

Remediation of a Former Oil Well, Leaking into a Freshwater Lake

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Background/Objectives. A light non-aqueous phase liquid (LNAPL), consisting of weathered crude-oil, had been seeping through the sediment, causing extensive sheening on a tributary to Bear Lake known as the Fenner's Ditch canal ("the Site:"). The sheening had been documented on Fenner's Ditch as early as 1978. The presence of this LNAPL sheen was impacting the local ecosystem and preventing local home owners from enjoying the benefits of the natural resources adjacent to their properties. On a broader watershed perspective, Fenner's Ditch is listed as a beneficial use impairment (BUI) for degraded aesthetics in the Muskegon Lake Area of Concern (AOC), and that the remedy will support the removal of this BUI.

Approach/Activities. While the actual source of the venting LNAPL was unknown, previous investigators had surmised that the source is a historic oil well formerly known as the Dolly Damm #4, which had been reported as abandoned in 1931. Venting may be occurring related to repressurization of the inactive Muskegon Oil field, and later modifications/dredging in Fenner's Ditch might have further exacerbated a preferential pathway for vertical migration of oil to the surface water. An investigation performed in 2010 indicated that the oil was migrating upward from depth and "daylighting" at a near-shore venting location. Later, in November 2016, TRC conducted a focused Remedial Investigation (RI) of the historical oil well, which included the investigation of the subsurface using both high resolution site characterization ("HRSC", i.e., optical imaging profiler) coupled with traditional soil and groundwater sampling methods. Work was performed both in the canal (via barge) and on the adjacent upland. The focused RI provided the necessary additional information on extents and provided analytical data to support final remedy selection. Based on the results of the RI, in January 2016 TRC, EPA and Michigan Department of Environmental Quality (MDEQ) completed a Focused Feasibility Study and selected the preferred remedy, an innovative capping system to contain and capture the NAPL. In 2017 the remedy was designed, and during the summer of 2018 the remedy was constructed.

Results/Lessons Learned. To address the continuing release of LNAPL to surface water, TRC designed and oversaw the installation of an innovative capping system with passive recovery captures LNAPL moving upward due to buoyant forces, as well as ebullition-facilitated transport. The basis of this design incorporated the results of investigations and bench-scale tests completed in 2017 using a Site-surrogate LNAPL, which were designed to evaluate LNAPL mobility, geometries, and collection within the capping system. The project was completed within five weeks in summer of 2018, and after a monitoring period, the cap and trap system has been shown to be effective. Field monitoring parameters (e.g., LNAPL thickness, methane and CO² measurements) indicate that the LNAPL is being contained and natural degradation of the oil is occurring within the system, as designed. The canal and shoreline at Fenner's Ditch has been restored and the community is able to enjoy this natural resource.