Time-resolved terahertz (THz) spectroscopy and open circuit photovoltage measurements were employed to examine the size-dependent charge carrier dynamics of tungsten oxide (WO$_3$) particles. Specifically, films of commercially available WO$_3$ nanoparticles (NP) and granular particles (GP) with diameters of 77 ± 34 nm and 390 ± 260 nm, respectively, were examined in air and also while immersed in 0.1 M Na$_2$SO$_4$ electrolyte. Examination of the frequency-dependent transient photoconductivity at short and long timescales demonstrated the presence of high and low mobility photoinduced charge carriers with comparable carrier densities. The presence of long-lived photoinduced charge carriers that contribute to surface chemistry are not detectable until the highly mobile carriers were trapped. Optical pump − THz probe (OPTP) measurements revealed that the majority of highly mobile photogenerated carriers are trapped within 50 ps after photoexcitation in both the NPs and GPs. However, for the NP sample in the presence of electrolyte, a non-negligible quantity of long-lived carriers (~2% of the total OPTP signal) were detected beyond 600 ps.