Lower Cretaceous sediment was delivered to the McMurray Sub-Basin, probably via a continental-scale drainage system with headwaters in the Canadian Shield, Appalachians, and Cordillera of North America. Towards the mouth of the continental-scale drainage, a series of tributaries drained the Canadian Shield, although the number, scale, and position of tributaries is poorly constrained. Herein, the McMurray paleodrainage system is mapped from the main fairway east towards the sparsely drilled and erosionally truncated subcrop edge. Linear and exponential regression is then used to map the McMurray Fm to its theoretical eastern extent. Interpretations provided in this study indicates Assiniboia Valley, trunk valley of the McMurray Fm drainage, is not substantially wider than currently mapped, and the currently identified axis of Assiniboia Valley is accurate. However, the tributary network entering Assiniboia Valley from the Canadian Shield is complex with three main tributaries identified: Firebag, Buffalo River, and Choiceland tributaries.