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Agency of Natural Resources

Memorandum

TO: Jeff Crocker, River Ecologist
Eric Davis, River Ecologist

FROM: Lael Will, Fisheries Biologist

DATE: 10/26/2015

SUBJECT: Ball Mountain White Water Release

It is well known that impoundments and their associated dams can have detrimental impacts to water quality and aquatic habitats by altering the physical, chemical, and biological processes within, as well as downstream of the waters that they impound (Baxter 1977). With respect to regulated rivers, maintenance of the natural flow regime has often been the focus for managers as flow is a major determinant of the physical habitat in rivers and is a key driver for conserving biological resources native to these river ecosystems (Bunn and Arthington 2002). For example, aquatic species have evolved life history strategies that are in direct response to the natural flow regime. The impacts of altered flow regimes are evident across broad taxonomic groups including riverine plants, invertebrates, and fish (Bunn and Arthington 2002).

The Agency has recognized the value of managing regulated rivers to mimic the natural flow regime while incorporating the needs of other users (e.g. flood control). As such, the Agency and the Army Corps of Engineers (Corps) have historically worked collaboratively to develop outflow guidance for each project in Vermont that established conservation flows and ramping rates intended to protect aquatic resources. The outflow guidance for each project is based on best available information in order to meet water quality standards and other state environmental laws, and to fulfill the Corps mission of flood control. The overall goal of the adaptive management process that the Corps, Agency, and the U.S. Fish and Wildlife Service have been involved in over the past decade is to adopt and expand opportunities for run-of-river operation at District flood control dams that would protect the aquatic resources and meet requirements under the federal Clean Water Act.

In regards to whitewater releases at Ball Mountain Project on the West River, the current outflow operations for whitewater releases were developed in 2003 in order to reduce the environmental impact of whitewater releases and to better protect aquatic resources. The outflow guidance defines acceptable ramping rates, and overnight flows during these events. Time-shift releases have not been promoted.

While native biota are well adapted to natural high flow events, the duration, frequency, timing and magnitude at which they occur can cause negative impacts (Young et al. 2011). It has been well documented that erratic changes in flows without providing appropriate base flows and

ramping rates can have negative consequences to aquatic resources. The literature documents a reduction in species richness of benthic macroinvertebrates, reduction in standing crop of benthic macroinvertebrates, and stranding and displacement of macroinvertebrates and fish (Bunn and Arthington 2002) due to rapid flow fluctuations.

Over the course of 35 years, researchers have observed effects on fish at all life stages which have consequently affected fish populations (Young et al. 2011). In addition to stranding and displacement of fish, high flow fluctuations can cause behavioral changes in spawning activity, nest dewatering, nest scouring, and reduced survival and growth of juvenile fishes (Young et al. 2011). Juvenile fish are most vulnerable to due to weak swimming ability and typical habitat preference (Young et al. 2011). It should be noted that stranding of juvenile sized fish was observed in the West River after the two-day whitewater release in 2014.

Storing of water and reducing adequate base flows poses additional impacts to aquatic resources. Storing of water leads to a reduction in stream flow than would naturally occur. This was evident during the 2014 white water release where flows were well below the 62 year median for weeks prior to the release (Figure 1). These abnormal low flow conditions can pose added stress to fish (e.g. trout), during a time that they are particularly sensitive. Providing adequate base flows which mimic the natural hydrograph is recommended to insure that aquatic resources are provided with the necessary habitat to meet their biological needs.

Impoundments are known to cause elevated water temperatures (Lessard and Hayes 2003) within the impoundment as well as the receiving waters below. Lessard and Hayes (2002) found that increased temperatures downstream of an impoundment coincided with lower densities of several cold-water fish species, specifically brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*) and slimy sculpin (*Cottus cognatus*). Storing of water prior to a release likely exacerbates the thermal impacts and should be avoided.

Overall, the Department has concerns regarding the Corp's recent management of flows to provide white-water kayaking opportunities. The storage of water and rapid flow fluctuations are not consistent with the Agency's long standing position of managing regulated rivers to mimic the natural flow regime. We recommend that the Agency re-iterate these concerns to the Corps with the goal of moving back towards the original agreement.

If you require more clarification or have any questions regarding these recommendations, please do not hesitate to contact us.

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Literature Cited

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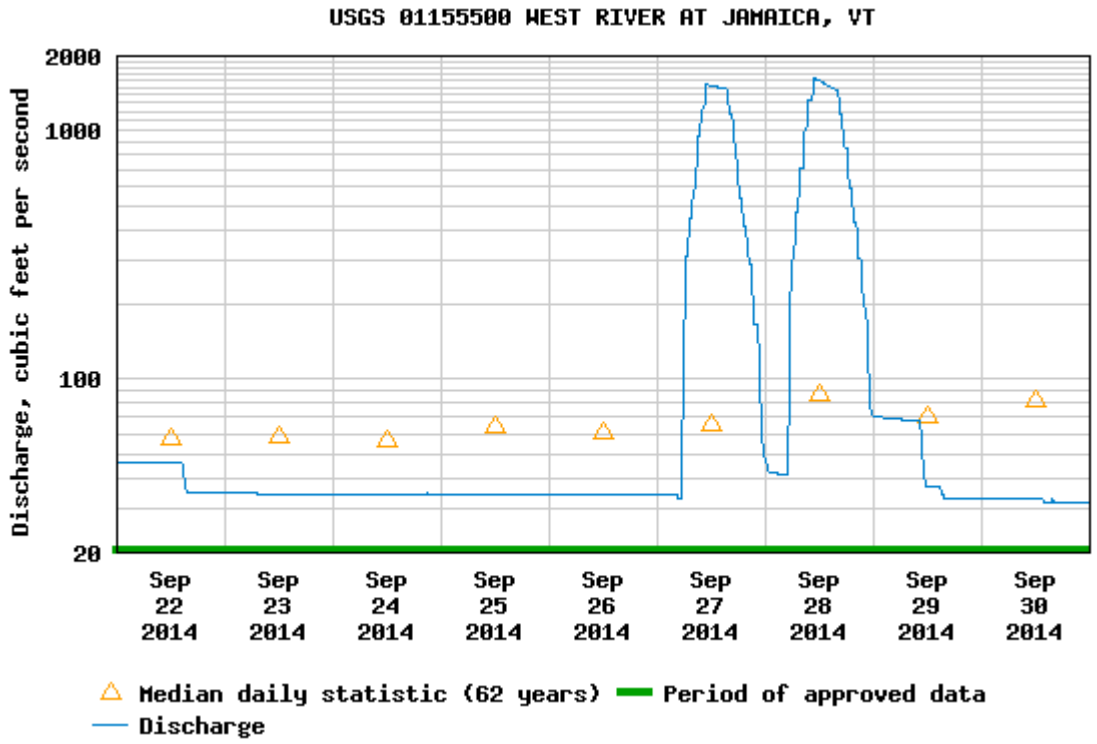
Discharge, cubic feet per second

Most recent instantaneous value: 69 10-06-2015 09:30 EDT



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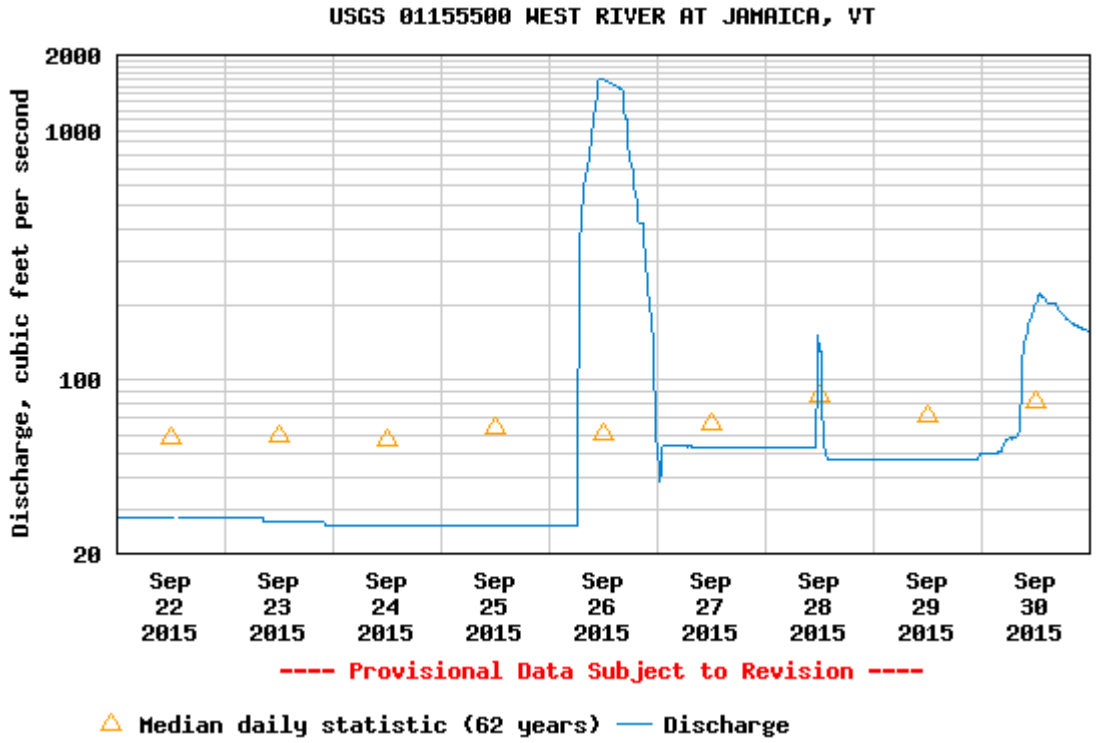

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