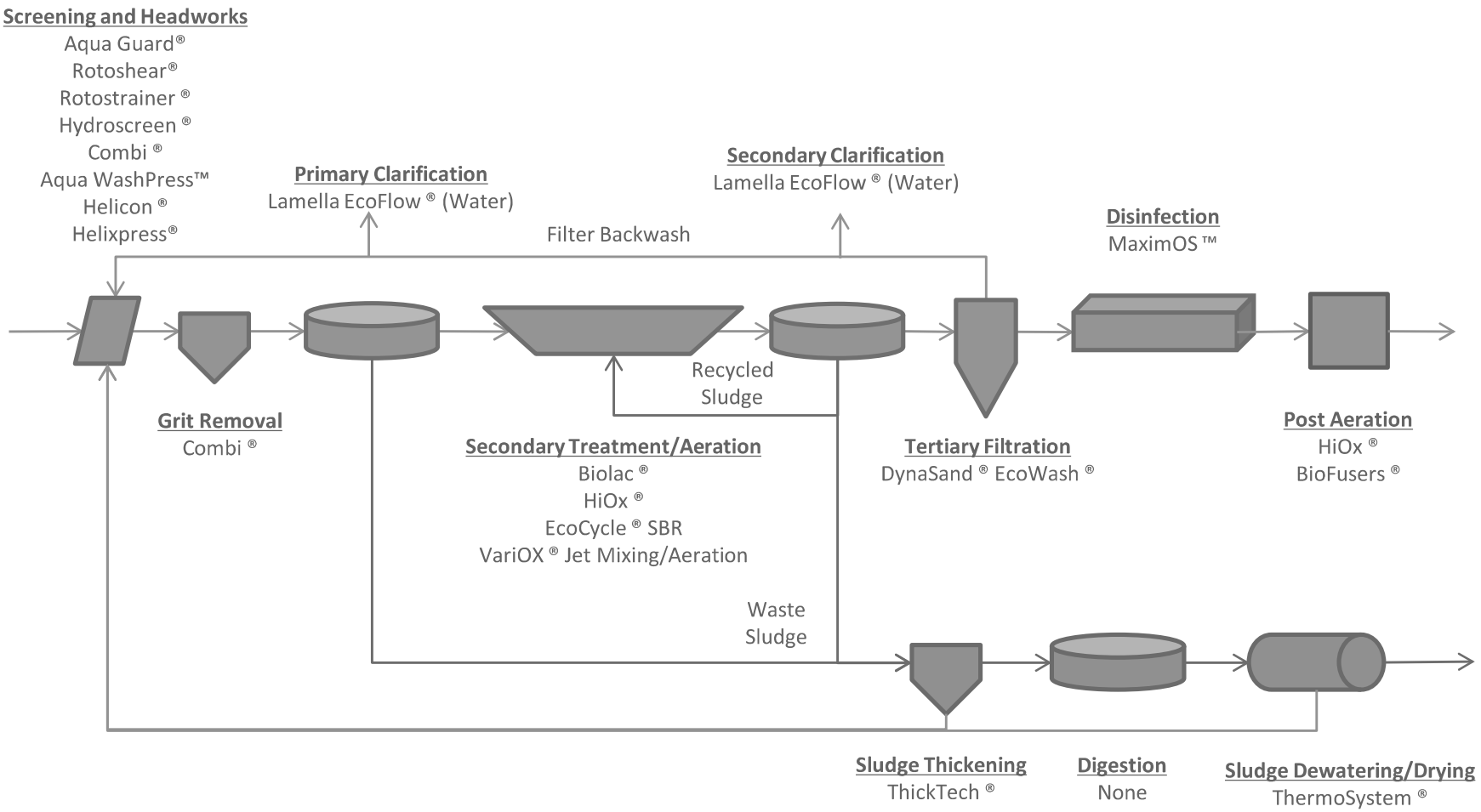
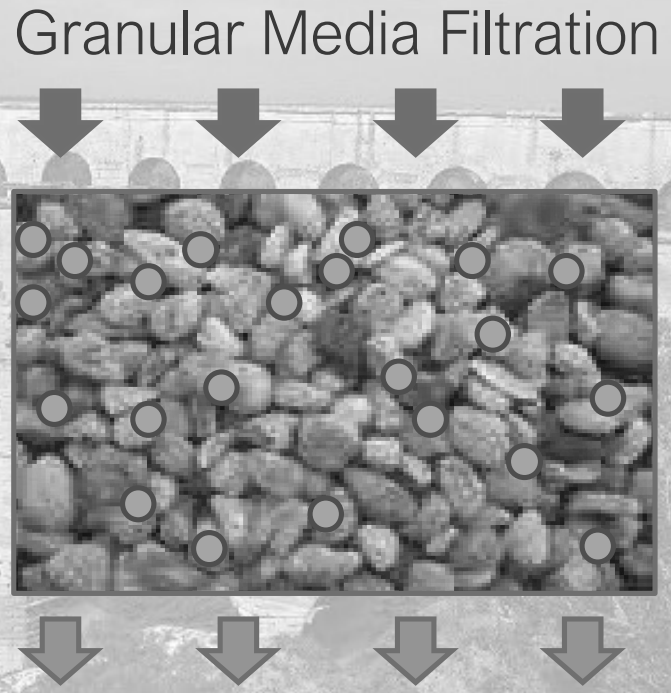
Hybrid Sand Filtration

Typical WWTP Layout



Sand Filtration Basics

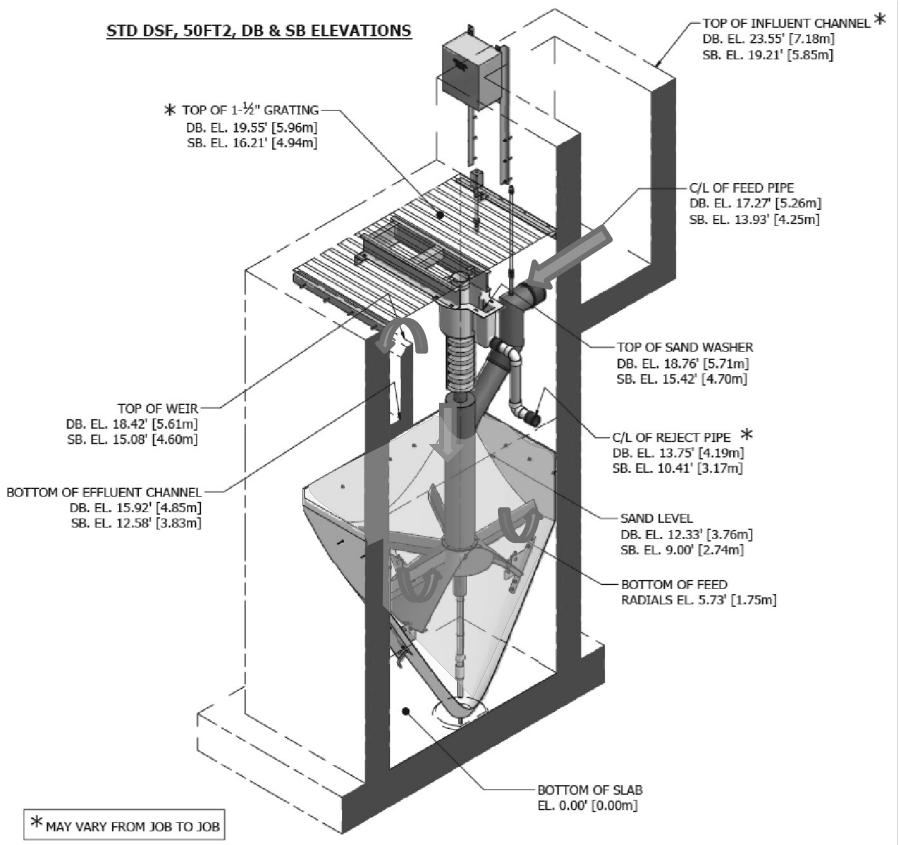
- **As old as water treatment itself dating back to 2,000 – 4,000 BC**
- **Big stuff stays in, small stuff passes through**
- **Porous media – Depth Filtration**
- **Solids Build Up in Sand Bed then Need to be Removed/Cleaned**



Continuous Filtration

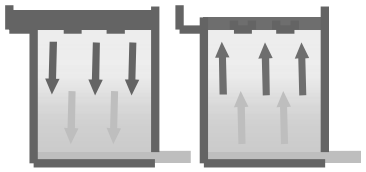
First upflow continuous backwash in America - 1978

A "Continuous" filter is an upflow, deep bed, granular media filter with continuous backwash



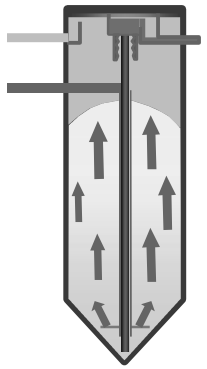
- Up Flow – Dirty water is introduced at the bottom of the sand bed
- Deep Bed – Process is defined as depth filtration as opposed to surface filtration
- Granular Media – Sand (0.9mm or 1.4mm depending on application)
- Filter – Big stuff stays in, small stuff goes out
- Continuous Backwash – Sand is cleaned during regular operation, i.e. no downtime

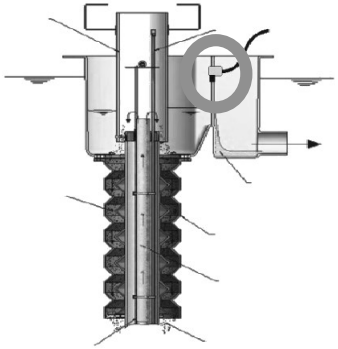
Hybrid Filtration Basics



Traditional filters backwash based upon solids, which can be better for performance, but require redundant filters and ancilliary equipment.

Continuous filters backwash based on hydraulics, which may sacrifice some performance, but doesn't require additional redundancy or ancillary equipment.

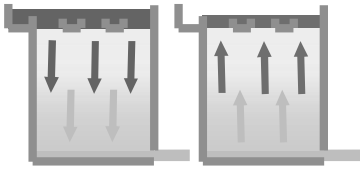


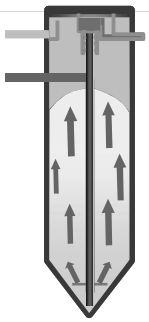


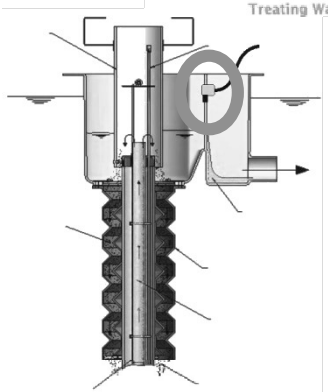
EcoWash is Hybrid of these two. EcoWash uses a continuous filter, but operates it based on solids like a traditional filter, giving the best of both worlds.

EcoWash™ *A Hybrid Filter*

Benefits of DynaSand® EcoWash™

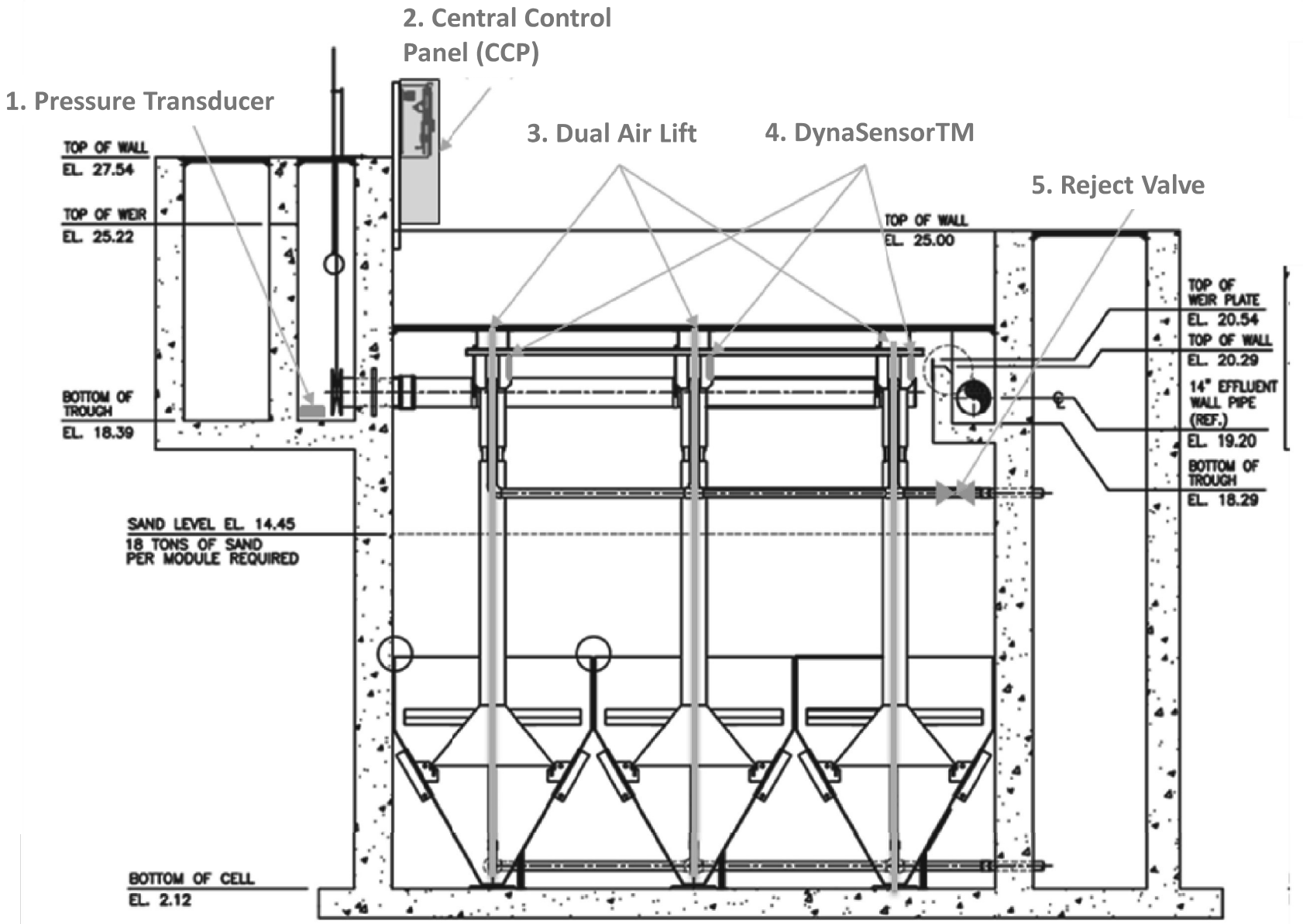






	Traditional	Continuous	EcoWash™
Filtrate Quality	✓		✓
Variable Flow	✓		✓
Chemical Dosing	✓		✓
Reject Water	✓		✓
Power Usage		✓	✓
Footprint		✓	✓
Ancillary Equipment		✓	✓
Capital Cost		✓	✓
Required Redundancy		✓	✓
Remote Monitoring	–	–	✓
Labor	–	–	✓

EcoWash Components



EcoWash Basics

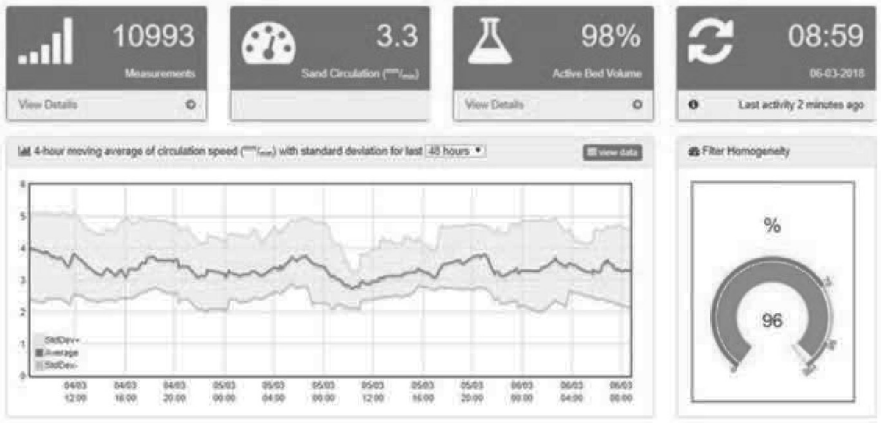
- EcoWash utilizes a continuous filter but backwashes intermittently when needed.
- Backwashing Triggers – At all times, there are two set points. Whichever is reached first triggers a backwash
  - Headloss – When solids build up and head loss increases, a backwash is triggered
  - Time – A timer will limit the amount of time between backwashes regardless of solids
- Control Strategies
  - If the headloss trigger is set more aggressively than the timer, backwashes will be predominantly started based on solids in the filter.
  - If the timer set point is set more aggressively than the headloss set point, backwashes will be predominantly started based on time.
- Sequence of Operation During Backwash
  - Reject Valve is Opened
  - Upper Air Burst
  - Lower Air Burst
  - Normal Air flow

EcoWash Alarms

- No Sand Movement
  - The DynaSensor Detects a Lack of Sand Movement in the Air Lift
  - The Air Burst Sequence will be Triggered
  - If Sand Movement is Not Detected, Alarm will be Issued
  - Operator to Physically Verify Sand Movement
- Reject Valve Fail to Close
  - The DynaSensor Detects that the Reject Valve has Failed to Close During Non-Backwash Cycles
  - Filter will Default to Continuous Backwash
  - Alarm will be Issued

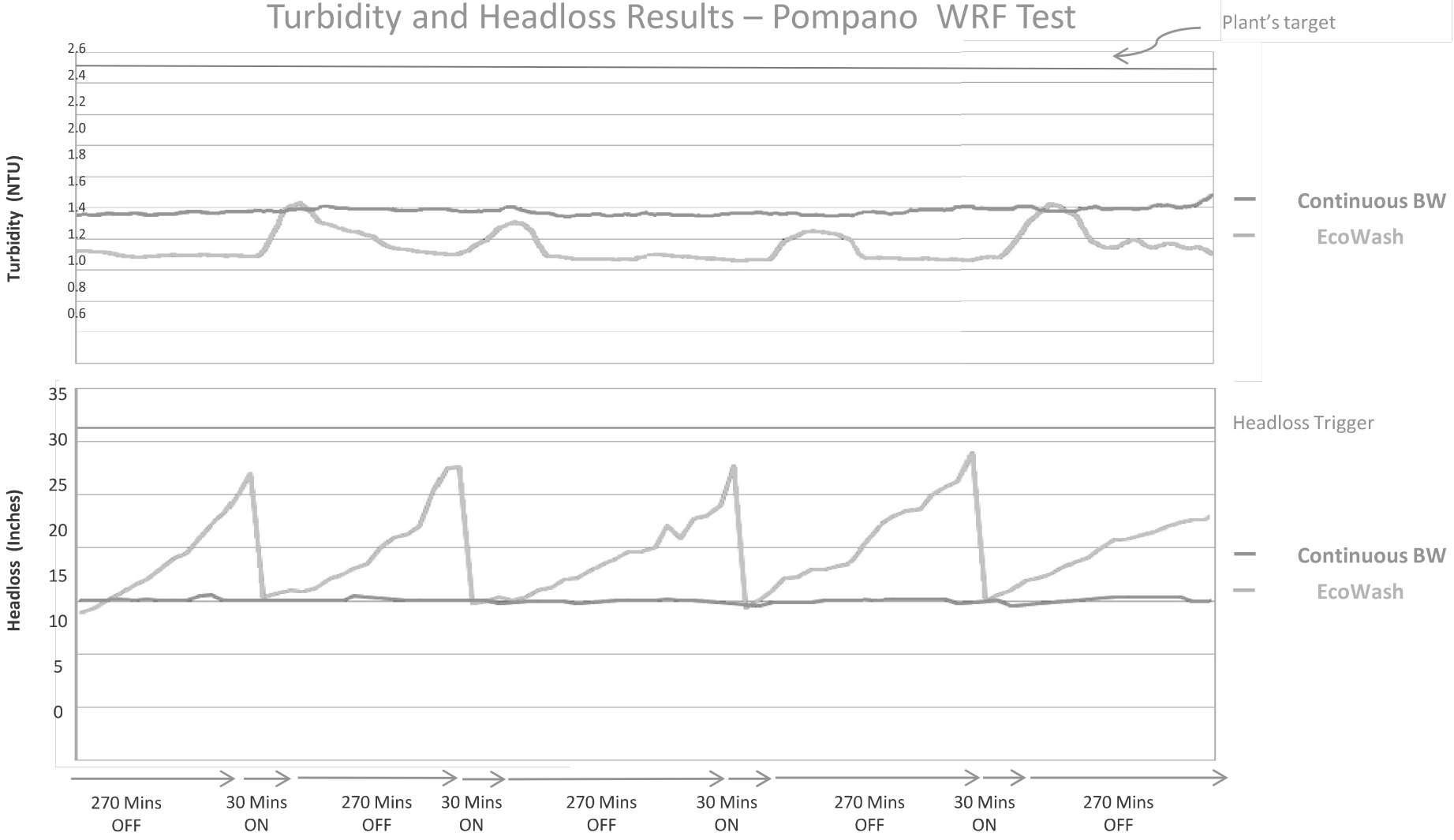
ECOWASH Further Improvements

- The DynaSensor for Sand movement can tell us whether or not the sand is moving – on/off
- In collaboration with industry partners, and using ioT, we are now offering solutions that can measure the “rate” of sand movement
- This is done using RFID chips moving along with the sand bed.
- This technology is able to provide plant managers and maintenance teams with important information such
  - Sand movement rates
  - Dead zones
  - Last activit



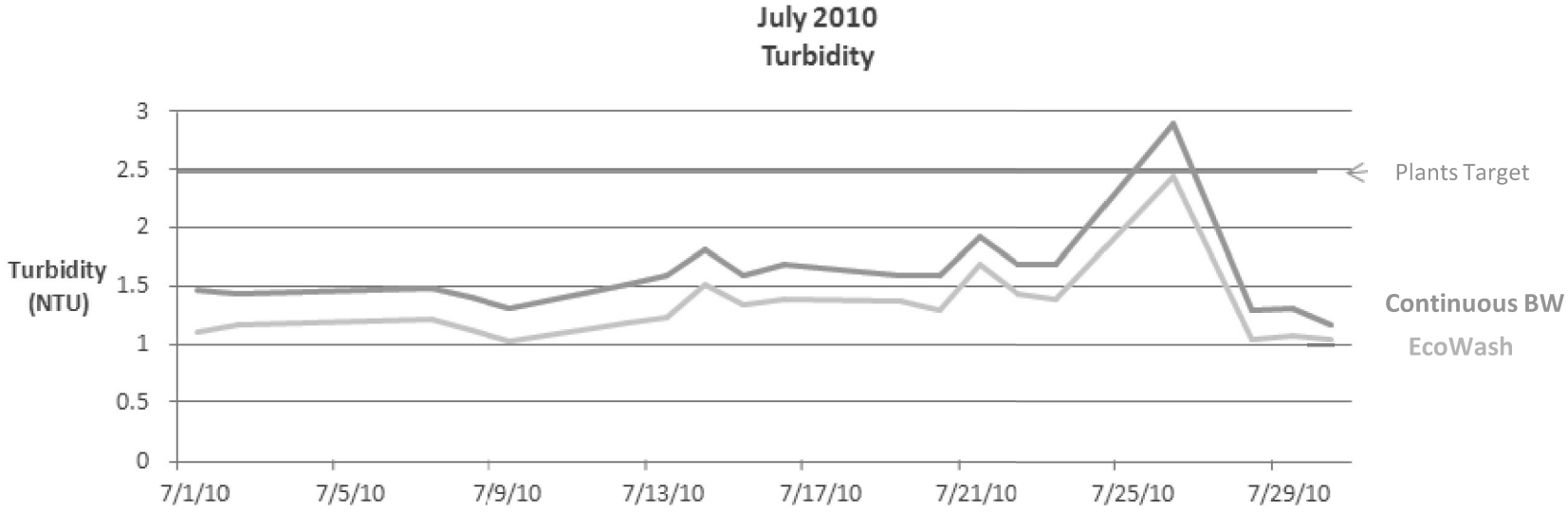
Hybrid Filtration Results

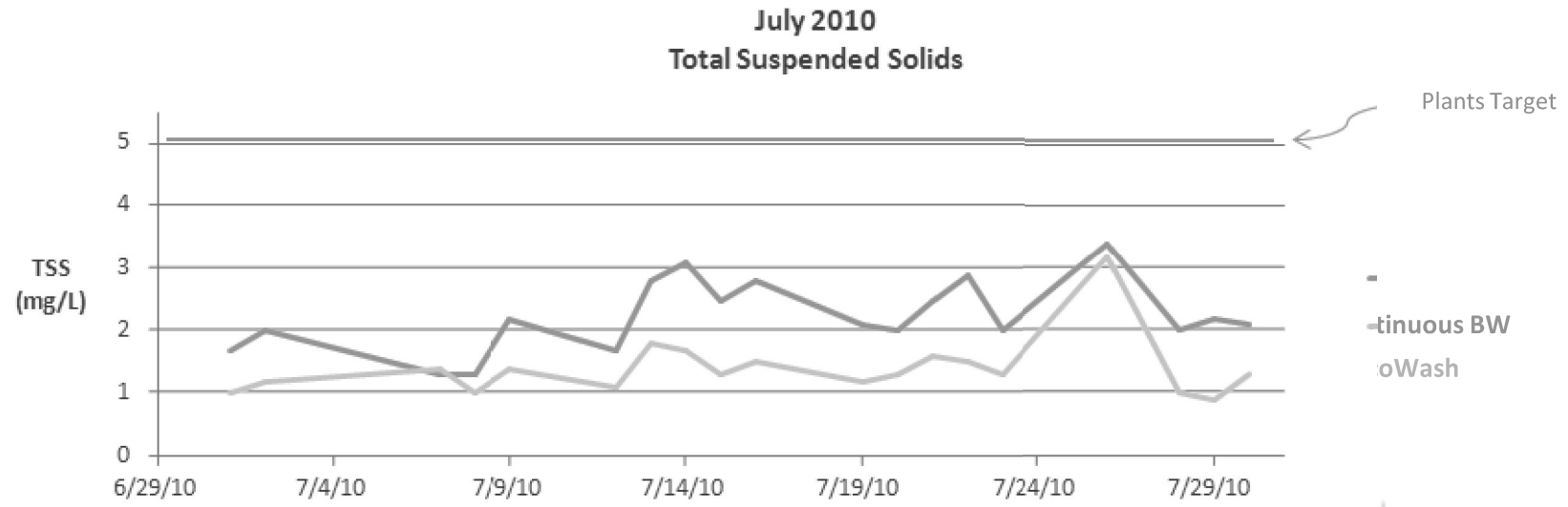
Turbidity and Headloss Results – Pompano WRF Test



Hybrid Filtration Results

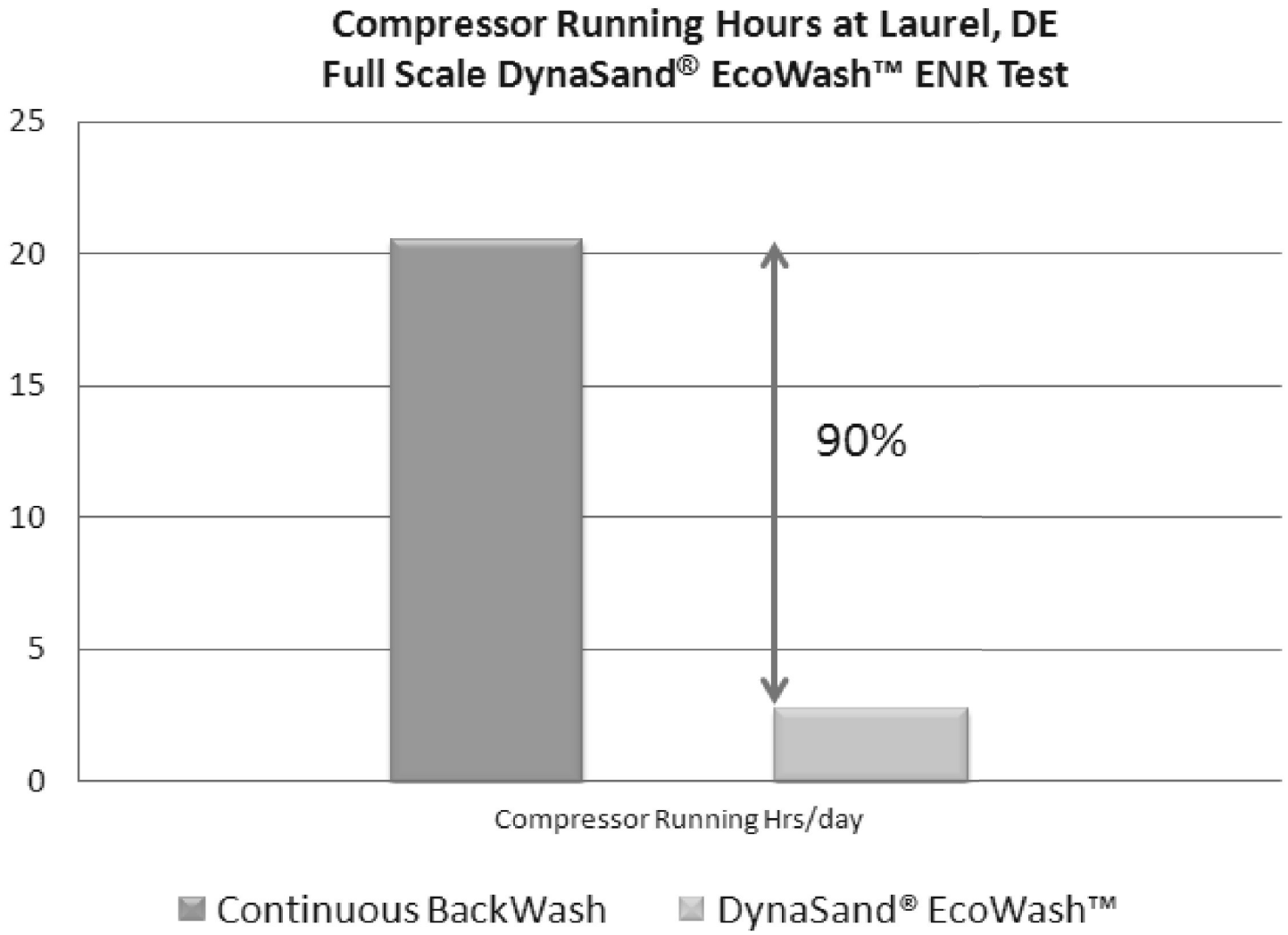
Turbidity and TSS Results – Pompano WRF Test





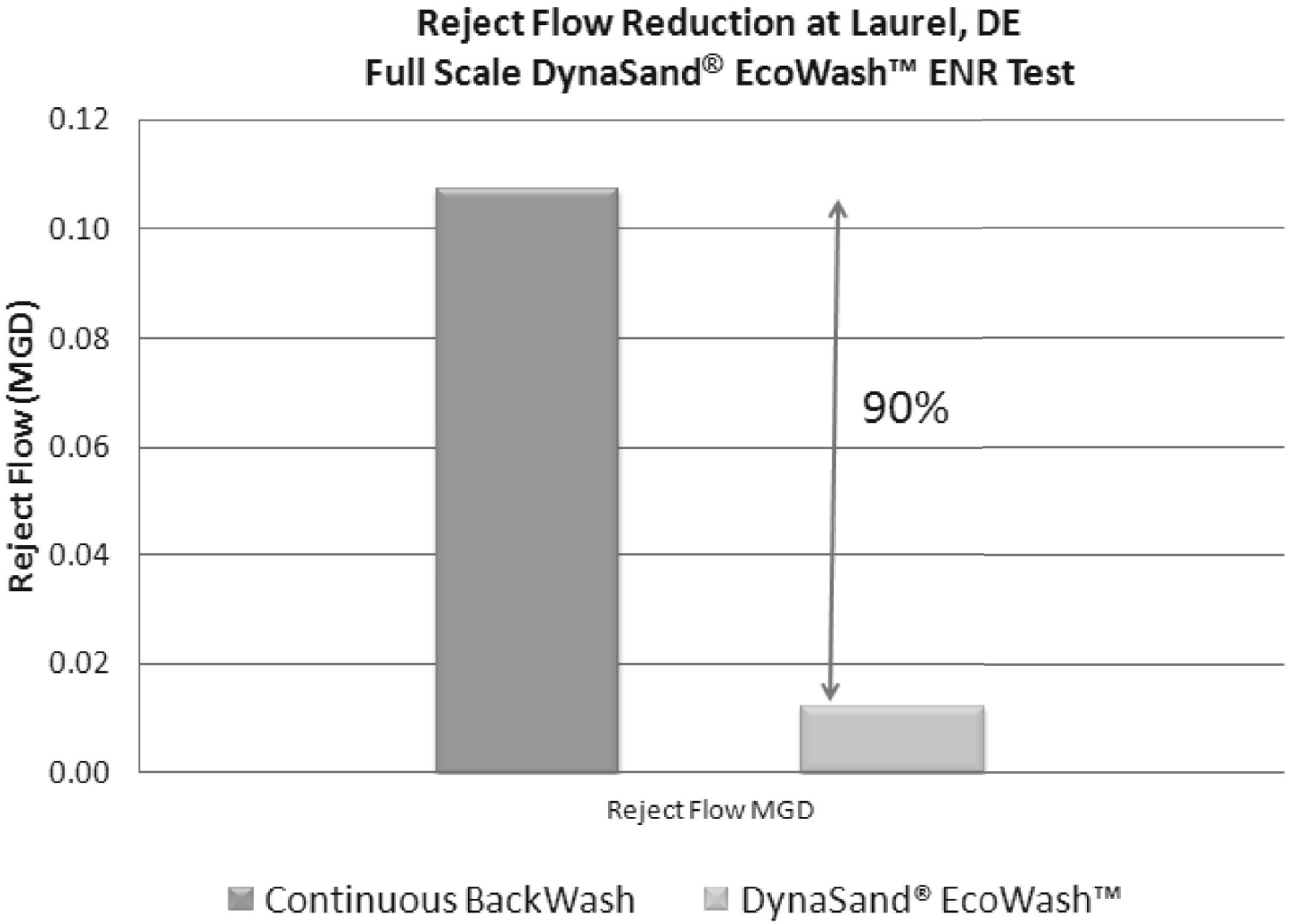
Hybrid Filtration Results

Laurel, DE – ENR Application



Hybrid Filtration Results

Laurel, DE – ENR Application



ECOWASH Benefits

- Unmanned Filter Plant Operation
- Full visibility of Filter Plant operating parameters
- Improved Filter Performance
  - < 2NTU for Tertiary Wastewater Applications
  - < 0.5 NTU and SDI < 3 for Desalination Pretreatment
- Lowest Reject rates of < 1% of Influent flow rate
- Lowest power consumption < 90% compared to traditional Sand Filters

EcoWash™ *A Hybrid Filter*

Parkson
Treating Water Right
50 YEARS 2010

Questions

Abdul Jamaludin
Abdul.jamaludin@ciclo-tech.com
+971508911952