We present a study of exact solutions to the coupled system of Einstein–Maxwell equations for Robinson–Trautman and Kundt geometries with a cosmological constant in 2+1 gravity. We also consider an electromagnetic field without any charges or currents. The equations are fully integrated for the nonexpanding Kundt family of spacetimes which only admit an aligned electromagnetic field, and for the aligned Robinson–Trautman class. A special subclass of these solutions is then identified as the charged black hole spacetime in 3D gravity. The nonaligned Robinson–Trautman solution decouples into a separated system of differential equations for the metric and the electromagnetic field. We show that the Robinson–Trautman spacetime admits a nonaligned electromagnetic field by finding a simple particular solution to the equations. Furthermore, we develop a new method of algebraic classification of spacetimes in three dimensions based on the projections of the Cotton tensor onto a suitable null basis. We then show that this classification is equivalent to the Petrov classification of the Cotton–York tensor in 2+1 gravity.