

RESEARCH INITIATIVES FOR DEVELOPING PASSIVE-TREATMENT TECHNOLOGIES FOR AMELIORATING ACID MINE DRAINAGE IN NEW ZEALAND

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Abstract: The challenging complexities associated with acid mine drainage treatment require logical, novel and practical interdisciplinary research approaches for understanding and optimizing appropriate passive-treatment technologies. The major focus of this research pertains to engineered wetland-type systems. Water chemistry and flow were monitored at numerous seeps at Stockton Mine, an active coal mine located in New Zealand, to find a site suitable for implementing pilot-scale engineered wetlands systems. Numerous seeps were eliminated as feasible candidate sites due to current or proposed mining activities, complex hydrogeology, topographical challenges, land space availability issues or water chemistry. The Manchester Seeps site was monitored for ten months and deemed a good candidate site for implementing sulfate-reducing bioreactors (SRBRs).

Substrate materials used in SRBRs were sourced mainly from industrial waste products including alkalinity generating and organic materials. Substrate materials were analyzed for various chemical and geotechnical properties including hydraulic conductivity. Mesocosm SRBRs operated for almost four months in a laboratory to determine system efficacy and optimize design criteria (see McCauley et al, this issue). Tracer studies and system autopsies were later performed. Pilot-scale systems were designed and constructed on site based on site-specific climatic and topographic characteristics using results of mesocosm tests. Pilot-scale systems incorporated a staged-treatment approach. The initial stage included a sedimentation basin to remove sediment that could potentially clog subsequent treatment stages. The second stage involved three SRBRs in parallel to test varying substrate mixtures and hydraulic configurations. The final treatment stage consisted of aerobic wetlands or iron floc settling basins in parallel for "final polishing" of SRBR effluent.

Additional Key Words: Sulphate-Reducing Bioreactors, SRBR, AMD, passive treatment, constructed wetlands, engineered wetlands, mine water treatment, Stockton Mine, tracer studies, system autopsies

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