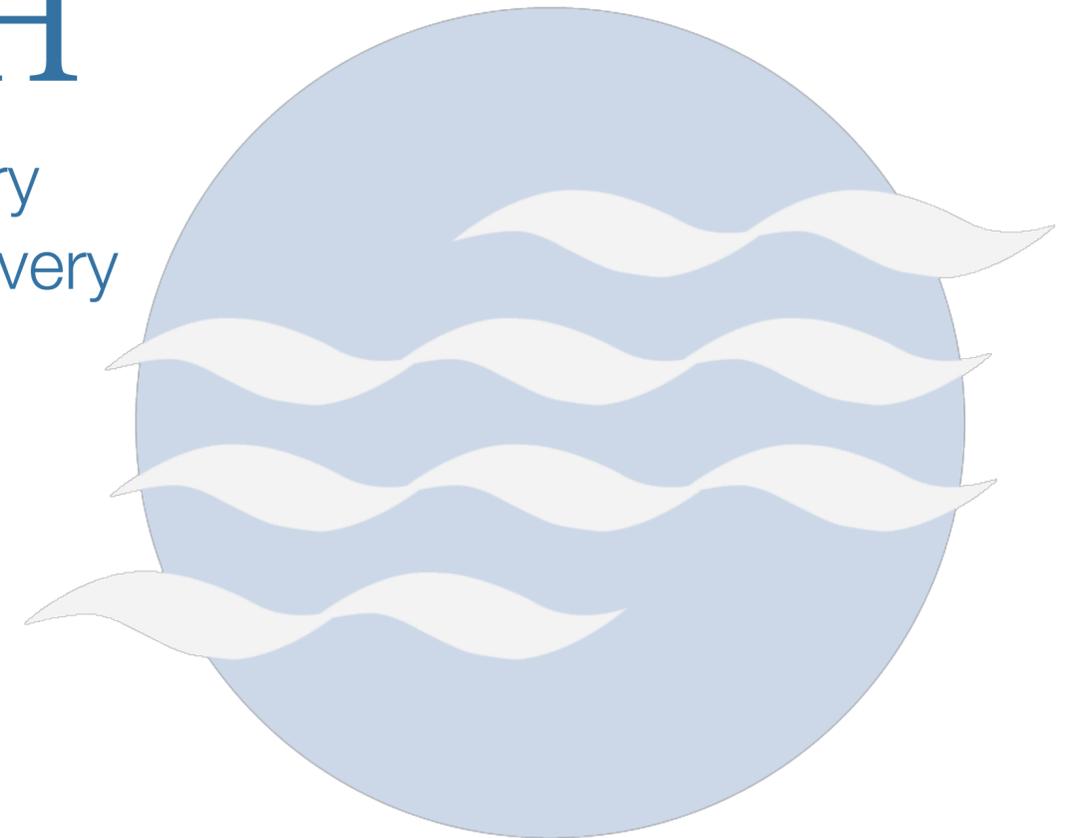




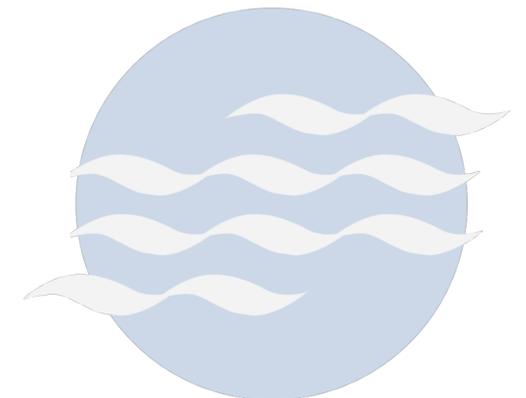
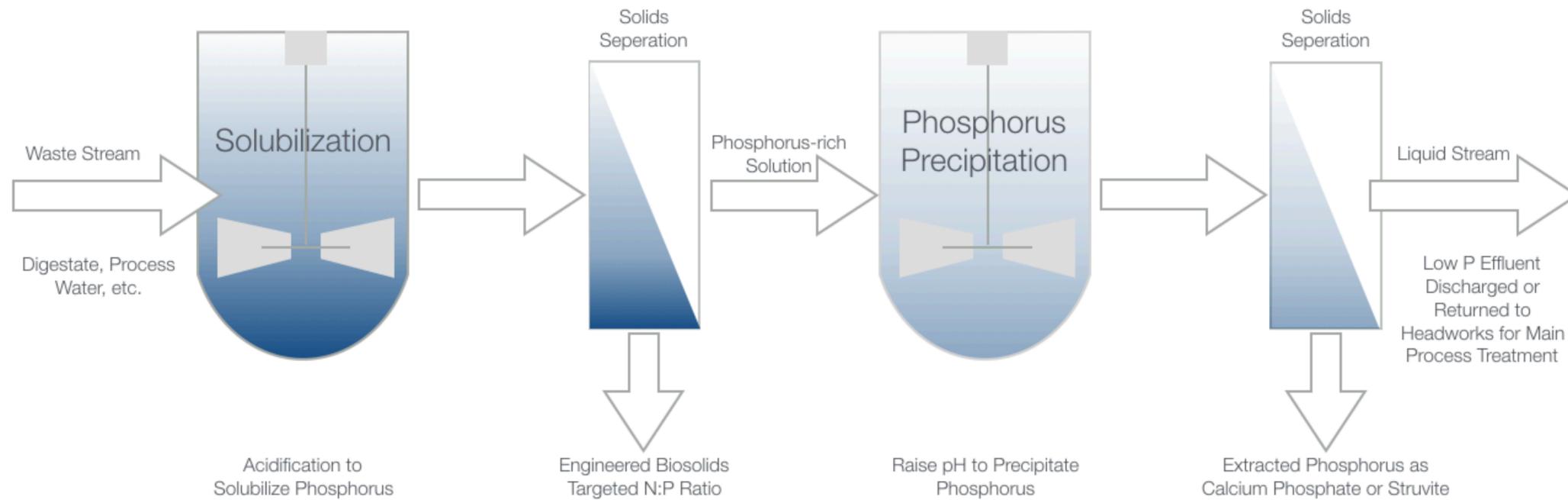
RENEWABLE  
NUTRIENTS

# QUICK WASH<sup>®</sup>

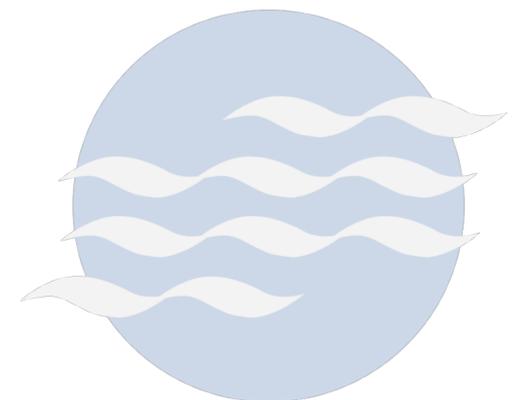
Phosphorus Extraction & Recovery  
Nitrogen Removal & Ammonia Recovery



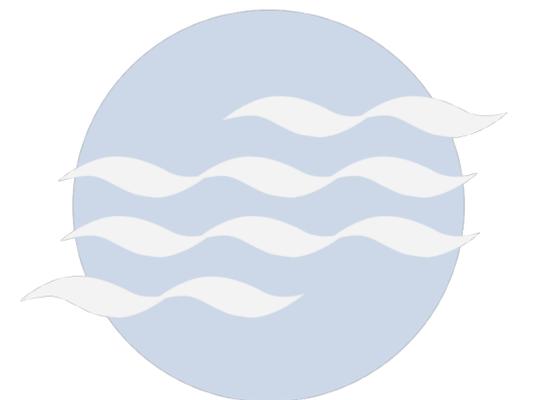
Quick Wash Phosphorus Extraction and Recovery extracts phosphorus from municipal, agricultural, or industrial waste streams in solids or liquids (effluent) and recovers the phosphorus in the form of Calcium Phosphate or Struvite.



- Removes and recovers more than 95% of phosphorus
- Reduce phosphorus recycle load
- Reduce polymer & metal salts
- Reduce disposal costs
- Eliminate struvite scaling
- Increase revenue
- Meet EPA nutrient TMDL requirements



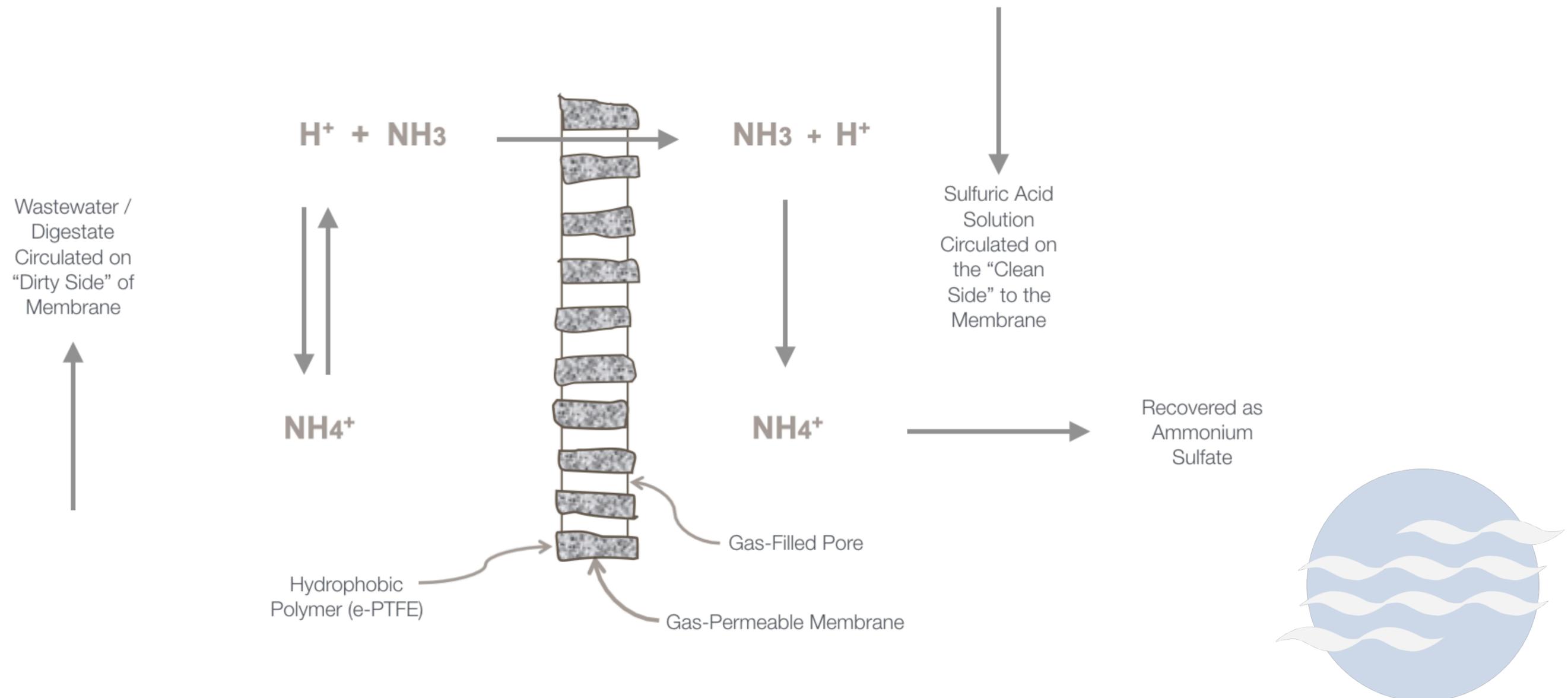
- Ammonia **LIQUID** technology relates to a system and methods for the removal, recovery and use of ammonia from ammonia-containing liquid effluents such as animal and municipal wastewater. Ammonia is recovered in the form of Ammonia Salt
- Ammonia **GASEOUS** technology relates to a system and method for the removal of gaseous nitrogen to reduce emissions from systems that produce gaseous nitrogen. Ammonia is recovered in the form of Ammonia Salt



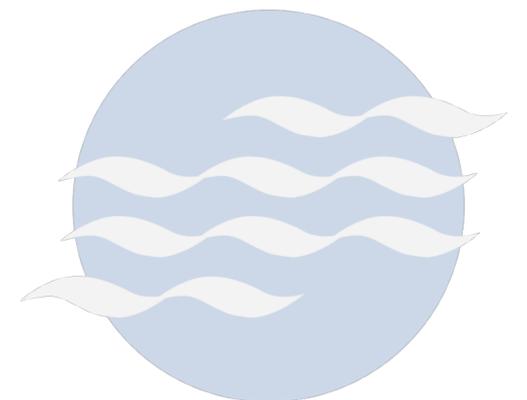
# QUICK WASH<sup>®</sup>

## Nitrogen / Ammonia Process Flow

In both applications (liquid / gaseous), the technology utilizes an acid passing through a gas permeable membrane to recover ammonia



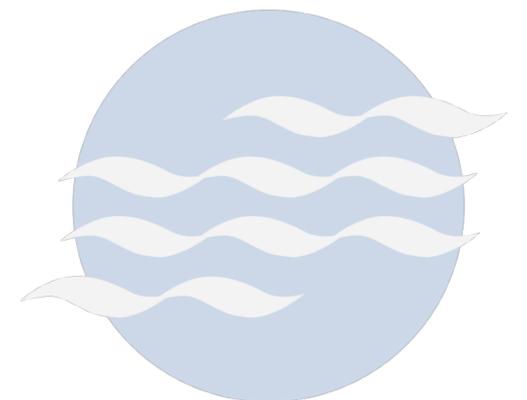
- Reduce inputs of energy, carbon, alkalinity
- Recover rather than destroy a valuable resource
- Produce a high quality, marketable product
- Improve the quality of the effluent by enhancing exiting nutrient removal processes
- Allow the reduction of ammonia alkalinity
- Potentially free existing capacity and allow the re-rating of treatment plants in lieu of additional capital investment
- Provide a solution for additional capacity in plants with limited footprint for expansion



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## Nitrogen / Ammonia & Phosphorus Combined

- A combined application of both **N & P** extraction and recovery technologies to solve the total nutrient issue for high strength streams
- Depending on conditions, the **N** process can come first, or the **P** process can come first, they complement each other in either order
- The use of existing tankage, piping, and pumping is highly possible and recommended
- We anticipate that regulatory agencies will enforce discharge requirements for both **N & P**
- Economy of scale can be achieved by implementing both technologies
- Utilizing both technologies will enable the extraction, recovery, and reuse of valuable nutrients



Item no.	Description	Discussion	Value
1	Ability to treat high-strength side stream digestate, centrate, filtrate without complex or expensive equipment	Depends on application. Compared to other technologies, the RN technology can serve as an enabling technology, solving the problems that are generated from anaerobic digestion	Possibly worth millions depending on specific project application and compared to alternative technologies
2	Production of beneficial use byproducts	Our standard design produces calcium phosphate and ammonium sulfate. Both are valuable and popular in the agronomics/agriculture sector for fertilizer and other uses.	We recognize the byproducts do not generate significant revenue. But they generate revenue rather than a byproduct that requires further cost for disposal. Value in tens of thousands to hundreds of thousands annually depending on system size
3	Elimination of struvite formation	Many agencies are struggling with the effects of scaling and struvite formation in piping, pumps, and equipment. By recovering the P, and not allowing it back into the plant to form struvite scaling.	Many agencies are spending hundreds of thousands, even millions, annually to mitigate struvite issues. The value of elimination of struvite is significant.
4	Small footprint	Unlike some technologies, the RN technologies do not require a great deal of space	Many other technologies are disqualified due to space requirements. Having a technology with a small footprint requirement may save significant project dollars.
5	Low cost of operations	The input chemicals are relatively inexpensive and the power costs are low. Depending on the hydraulic grade considerations for a specific site, much of the process can flow via gravity	Sulfuric acid is a low cost chemical in comparison to many, as is lime or caustic. Because this is a chemical solution, there are chemical costs, but they are simple, affordable chemicals.
6	Fast process	Compared to other technologies, the RN technologies are fast acting, therefore not requiring large tankage for long HRT's. This reduces CapEX and OpEx.	Compared to many, the RN technologies are fast. Speed is related to cost. The value in treatment costs is significant.
7	Major opportunity to reuse existing facilities	Existing tankage, pumps, and other facilities can be reused with ease to reduce costs	The equipment required for the technology is simple and is not proprietary. Therefore, existing tanks, mixers, pumps, piping and other facilities can be repurposed reducing project costs and saving money.
8	Flexibility in targets for performance	Adjustments in stoichiometric can allow for flexibility in performance and results and costs	Facilities can be sized and operated to achieve specific targets. The flexibility is valuable and allows for a system to follow changing conditions. The value of this flexibility is significant.
9	Technology is more robust than biological process - chemistry vs biology	With biology, a rogue contaminant, or rapid changes in conditions, can upset the active organism causing treatment failure. Chemistry is more predictable and reliable.	Other technologies that rely on bacteria, algae, microorganisms, or other biological presence have struggled to treat nutrient rich water (particularly) high strength due to the sensitive nature of the organisms. Having a reliable process that is more robust is priceless.
10	Processes will be more familiar to operations staff	Most operations staff are familiar with the use of pH modifications to manipulate treatment processes. Not much new to learn with RN tech.	Reduction in training and an acceleration in process acceptance has significant value.
11	Site specific Benefits	Depending on conditions and financial opportunities ie. Insurance & nutrients trading	Potential to be game changing for a privately owned facility

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