up behind the boulder as it runs against the boulder. The accumulation of sand behind the mini-boulder dam (which looks like a fan of sand materials) slows flows upstream so that a pool is created. Once water is forced to pass through the constricted part of the river, flow increases but as water exits out of the rapid, the area of flow widens and deepens. This strong jet of water scours out a deep pool and this is where the recirculating eddy forms, next to the jet of water pushing through the rapid.

This pattern of rapid, recirculating eddy, pool is known as a Fan-Eddy complex explained Jason Wiener. And it is these complexes that make up the basic landform in the Grand Canyon. Unfortunately, since sediment flow is very low since dams have been built, rapids have intensified as Fan-Eddy complexes become more permanent features with no heavy sediment flows to scour them out in high floods. Less sand also means it is harder to have sandbars, which are critical camp areas for rafters.

It seems that sand, in the Grand Canyon, is in high demand. Next time you visit the Colorado River consider dumping a small handful of sand into the water. It's not often that scientists are scrambling to find ways to dump a whole lot of sand into a river.