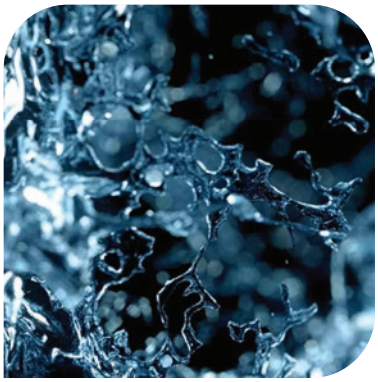
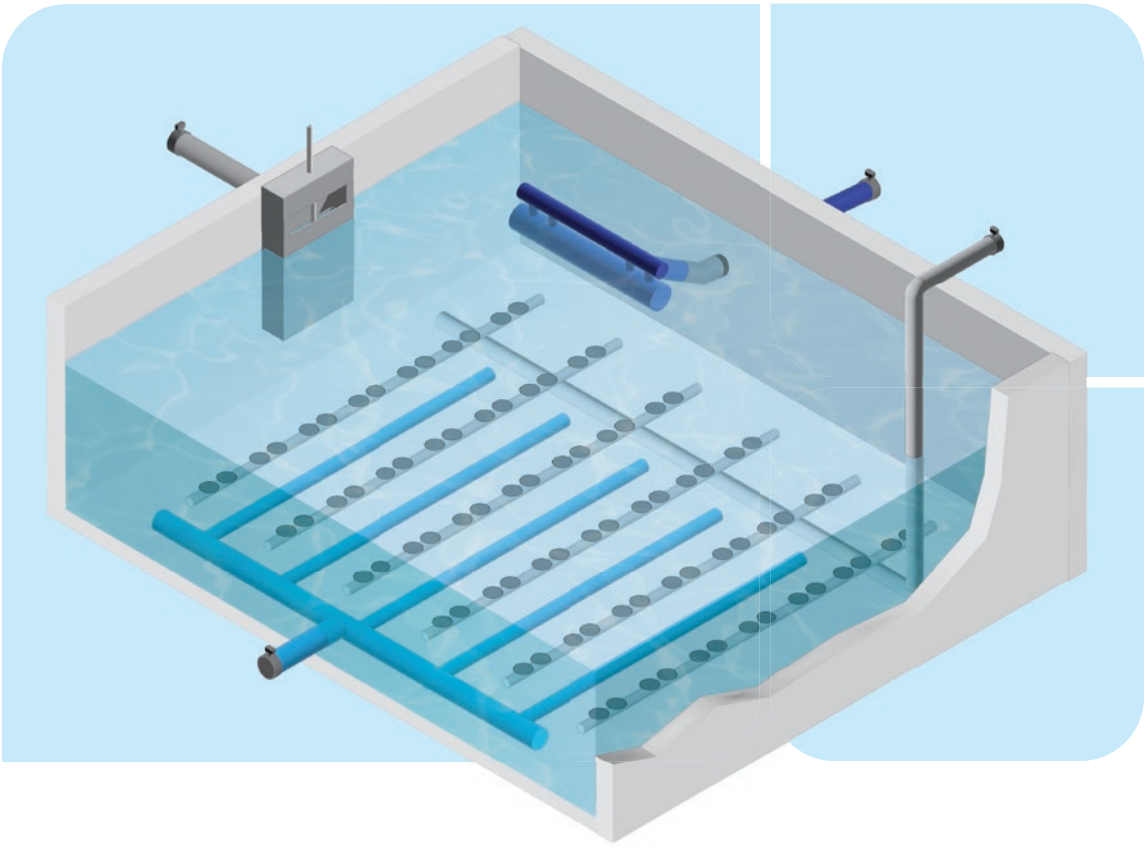


Parkson™
Treating Water Right



Granite AGS™
Aerobic Granular Sludge

SETTLES LIKE A ROCK™

- Microbial communities within granular structures
- Consistently meets stringent regulatory requirements
- Higher MLSS, faster settling
- Less space compared to conventional treatment
- Lower energy consumption
- Resilience to fluctuations in flows and loads

GRANITE AGS™,
Parkson's Aerobic Granular Sludge Process.

The **Granite AGS** process is a cutting edge technology designed to improve the performance of activated sludge systems. The process produces biomass in a granular form which is much more dense than typical activated sludge floc. Utilizing densified sludge greatly improves the reliability and efficiency of the secondary treatment process.

Granite AGS is a fill and draw granular sludge process that operates in a batch mode. The AGS process completes all unit process treatment steps within the reactors, eliminating the need for anaerobic or anoxic zones, RAS systems, and secondary clarifiers.

Granular sludge particles contain multiple layers of microbes. The outer layers typically contain aerobic microbes which have access to surrounding dissolved oxygen during the aerobic portion of the cycle. Inner layers are typically anaerobic and anoxic microbes which achieve Bio-P uptake and removal of nitrite and nitrate. The layered bacteria allow available carbon to be shared between microbes, eliminating or reducing chemical addition needed for nutrient removal.

Multiple microbes growing in a single colony (granule) inherently have a higher density which results in a much higher settling velocity and sludge compaction when compared to typical activated sludge. The **Granite AGS** process typically achieves Sludge Volume Index (SVI) values of <50 ml/g.

Key Features of Aerobic Granular Sludge:

1. Nature's Efficiency:

Aerobic Granular Sludge fosters the growth of robust microbial communities (Heterotrophic, Nitrifiers, Denitrifiers, PAOs, and GAOs) within compact granular structures. These dynamic microorganisms work synergistically to effectively remove nutrients from the wastewater.

2. Reliable Performance:

Granular sludge compacts very well resulting in SVI's (Sludge Volume Index) of around 50 ml/g. The highly compacted sludge provides a greater interface between the settled solids and the clear effluent that is removed from the upper portion of the basin.

3. Space- Saving Design:

Excellent settling and compaction characteristics allow the system to be designed at a much higher MLSS concentration when compared to conventional activated sludge. This greatly reduces tank sizes, footprint, and overall cost of construction. Existing systems can be retrofitted to increase treatment capacity within existing tankage.

4. Lower Energy Consumption:

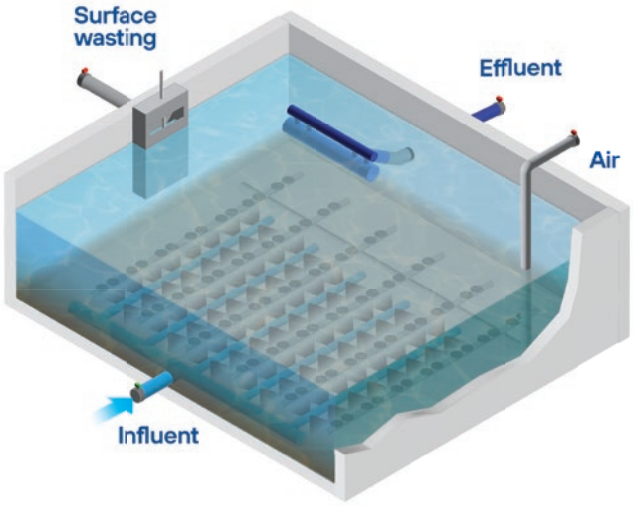
Smaller treatment basins require less mixing energy so overall power consumption is reduced. Aerobic conditions are achieved utilizing highly efficient fine bubble diffusers.

5. Enhanced Process Stability:

Utilizing a densified sludge provides more resilience in terms of maintaining treatment during sustained high peak flow events. Solids washout, which can be a problem with typical floc-forming bacteria, is much less likely with the heavier granular sludge.

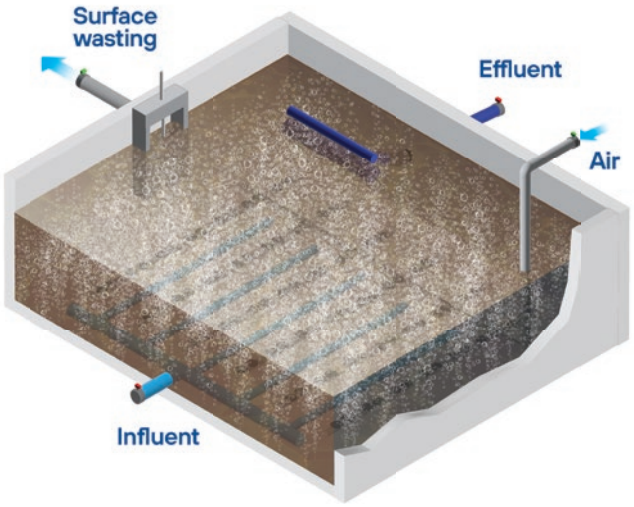
Sequence of Operation

1. Anaerobic Fill



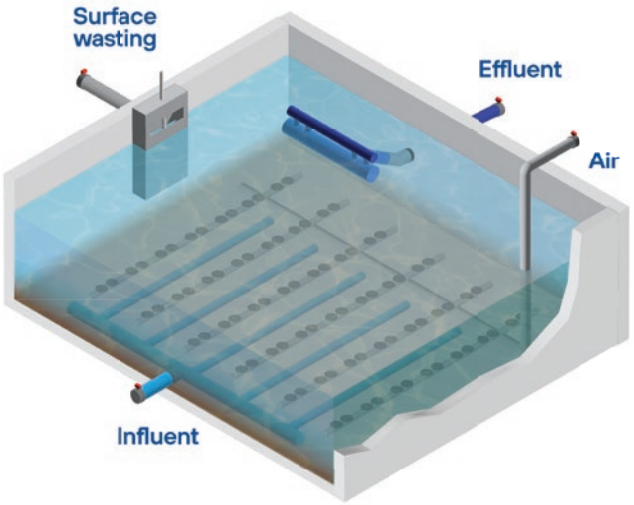
- Operated in series with one tank being filled at any given time
- No aeration occurs during this period, Oxygen Reduction Potential (ORP) is monitored
- Anaerobic conditions encourage the production of Extracellular Polymeric Substances (EPS)
- EPS is key in the creation of granular sludge particles

2. React



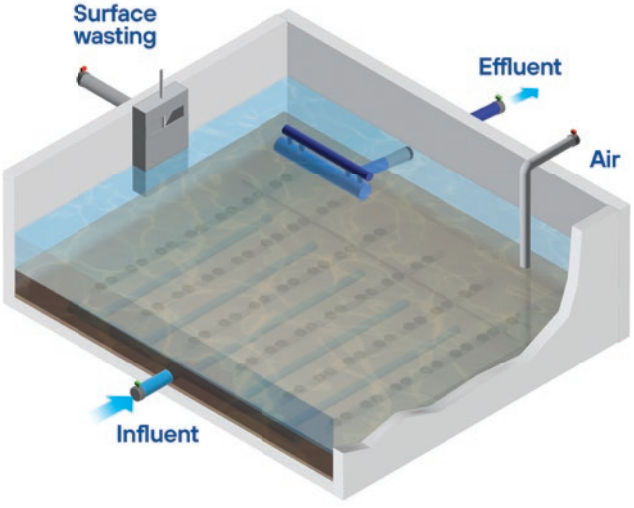
- Flow diverted to the next basin
- Aeration and mixing occurs until complete biodegradation of organics is complete
- Luxury uptake of Phosphorus takes place
- Surface wasting of mixed liquor
- Waste sludge transferred to the Sludge Thickening Tank

3. Settle



- No influent enters the basin
- No aeration or mixing to create perfect quiescent conditions Entire reactor basin volume used for solids separation

4. Filled Decant



- Effluent withdrawal occurs
- Anaerobic fill begins
- Influent Distribution System is utilized to allow for low inlet velocities
- Sludge blanket remains compact

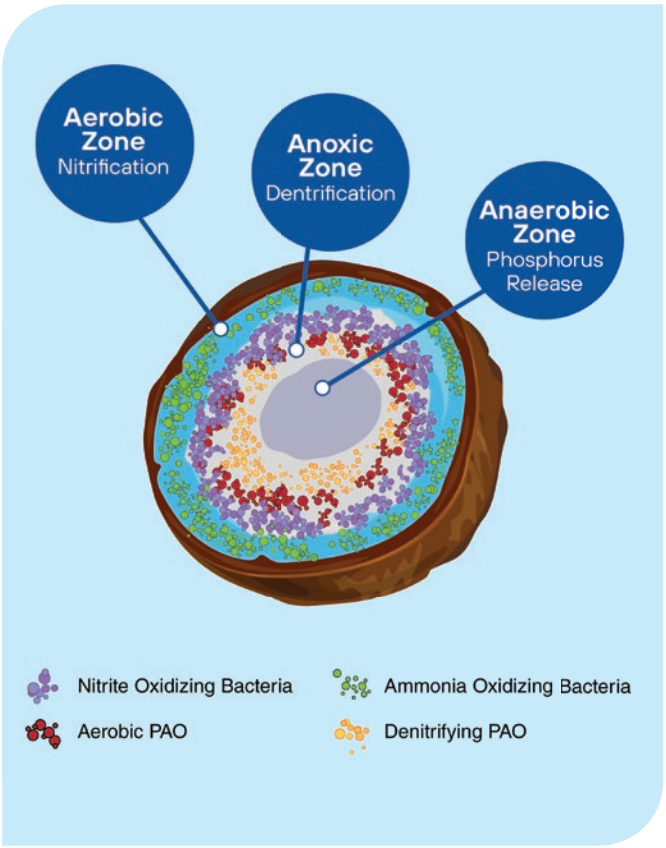
Granite AGS - Aerobic Granular Sludge Layered Microbial Community

Anaerobic / Aerobic Conditions Promote BNR

- PAOs = phosphorus-accumulating organisms
  GAOs = glycogen-accumulating organisms
- Same carbon used for PAO/GAO growth and denitrification
- DO controlled to provide simultaneous nitrification/denitrification
  Denitrification provides alkalinity for pH control
- Bacteria required to achieve ammonia, nitrate, and phosphorous removal grow within a single colony.

Results:

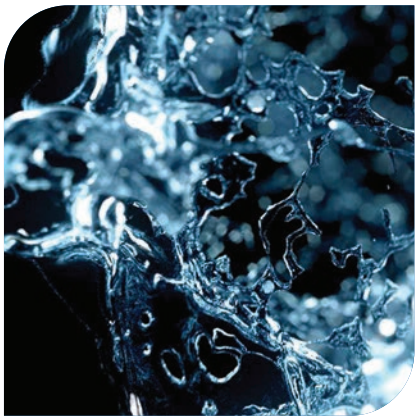
- Simultaneous use of carbon for N and P removal so utilization is optimized - can reduce chemical (methanol) addition needed. Solids particles are larger and denser (more granular) than typical activated sludge which greatly enhances settling characteristics. Sludge Volume Index (SVI) of <50 ml/g.
- Solids particles typically >200 microns.
- Grows naturally in activated sludge processes if proper conditions exist.



Years of Experience

With over 100 years of combined experience, the Biological team at Parkson is an ideal partner with strong focus on providing reliable and responsive support throughout the project design, execution and startup phases.

Parkson Corporation – a recognized worldwide leader in the wastewater industry for over 60 years and with historical and successful projects in municipal and industrial applications – is dedicated to a wide array of innovative biological solutions.



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