Development of the oil sands has led to increasing atmospheric N deposition, with values as high as 17 kg N ha-1 yr-1; regional background levels <2 kg N ha-1 yr-1. To examine responses to N deposition, over five years, we experimentally applied N (as NH4NO3) to a poor fen near Mariana Lake, Alberta, at rates of 0, 5, 10, 15, 20, and 25 kg N ha-1 yr-1, plus controls (no water or N addition). From 2011 through 2014, we quantified net N mineralization in each plot using the in situ buried polyethylene bag technique. Concentrations of initial KCl-extractable NH4+-N, NO3--N, and DIN in the top 10 cm of peat were unaffected by N inputs. We hypothesized that as N deposition increases to a level that exceeds the capacity of the fen vegetation to take up N, net N mineralization in surface peat would be inhibited by higher NH4+-N availability, net nitrification would be stimulated by higher NH4+-N availability, and concentrations of DIN in porewater at the top of the water table would increase, as DIN bypasses interception by the ground layer vegetation. None of these hypotheses was supported. Experimentally added NH4+-N and NO3--N apparently appear to be rapidly immobilized. This immobilization prevents experimentally added DIN from moving downward through the peat to the bog water table.