

# BESST

Biologically Engineered Single Sludge Treatment Information Pack

Innovating Wastewater Solutions



| nutrient removal | wastewater treatment | industrial  
wastewater | treatment | carbonaceous BOD removal |  
| nitrification/denitrification | phosphorus removal |



## The BESST

With the incorporation of the UWWTD governing eutrophication and drivers from Water Authorities to reduce nitrate levels from wastewater effluents to protect their water abstraction sites, the demand for total nutrient removal has never been stronger. The BESST is the latest addition to WPL's portfolio of high performance wastewater treatment products.

The revolutionary newly patented process is capable of meeting some of the tightest discharge consents imposed by the EA. The BESST is a design based on further enhancements to the Modified Ludzak-Ettinger (MLE) process featuring an integrated Upflow Sludge Blanket Clarifier (USBC).

## Benefits

- Effluent quality surpasses 10 mg/l BOD, 10 mg/l TSS, 1 mg/l NH<sub>4</sub>-N and 10 mg/l Total N. Phosphorous reduction to < 3 mg/l is achievable through luxury uptake. Higher Phosphorous removal rates can be achieved through ferric dosing.
- Significant reductions in power requirement and use of service maintainable items over comparable process technologies. Both of these factors prove significant in driving down operational expenditure and life span costs.
- Anoxic selector promotes excellent sludge settlement characteristics.
- Reduced capital costs – Fabrication of the tank in a single integrated unit reduces footprint and civils costs when compared to the construction and installation of separate tank systems.
- Module design allows for multiple unit configurations on higher flow rate plants and larger works.
- Easy retrofit of clarifier, associated pipework and ancillaries into existing concrete assets.
- With options of stainless steel and painted mild steel (with optional cathodic protection) construction, the process can be installed either above or below ground level.
- Minimal operational effort - Once the unit has been commissioned, the robust process requires very little operator intervention in order to sustain treatment and fulfil its performance objectives.
- Long sludge age and integral digester minimises sludge production, associated disposal and treatment costs.
- The stability and age of the sludge, combined with the aerobic conditions result in a process with no unpleasant odours.



## Health and Safety

- Tanks fully covered in galvanised gridding for safe operator access
- Galvanised handrails installed on above ground plant
- Bespoke "cut-away" sections of gridding for ease of access to service valves
- Diffusers removable by quick release for operator maintenance
- Davit sockets provided for the removal/lowering of equipment into the unit

## Research & Development

A fully operational 100p.e reference plant is operating at a Southern Water sewage treatment works which benefits from fully equipped laboratory facilities. This has allowed the BESST to be safely tested beyond design limits using standard methods for wastewater analysis.

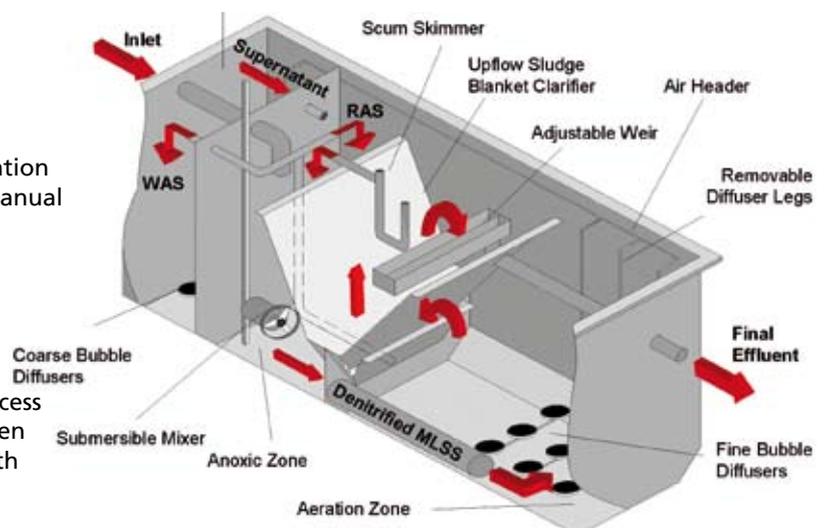
Testing of the reference plant included carrying out the standard suite of wastewater analysis including: BOD<sub>5</sub>, SS, VSS, NH<sub>4</sub>-N, NO<sub>3</sub>, TKN, Total P, ortho-PO<sub>4</sub>, pH, conductivity, DO, FOG and SSVI<sub>3.5</sub>. Extensive field testing of the BESST system supplements existing data on the efficiency and capability of the process and exemplifies WPL's commitment to product research and development.



## Process Description

- Raw sewage enters the anoxic zone where the endogenous organic carbon source is utilised as the electron donor in denitrification reactions. The anoxic zone is also fed with nitrified return activated sludge (RAS) from the base of the sludge blanket clarifier via an air lift pump.
- Mechanical mixing occurs in the anoxic zone, to ensure homogeneity, increase denitrification efficiency and present an unfavourable environment for the growth of filamentous organisms.
- The denitrified mixed liquor and sewage enter the aerobic compartment for BOD<sub>5</sub>, COD oxidation and nitrification.
- By continuous recycle between aerobic and anoxic zones, soluble phosphorous is removed from the effluent and nitrification/denitrification can also be achieved. Enhanced biological phosphorus removal is facilitated by 'luxury uptake' – a process in which specific micro organisms absorb polyphosphates in excess of that required for optimum growth. Such phenomena are enabled by way of extended sludge age operation whereby anaerobic cores within the floc allow such biological mechanisms to proceed.
- As biologically stabilised mixed liquor enters the bottom of the patented upflow sludge blanket clarifier, a velocity gradient is established ensuring the lower fraction of sludge is kept in a constantly mixed state, preventing bulking. As solids rise up the clarifier, their velocity decreases and a sludge based, fluidised bed filter is created, trapping solids. As the sludge increases in weight, it sinks to the bottom of the clarifier where it is returned to the anoxic zone via airlift pump.
- At preset intervals, sludge is wasted to the integral aerobic digester to facilitate further reduction in sludge volume through endogenous respiration and removing phosphorus from the system. Secondary release of orthophosphorus and return via the supernatant is eliminated by maintaining aerobic conditions.
- Finally, the effluent flows over a weir plate which further reduces TSS, and floating scum is periodically removed from the surface of the clarifier and returned to the anoxic zone via air lift pump.

## Process Flow



## Instrumentation and Control

The process is offered across a wide range of specification levels ranging from 'duty only' configurations with manual valves and no instrumentation to a fully automated duty/standby configuration with self monitoring and corrective feedback.

With the total process control version, sludge wasting rates, air flow rates, scum removal and RAS rates can all be managed through PLC control via process instrumentation incorporating on-line dissolved oxygen monitoring, turbidity testing and sludge blanket depth detection.

A configuration of both solenoid and actuated valves and variable speed drives to control the motor speed of mixers and blowers carry out PLC automated instructions in order to ensure compliance with client requirements.

## Dimensions

Population	Aeration Zone (m <sup>3</sup> )	Anoxic zone (m <sup>3</sup> )	Clarifier (m <sup>3</sup> )	Total tank volume (m <sup>3</sup> )
100	11	6	4	20
300	32	18	10	60
500	53	29	16	100
1000	106	58	31	200
1500	159	87	47	300

Volumes are approximate and for reference only, based on standard strength domestic sewage (200l/hd.d, 60gBOD/hd.d and 8gNH<sub>4</sub>-N/hd.d) and to meet a 10:10:1:10:3 (BOD:SS:NH<sub>4</sub>-N:TN:P) consent.

## Servicing

The BESST has been engineered to minimise ongoing servicing costs. This is due to the ingenuity of the tanks' internal hydraulic pathways, geometric configuration and airlift pumps being operated via the same compressed air supply as that used for providing process oxygen.

All operation and maintenance activities can be undertaken without the need to empty the contents of the tank. All service and isolation valves are located just below the gridding for ease of access and diffuser leg sections can be taken out by isolating the air supply to each lateral and removing the leg.

The submersible mixers can be removed from the tank as they are coupled to dedicated guide rails which traverse the total height of the unit.

Typical desludge intervals are 30 days. This can be extended to meet customer requirements. Please contact WPL for further information.

## Bespoke Design

With the BESST, WPL are able to offer and design highly flexible and tailored solutions to meet individual customer requirements across an even broader range of waterwater applications than before.

For further information, please contact WPL to discuss site and process specific cases.

## Delivery

Deliveries within mainland England, Scotland and Wales can normally be guaranteed within ten working weeks, subject to factory workload.

Please contact a member of WPL for your specific requirements.

WPL is recognised internationally as a principle designer and manufacturer of high quality package and turnkey sewage treatment systems, and grease management solutions.

It has over 14 years' industry experience and services an extensive customer portfolio comprising the UK's major water utilities, all areas of the commercial sector and the domestic market place.

The company's consistent focus on ecology, coupled with extensive research & development into new technology, have enabled it to far exceed all existing and proposed discharge consent standards enforced by the Environment Agency, SEPA and other regulatory authorities.



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