Table S.2. Potable water treatment options for nitrate management (adapted from WA DOH 2005).

	Ion Exchange	Reverse Osmosis	Electrodialysis	Biological Denitrification	Chemical Denitrification
Full-scale Systems	Yes	Yes	Yes	Yes	No
Treatment Type	Removal to waste stream	Removal to waste stream	Removal to waste stream	Biological reduction	Chemical reduction
Common Water Quality Design Considerations	Sulfate, iron, manganese, total suspended solids (TSS), metals (e.g., arsenic), hardness, organic matter	Turbidity, iron, manganese, SDI, particle size, TSS, hardness, organic matter, metals (e.g., arsenic)	Turbidity, iron, manganese, TSS, hydrogen sulfide, hardness, metals (e.g., arsenic)	Temperature and pH, anoxic conditions	Temperature and pH
Pretreatment Needs	Pre-filter, address hardness	Pre-filter, address hardness	Pre-filter, address hardness	pH adjustment, nutrient and substrate addition, need for anoxic conditions	pH adjustment
Post-treatment Needs	pH adjustment	pH adjustment Remineralization	pH adjustment Remineralization	Filtration, disinfection, possible substrate adsorption	pH adjustment, iron removal, potential ammonia control
Waste/Residuals Management	Waste brine	Concentrate	Concentrate	Sludge/biosolids	Waste media, Iron sludge
Start-up Time	Minutes	Minutes	Minutes	Initial plant startup: Days to weeks After reaching steady state: Minutes	Minutes
Water Recovery	Conventional (97%) Low brine (Up to 99.9%)	Up to 85%	Up to 95%	Nearly 100%	Not demonstrated full-scale
Advantages	Nitrate selective resins, common application, multiple contaminant removal	Multiple contaminant removal, desalination (TDS removal)	Multiple contaminant removal, higher water recovery (less waste), desalination, unaffected by silica	No waste brine or concentrate, nitrate reduction rather than transfer to a waste stream, high water recovery, and potential for multiple contaminant removal	No waste brine or concentrate, nitrate reduction rather than transfer to a waste stream, and potential for multiple contaminant removal
Disadvantages	Potential for nitrate peaking, high chemical use (salt), brine waste disposal, potential for disinfection byproduct (DBP) formation (e.g., NDMA)	Membrane fouling and scaling, lower water recovery, operational complexity, energy demands, waste disposal	Energy demands, operational complexity, waste disposal	Substrate addition, potentially more complex, high monitoring needs, possible sensitivity to environmental conditions, risk of nitrite formation (potential incomplete denitrification), post-treatment to address turbidity standards and 4-log virus removal (state dependent)	Inconsistency of nitrate reduction, risk of nitrite formation (potential incomplete denitrification), reduction to ammonia, lack of full-scale systems, pH and temperature dependence, possible need for iron removal