

## Laboratory Testing to Optimize Retention Time in Auto-Flushing Limestone Beds<sup>1</sup>

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**Abstract:** Auto-flushing limestone beds (AFLB) have been presented as an innovative solution to the widespread problem of armoring and clogging of traditional, flow-through limestone beds. A baffled limestone bed was constructed in 2012 to treat the Puritan discharge outside of Portage, PA. Plans are in place to retrofit the current system through the addition of AFLB. In order to determine if AFLB would result in improved water quality and to determine the optimum retention time for metals and acidity removal and alkalinity generation, bucket tests were conducted in spring 2018. A total of eight bucket tests were conducted, each in triplicate. Time which water was in contact with the limestone prior to flushing and settling was varied in each test, ranging from 4 to 24 hours. After the first settling period, each test was run again to simulate a second limestone bed. Alkalinity and pH were measured immediately at the end of each contact or settling period and acidity and dissolved Fe, Al, and Mn samples were collected. Average pH of the influent was 3.03 and average acidity and alkalinity were 110 mg/l and 0 mg/L, respectively. Average dissolved Fe, Al, and Mn were 5.29 mg/L, 10.7 mg/l, and 1.34 mg/L, respectively. All bucket tests were effective at removing Fe to below the detection limit (0.10 mg/L) and Al to an average 0.12 mg/L. Mn removal was mostly negligible, with noticeable removal in two of the longer duration tests. All acidity was neutralized and pH raised to an average of 5.91 within the first contact period in all bucket tests, with additional improvement during the second contact period. The majority of alkalinity was generated during the first contact period, with more generated during the second. Tests where all water was added at the beginning of the contact time resulted in better water quality than tests where water was added gradually throughout the contact time. Although longer retention times generally resulted in improved water quality, results may exceed water quality criteria such that a shorter retention time may be sufficient. These results will be used to aid in the design of the improved Puritan treatment system.

**Additional Key Words:** bucket test, acid mine drainage, alkalinity, acidity.

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