



## **Nitrate Remediation of Soil and Groundwater Using Phytoremediation: Transfer of Nitrogen Containing Compounds from the Subsurface to Surface Vegetation**

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The basic concept of using a plant-based remedial approach (phytoremediation) for nitrogen containing compounds is the incorporation and transformation of the inorganic nitrogen from the soil and/or groundwater (nitrate, ammonium) into plant biomass, thereby removing the constituent from the subsurface. There is a general preference in many plants for the ammonium nitrogen form during the early growth stage, with the uptake and accumulation of nitrate often increasing as the plant matures. The synthesis process refers to the variety of biochemical mechanisms that use ammonium or nitrate compounds to primarily form plant proteins, and to a lesser extent other nitrogen containing organic compounds.

The shallow soil at the former warehouse facility test site is impacted primarily by elevated concentrations of nitrate, with a minimal presence of ammonium. Dissolved nitrate ( $\text{NO}_3^-$ ) is the primary dissolved nitrogen compound in on-site groundwater, historically reaching concentrations of 1000 mg/L.

The initial phases of the project consisted of the installation of approximately 1750 trees, planted in 10-foot centers in the areas impacted by nitrate and ammonia in the shallow soil and groundwater.

As of the most recent groundwater analytical data, dissolved nitrate reductions of 40% to 96% have been observed in monitor wells located both within, and immediately downgradient of the planted area.

In summary, an evaluation of time series groundwater analytical data from the initial planted groves suggests that the trees are an effective means of transferring nitrogen compounds from the subsurface to overlying vegetation. The mechanism of concentration reduction may be the uptake of residual nitrate from the vadose zone, the direct uptake of dissolved constituent from the upper portion of the saturated zone/capillary fringe, or a combination of these two processes.