The reliable characterization of subsurface contamination of spatially extended contaminated sites is a challenging task, especially with an unknown history of land use. Conventional technologies often fail due to temporal and financial constraints and thus hinder the redevelopment of abandoned areas in particular. Here we compare two site screening techniques that can be applied quickly at relatively low cost, namely Direct Push (DP)-based groundwater sampling and tree core sampling. The effectiveness of both methods is compared for a rural megasite contaminated with chlorinated hydrocarbons. Unexpected pollution hot spots could be identified using both of these methods, while tree coring even enabled the delineation of the contaminant plume flowing into an adjacent wetland inaccessible for DP units. Both methods showed a good agreement in revealing the spatial pattern of the contamination. The correlation between groundwater concentrations and equivalent concentrations in wood was linear and highly significant for trichloroethene. Correlation was less obvious for its metabolite cis-dichloroethene, but still significant. As outcome of our study we recommend tree coring and for initial screening in combination with a DP sampling to retrieve quantitative data on groundwater pollutants in order to assess the contamination situation of a non- or only partly investigated site. The subsequent placement of monitoring wells for long-term monitoring of contamination levels is recommended. A combination of methods would achieve more relevant information at comparable or possibly even lower efforts in comparison to a conventional site investigation.