Bench-Scale Sediment Geotextile Dewatering Treatability Study and Weep Water Treatment Design

Huan Xia, Ph.D. (hxia@langan.com), Lingke Zeng (lzeng@Langan.com), Elle Anzinger, Sean Damon, P.G., Stewart Abrams, P.E., and Steve Ueland, P.E. (Langan Engineering, Doylestown, PA, USA)

Background/Objectives. In support of a sediment remediation effort involving hydraulic dredging and capping at a site in New Jersey, we conducted a bench-scale treatability study to evaluate the feasibility of geotextile dewatering of the sediment, identify the preliminary design criteria, evaluate potential weep water treatment technologies, and develop a preliminary design of a full scale geotextile dewatering process for the heavy metal impacted sediment at the site. Current estimates involve sediment volumes ranging from 20,000 to over 100,000 cubic yards, depending upon the final remedy approach.

Approach/Activities. Sediment samples were collected and a baseline characterization was conducted. Various coagulant/flocculant combinations and geotextile fabrics, provided by various vendors, and jar tests were performed to evaluate 1) the effects of sediment solids contents on floc formation, 2) effect of flocculant dosage on floc formation and 3) performance among different coagulant/flocculants. The selected superior coagulant/flocculant combination was further tested in bench-scale geotextile dewatering bags to assess 1) the effect of sediment solids contents in dewatering efficiency, 2) to compare performance between different geotextile fabrics, and 3) to identify the waste profile of the filter cake and weep water. In order to treat the weep water to meet applicable discharge standards, a bench scale flow-through column system proportionally representative of a full scale treatment system was designed and consisted of treatment units, including a multi-media filter, granulated activated carbon (GAC) and organoclay. The removal effectiveness of metals, suspended solids, and semi-volatile organic chemicals (SVOCs) in weep water by each treatment unit was evaluated against the discharge standards. The appropriate water treatment technology was identified and the dimensions of the geotextile tubes and laydown area were estimated for full-scale operation.

Results/Lessons Learned. The floc size positively correlates with the sediment solids content (up to 10% solids content), but no apparent floc formation was observed with solids content of above 15%. Four different flocculants exhibited varying performances in floc formation and the optimal dosage was determined to vary for each flocculant. The floc formation positively correlates with flocculant dosage, but no appreciable improvement in floc size or settleability was observed above a certain level. Geotextile fabric characteristics had a major impact on dewatering rate: a stronger and more tightly woven texture lead to a decreased dewatering rate, but improved water quality (e.g., with lower suspended solids content and total metal levels). Dewatering pressure with approximately 1 pound per square inch also facilitated the dewatering process significantly. Dewatering rates generally decreased with increased sediment solids content: i.e., dewatering rate decreased by 50% when solids content increased from 6% to 10%. The initial filter cake solids content after dewatering were around 20%, which increased to 30% after one night's draining and up to 33% after another two nights' draining.

A bench-tested water treatment system using GAC, organoclay and multi-media filtration effectively removed heavy metals (above 90%) and SVOCs (above 70%) in the weep water, achieving the applicable discharge standard. The majority of the chemical impacts were associated with the solid particles in the weep water, which was removed primarily via a filtration cartridge. The required geotextile stackability and dewatering surface, as well as the dewatered

sediment tensile force and gravitational pressure (for geotechnical assessment) were estimated for a full scale operation according to the site conditions.