abstract As a pilot study to investigate the distribution of matter in the fields of powerful AGN, we present weak lensing observations of deep fields centered on the radio-quiet quasar E1821+643, the radio galaxy 3C 295, and the two radio-loud quasars, 3C 334 and 3C 254. The host clusters of E1821+643 and 3C 295 are comfortably detected via their weak lensing signal, and we report the detection of a cluster-sized mass concentration in the field of the $z = 0.734$ quasar 3C 254. The data for the 3C 334 field are so far inconclusive. We find that the clusters are massive and have smooth mass distributions, although one shows some evidence of past merger activity. The mass-to-light ratios are found to be moderately high. We discuss the results in light of the cooling flow and the merger/interaction scenarios for triggering and fuelling AGN in clusters, but find that the data do not point unambiguously to neither of the two. Instead, we speculate that sub-cluster mergers may be responsible for generating close encounters or mergers of galaxies with the central cluster member, which could trigger the AGN.