Table A.6. Advantages and disadvantages of the five major treatment options for nitrate removal.

	Advantages	Disadvantages
Ion Exchange	• Years of industry experience, • Multiple contaminant removal, • Selective nitrate removal, • Financial feasibility, • Use in small and large systems, and • The ability to automate.	• The disposal of waste brine, • The potential for nitrate dumping specifically for non-selective resin use for high sulfate waters, • The need to address resin susceptibility to hardness, iron, manganese, suspended solids, organic matter, and chlorine, and • The possible role of resin residuals in DBP formation.
Reverse Osmosis	• High quality product water, • Multiple contaminant removal, • Desalination (TDS removal), • Feasible automation, • Small footprint, and • Application for small and POU applications.	• The disposal of waste concentrate, • Typically high capital and O&M costs, • The need to address membrane susceptibility to hardness, iron, manganese, suspended solids, silica, organic matter, and chlorine, • High energy demands, and • The lack of control over target constituents (complete demineralization).
Electrodialysis/ Electrodialysis Reversal	• Limited to no chemical usage, • Long lasting membranes, • Selective removal of target species, • Flexibility in removal rate through voltage control, • Better water recovery (lower waster volume), • Feasible automation, and • Multiple contaminant removal.	• The disposal of waste concentrate, • The need to address membrane susceptibility to hardness, iron, manganese, and suspended solids, • High maintenance demands, • Costs (comparable to RO systems), • The need to vent gaseous byproducts, • The potential for precipitation with high recovery, • High system complexity, and • Dependence on conductivity.
Biological Denitrification	• High water recovery, • No brine or concentrate waste stream (nitrate reduction rather than removal to waste stream), • Low sludge waste, • Less expensive operation, • Limited chemical input, • Increased sustainability, and • Multiple contaminant removal.	• The need for substrate and nutrient addition, • High monitoring needs, • Significant post-treatment requirements, • High capital costs, • Sensitivity to environmental conditions (sometimes), • Large system footprint (sometimes), • High system complexity (sometimes, can be comparable to RO), • Lack of full-scale systems in the U.S., • The possibility of partial denitrification, • Permitting and piloting requirements, and • Slower initial start-up, which could cause challenges for wells with intermittent run time.

Chemical Denitrification	• Conversion of nitrate to other nitrogen species (no brine or concentrate waste stream),
	• The potential for more sustainable treatment,
	• High water recovery (higher than RO according to Cleanit -LC), and
	• Multiple contaminant removal.
		• The potential reduction of nitrate beyond nitrogen gas to ammonia,
		• The possibility of partial denitrification,
		• The possible dependence of performance on pH and temperature,
		• The possible need for iron removal, and
		• The lack of full-scale chemical denitrification systems resulting in:
		  ○ Unknown reliability,
		  ○ Unknown costs, and
		  ○ Unknown operational complications.

(Jensen, 2012)