Trails, Sediment, and Aquatic Habitat:

McLean Creek

By Logan Boyer

It was mid-May and fresh snow blanketed the ground as I walked along McLean Creek searching for potential sediment sources. A strange bleating sound emanated from waters beside me, drawing me toward the creek. As I came to the edge of the bank, I finally saw the source of the unusual noise; a moose calf was trapped by the steep banks and unable to move in the cold waters. Thankfully, he was very young and I was easily able to pull him to dry land. There he barely had enough strength to attempt to stand up and fell to his knees again. Eventually, he was able to stand for a brief moment and I knew he would recover his strength. His mother's presence on a distant ridge urged me to move on and let nature take its course.

For moose, beavers, and many bird species, the wetlands and forests surrounding McLean Creek provide a suitable habitat despite the constant drones of OHVs, dirt bikes, and large trucks nearby. The same cannot be said, however, for fish populations in McLean Creek. Trail erosion from the off-highway vehicle (OHV) trails provides significant levels of total suspended sediments (TSS) in McLean Creek. These sediments negatively affect fish feeding, behaviour and physiology, and has lethal effects on their eggs and larvae. Increased TSS also reduces water quality as sediments act as substrates for bacteria. This incurs costs to downstream water treatment plants which require removal of sediments.

Working under the supervision of Dave Mayhood, an experienced aquatic ecologist, we studied TSS loading from OHV trails and roads into McLean Creek over a three-month field sampling period (May to July, 2017). Located in the foothills of the Rocky Mountains, McLean Creek is a Public Land Use Zone (PLUZ). Apart from its network of OHV trails, this PLUZ is open to logging, gas development, livestock grazing, and camping. We were able to verify a total of 113 sediment sources in the McLean Creek watershed, with a large portion of them being at moderate to high risk for sediment delivery to the creek due to large areas of erosion, steep slopes, and direct run-off into McLean Creek. Sources include official/designated OHV trails, gravel roads, pipeline access and cut lines – all provided run off into McLean Creek. The length of linear disturbance (130km) within the watershed was significant, over 2.5 times larger than the length of the watercourse. The density of linear disturbances (4.3 km/ km^2) was the highest we recorded among the 105 small southwest Alberta watersheds we assessed. Trails and roads do not provide any mitigation measures despite the large risk of sediment loading into the creek they present. Even at the single OHV-bridge across McLean Creek, which reduces stream crossings, pools of muddy run-off accumulate on the bridge and pour into the creek as vehicles drive over them. It appeared as if the

East McLean Creek headwaters; likely the largest sediment source to McLean Creek and a common area for mudding. PHOTO: © L. BOYER

An OHV trail capturing stream flow of West McLean Creek
PHOTO: © L. BOYER

Water quality differences in a McLean Creek tributary upstream and downstream of a gravel road. PHOTO: © L. BOYER

quality of McLean Creek waters had been sacrificed completely for recreational use.

Throughout the early months of sampling McLean Creek ran with a colour akin to a creamy coffee, as snowmelt and rainfall eroded the various dirt trails. We observed significant increases in TSS during precipitation events, with an average threefold increase of TSS concentrations downstream of sampled sediment sources. A striking example of sediment delivery was at a trail crossing near the headwaters of McLean Creek, where I could observe crystal clear waters meeting muddy trail runoff, increasing the TSS concentrations a hundredfold. The clear, unaffected waters only flowed for a quarter-kilometre, with the entirety of the creek downstream looking an opaque brown. This crossing is also a popular spot for mudding, as I witnessed multiple vehicles stuck in the mud there. This further exacerbates the sediment loading problem.

Although there have been no recent fish surveys in McLean Creek, a survey completed prior to OHV use in 1978 found small numbers of brook trout, bull trout, longnose dace and white suckers. Bull trout are of special interest as they are listed as a threatened species and are likely to have smaller populations where roads and trails are dense, if they even exist in McLean Creek anymore. The TSS levels we observed in McLean Creek during our study were enough to produce a 40 to 60 percent mortality rate for the eggs and larvae of spring spawning fish. Despite generally low concentrations of suspended sediments, the exposure duration of eggs and larvae to suspended sediments during key developmental periods makes it detrimental. On top of the fish habitat impacts, we determined that McLean Creek contributed around 12 to 14 tonnes of suspended sediment to the Elbow River during our brief study period. This contributes far more sediment than expected given the size of the watershed area. These estimates seem high given the fact that a reservoir lies at the downstream end of all sediment sources affecting McLean Creek. In theory this reservoir should settle out sediments before they their way into the Elbow River. This did not seem to be the case. The TSS contributions to the Elbow River are therefore fine particles which can be carried long distances, and potentially incur additional costs to downstream water treatment facilities.

Trucks and OHV's frequent McLean headwaters for mudding
PHOTO: © L. BOYER

McLean Creek may be an extreme example of rampant trail erosion and sediment delivery due to OHV trails and roads, but it underlines the impacts poorly designed trail systems will have in sensitive watersheds. Sediment loading could be greatly reduced if the trail systems in McLean Creek were improved. Adding sediment traps and fences, cross ditching, and closing highly erodible trails are examples of the improvements this badly damaged watershed requires.

Logan Boyer is a biologist and recent graduate of the University of Calgary who has a passion for all things outdoors and maintaining the natural setting of the Rockies.