Perfluorinated compounds (PFCs) have been manufactured and used in various industries including food packaging, paintings, and coating industries. Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) are the most commonly investigated PFCs that have bioaccumulative properties and a strong persistence in the environment. Despite the growing interest in using membrane technology to remove PFOA and PFOS from water, little information is available on the impact of natural water matrices on the removal of PFOA and PFOS when using nanofiltration (NF). The presence of natural organic matter (NOM) and cations (Ca²⁺ and Mg²⁺) in water matrices and their interactions with the PFCs may significantly impact their removal efficiency. The current study compared the rejection of PFOA and PFOS from laboratory-prepared water (deionized water), surface water and groundwater using a commercial NF membrane (NE 70). Three different experiments were conducted for 20 hours using a bench-scale flat sheet unit. Feed and permeate samples were collected and analyzed to determine the PFOA and PFOS concentrations using liquid chromatography-tandem mass spectrometry (LC/MS-MS). The compound rejections varied from 71 to 80% for PFOA and 42 to 80% for PFOS. The results showed increased rejection of PFOA/S in the surface water and groundwater when compared to the laboratory-prepared water. This is likely due to the presence of NOM and cations in the natural water matrices. The permeate flux declined (12.3% to 56.2%) as more cations and NOM were present in the feedwater, suggesting that the increased rejection of PFOS in natural waters was due to membrane pore blockage.