











Technology

natural waste water treatment

ARM Group Ltd
natural wastewater treatment

Whether you're thinking about a new reed bed system, or you just want some timely expert advice about effective operation, we can help.

Harnessing natural technology

Ever since natural waste water treatment systems came of age in the 1980s, ARM Ltd has led the way in reed bed and constructed wetland technology.

Working with the UK water companies, councils, contractors, industrial clients and research institutes, we have designed, built and maintained many hundreds of reed bed systems. These range in size from 10m^2 up to 20,000m^2, and we have consulted on reed beds of many hundreds of hectares.

Harnessing natural processes, we engineer them to deliver all the advantages of cost-effective, versatile and sustainable wastewater treatment – and we guarantee the performance of every system we design and install.

As the largest dedicated UK company by far in this specialised field, with a reputation dating back to 1947, ARM brings you unique expertise and experience. We can support you at every stage of the process – from initial planning and design through construction and commissioning to ongoing maintenance – ensuring the optimum performance of your reed bed system.

We continue to pioneer new and innovative ideas. Recent developments include an aggregate recycling system to reduce landfill costs and material usage, and a plough to retrofit FBA™ airlines into existing reed beds.

Why use reed beds?

The Chinese used wetlands more than two thousand years ago for their impressive effluent and water treatment capabilities.

Reed beds provide an ideal environment for a wide range of treatment processes. The combination of micro-organisms, plant roots, rhizomes and substrate matrix remove contaminants in a variety of natural ways.

They treat waste water as it flows though the system just like the process in conventional sewage treatment, but without using energy-intensive machinery.

With low maintenance requirements, low or zero power consumption and a long, productive lifespan, reed bed systems are both proven and sustainable, enhancing any landscape. Their removal mechanisms include settlement, filtration, biological and chemical action, containment and plant uptake. They can reduce levels of soluble organic matter, suspended solids, ammonia, pathogens, hydrocarbons, and metals.

The various types of reed bed can be used in different configurations to treat a variety of pollutants from industrial or municipal sources.

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Performance guaranteed

Our reed beds are used at all stages of the sewage treatment process providing primary, secondary and tertiary treatment as well as sludge dewatering.

They can also extend the life of older treatment works by providing a tertiary polish to effluent, bringing it within regulator consent, and saving capital expenditure.

They are increasingly used for tackling industrial effluent. Uses range from treating fire-fighting foam and metal removal from minewater drainage, to reducing ammonia levels in leachate and removing hydrocarbons from groundwater.

Other applications include treatments connected with:

- agriculture
- pharmaceutical
- food processing
- chemicals
- refinery waste
- distillery wastewater
- airport run off
- Sustainable Urban Drainage Systems (SUDS)

They can also be used to create wetland habitats – enhancing bio-diversity.

Whatever the application, we provide contractual guarantees of effectiveness, performance and quality – so you can be sure you're going to get the results you're looking for.

Our comprehensive range of services includes:

Consultancy: feasibility studies, process design, site surveys, landscape design, and advice on managing future changes

Project management: our experienced managers will look after your entire project from conception through to completion.

Design and build: our turnkey service delivers systems on time and within budget, including liaising with regulators and enforcement authorities on your behalf.

Design and supply of materials and equipment: a service we provide on request, for example to framework contractors.

Construction service: using our design or your own, we make it easy for contractors and save our clients significant amounts of money through design reviews based on experience – without compromising quality or performance.

Field services for system maintenance: we extend the life of your system, bring you peace of mind and help you get the best possible results.

Asset assessment: we evaluate process efficiency, check your system is operating at top performance, and make recommendations.

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ARM Group Ltd

About Us

ARM Group Ltd, a Staffordshire based privately owned company, is the leading designer and constructor of natural waste water treatment systems and associated technologies for the industrial and municipal waste water treatment market in the UK. The Company is noted for its invention and subsequent commercial development of equipment and processes within its chosen markets.

ARM Group Ltd has been trading since 1947 and was originally involved in development, design, manufacture, and construction within Agricultural Engineering. However, in the late 1980s ARM Group Ltd redefined its objectives and moved its customer and product bases into the global market of wastewater treatment specialising in the use of reed bed/wetland systems.

Today the Company operates out of offices in Rugeley, Staffordshire employing 21 people and using Associates and sub-contractors as required.

ARM Group Ltd is broadly divided into seven operating functions these can provide client support either individually, as a team, incorporating the requisite elements, or as a whole providing continuity of support for turnkey solutions from project conception through design construction, commissioning and maintenance, depending on the specific needs of the client. The functions are:

- Sales
- Design
- Project management
- Construction
- Research and Development
- Refurbishment and Maintenance
- Administration

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ARM Group Ltd

Experience

For the past 30 years ARM Group Ltd have specialised in reed bed and wetland systems having designed and installed over 700 beds during this period. This provides us with unique and extensive experience of their application, design and construction across the wastewater treatment spectrum. Our experience and knowledge has been accumulated through:

- Design and construction of reed bed systems
- Value engineering optimisation
- Application experience
- Working with academic institutions.
- The international constructed wetlands conference circuit
- Presenting papers
- Personal contact with leading researchers
- Working relationships with leading specialist in specific reed bed applications
- Founder member of the Constructed Wetland Association (CWA)
- Founder member of Global Wetland Technology (GWT)
- Over 1000 reed bed surveys

We have designed and constructed reed beds that provide treatment for:

- Mine water
- BOD and COD reduction
- Methanol removal
- Copper removal
- Pathogens
- Landfill leachate
- Hydrocarbons
- Septic tank waste
- Ammonia
- Surface water run off
- Solids
- Sludge dewatering
- Storm water
- Metals
- Glycol

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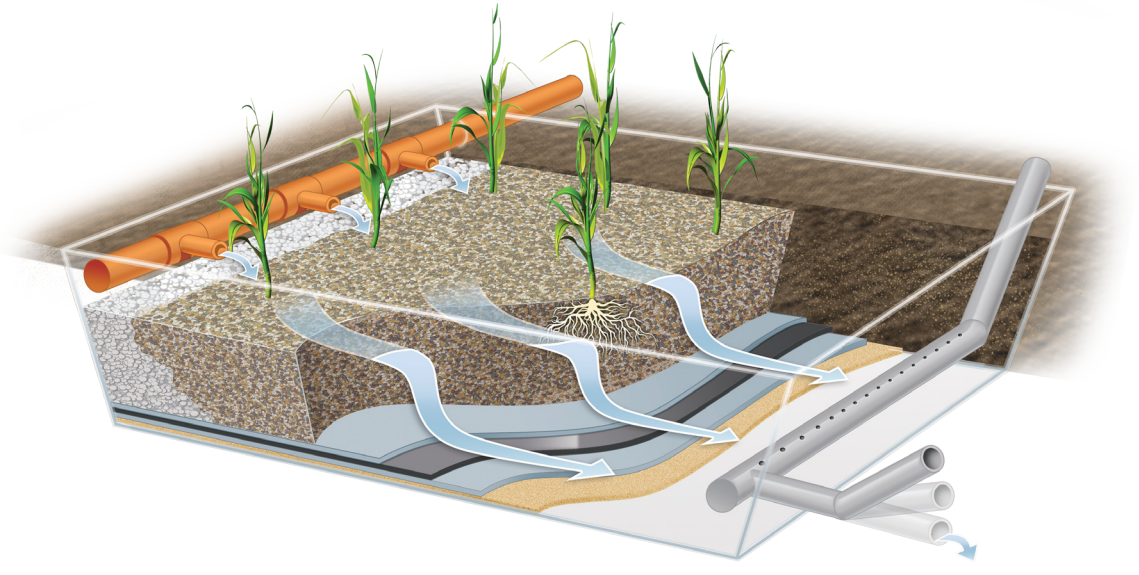
Horizontal Flow

The horizontal flow reed bed is the most commonly used reed bed system in the UK. It provides continuous treatment with minimal mechanisation.

Horizontal Flow (HF) reed beds consist of an excavation approximately 0.6 metre deep which is lined to ensure untreated effluent cannot percolate down into the groundwater. The bulk of the excavation is filled with single sized media such as gravel with larger media at the inlet and outlet. A piped inlet distribution and drainage system is installed and reeds are planted directly into the gravel media. The effluent to be treated passes through the gravel media and the level of the effluent is controlled by means of an adjustable level control pipe in an external discharge chamber

The wastewater passes through aerobic, anoxic and anaerobic zones within the bed. The aerobic zones are situated near the surface close to the roots and rhizomes of the reeds. The anaerobic and anoxic zones are situated deeper within the bed. Wastewater passes through the media where microbes attached to the gravel digest contaminants. Where there is little



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oxygen availability anaerobic organisms breakdown organic matter using metabolic processes that are not oxygen dependant.

Contaminant removal

The primary removal mechanisms of HF reed bed are microbial degradation, filtration and sedimentation. As well as the removal of soluble BOD these mechanisms also remove suspended solids and pathogens. HF systems are not particularly effective at removing ammonia by nitrification but the limited oxygen availability allows denitrification – the reduction of nitrate to nitrogen gas.

HF system types

There are two types of horizontal system, sub surface flow and surface flow. By far the most common type is the sub-surface flow in which effluent level is held just below the surface of the bed media. These are often used for final polishing or tertiary treatment applications. With surface flow systems, however, (also known as free water surface wetlands) the level effluent level is held above the surface of the media supporting the reeds. This prevents effluents with high solids loading from blocking up the front end of the reed bed. The solids are carried over the surface of the bed where they settle across the full area of the system into the media where treatment is effected. Clearly these systems are good at dealing with high solids loads. They also will remove metals as well through settlement, filtration and adsorption. The media in these systems is usually organic or soil based.

Twenty years experience

Horizontal Flow reed bed systems are used widely to treat low strength wastewaters or for pre-treated wastewaters for example, final polishing at a sewage treatment works. ARM's twenty years experience of design and construction of these systems has resulted in value engineering developments and optimisation reducing maintenance and operational requirements whilst maintaining treatment capabilities.

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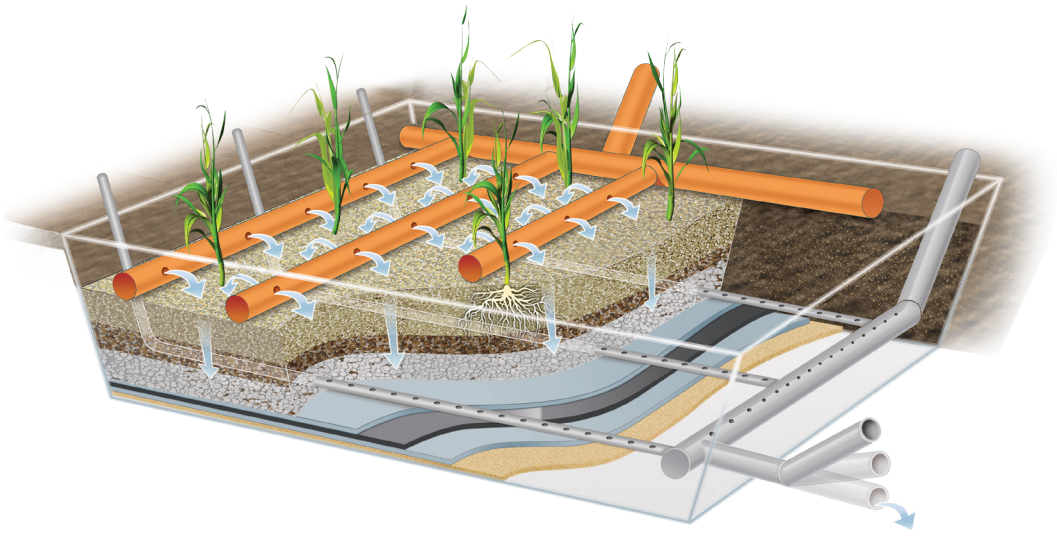
Vertical Flow

Vertical flow reed beds can achieve higher Oxygen transfer rates than other passive reed bed systems reducing the required land take and enhancing treatment capabilities.

The vertical flow (VF) systems comprise a lined excavation filled with media such as sand or gravel media and unlike the horizontal flow systems, VF systems media is often graded. VF systems can have a smaller footprint than HF systems and can cope with stronger effluents. Effluent can be dosed in a variety of ways including pulse-loaded (batch), recirculating vertical flow, continuous downflow and fill-and-drain (tidal flow) wetlands The effluent is distributed over the bed until the surface is flooded then passes through the bed where treatment occurs. The effluent is collected in pipes positioned along the bottom of the bed and discharged through an outlet chamber.

Vertical reed beds, although not as numerous in the UK as horizontal flow beds, are being used increasingly in applications with higher loads or where there is insufficient land available for a HF system.

The effluent drains down through the bed with air replacing the wastewater



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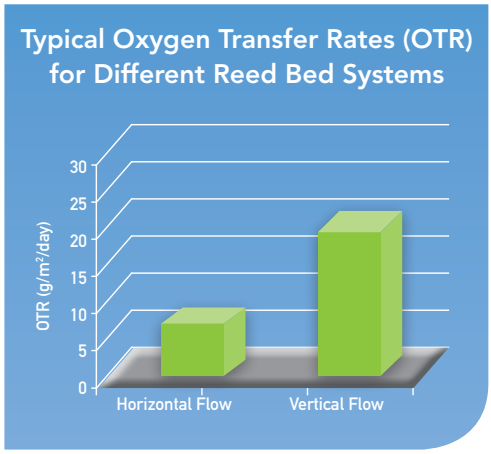

in the bed as it drains. The next dose traps the air which leads to a highly aerated system with good oxygen transfer permitting increased microbial growth and activity. VF systems are more effective than HF systems at ammonia removal due to their ability to nitrify as a result of increased oxygen levels within the beds. VF constructed wetlands typically provide a good removal of organics and suspended solids, but these systems typically provide little denitrification. Consequently, removal of total nitrogen is limited unless they are part of a multi stage or hybrid system when accompanied by a horizontal flow bed.

VF systems have many variants, these include:

Intermittent downflow

This option involves flood application of effluent on top of the bed for brief periods of time (e.g. Sludge Treatment Reed Beds).

Unsaturated downflow

This variant involves distributing effluent across the top of a granular media. Water then trickles through the media in unsaturated flow. Effluent can be recirculated through these systems.

Saturated flow

These systems employ continuous saturated flow of effluent through the bed. This is the system is typically used by ARM when installing Forced Bed Aeration (FBA™). The flow can be in a downward or upward fashion.

Tidal (fill and drain) flow

These systems employ cyclic filling and draining of a granular bed. These reactors create cycling redox conditions that contain both oxidising and reducing phases (e.g TAYA™ systems).

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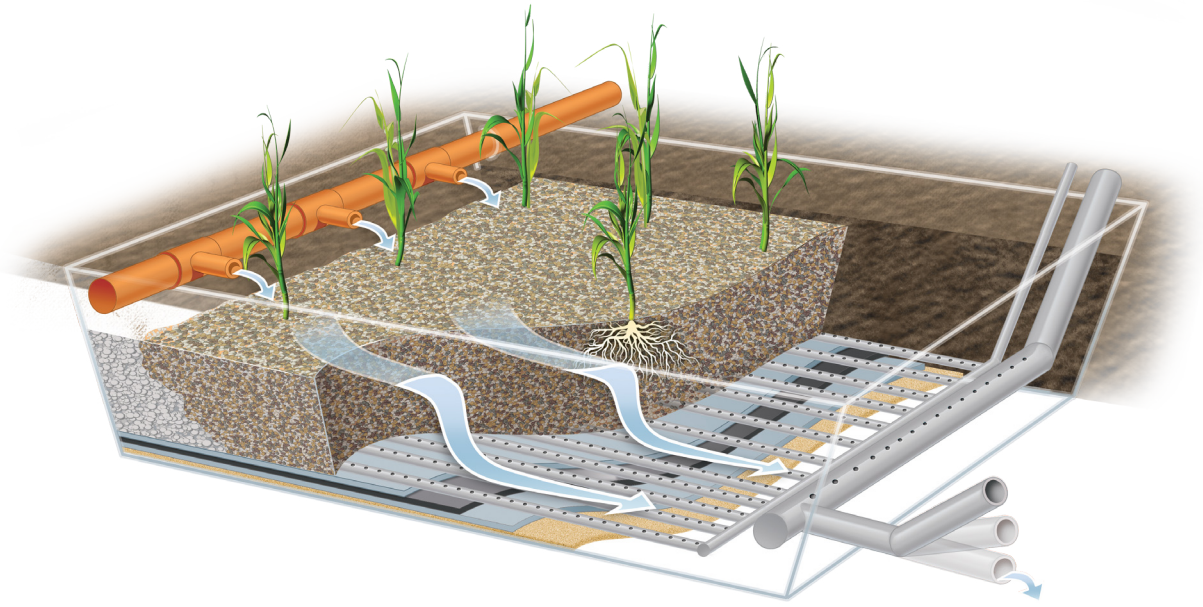
Forced Bed Aeration (FBA)

Forced Bed Aeration™ compliments and enhances existing reed bed technology, increasing treatment capacity by up to 15 times.

Forced Bed Aeration™ (FBA™) is a new wastewater treatment technology which enhances constructed wetland treatment performance. Significantly higher contaminant removal rates are attained along with an increased consistency of performance. Developed in the USA, by our partners Naturally Wallace, FBA™ can be used in both horizontal and vertical flow constructed wetland systems. Blowing air through the wetland system makes the system oxygen unlimiting increasing the treatment capacity by up to 15 times. This new technology can treat wastewaters high in BOD, SS, NH_4-N and other organic contaminants.

Forced Bed Aeration™ reed beds can reach performance levels which have been unobtainable in standard reed bed systems with less performance variability. Aeration of horizontal and vertical flow reed beds has multiple advantages.



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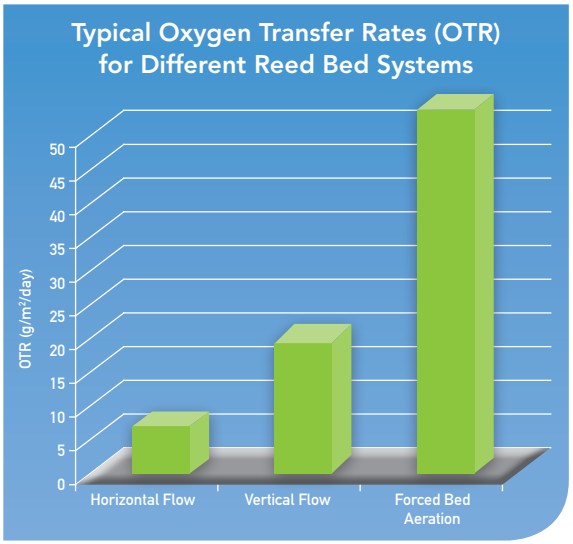
- FBA™ can completely nitrify wastewater
- FBA™ systems can be deeper than conventional reed beds therefore taking up 50% less space than passive systems.
- Plants thrive in FBA™ systems because the introduced oxygen prevents the formation of toxic products that can stunt plant growth in strongly anaerobic, passive system
- FBA™ reed beds can be divided into aerobic and anoxic zones to both nitrify and denitrify.
- FBA™ reed beds are ideal for treating fluctuating loads such as CSO's and locations with variable occupancy.
- Initial studies indicate FBA™ systems have reduced clogging rates extending the operational life of a treatment system.

Pipelines

FBA™ has a unique network of pipelines which provides a constant flow of oxygen into the reed bed. Patented rootguard technology prevents root rhizomes penetrating the emission points.

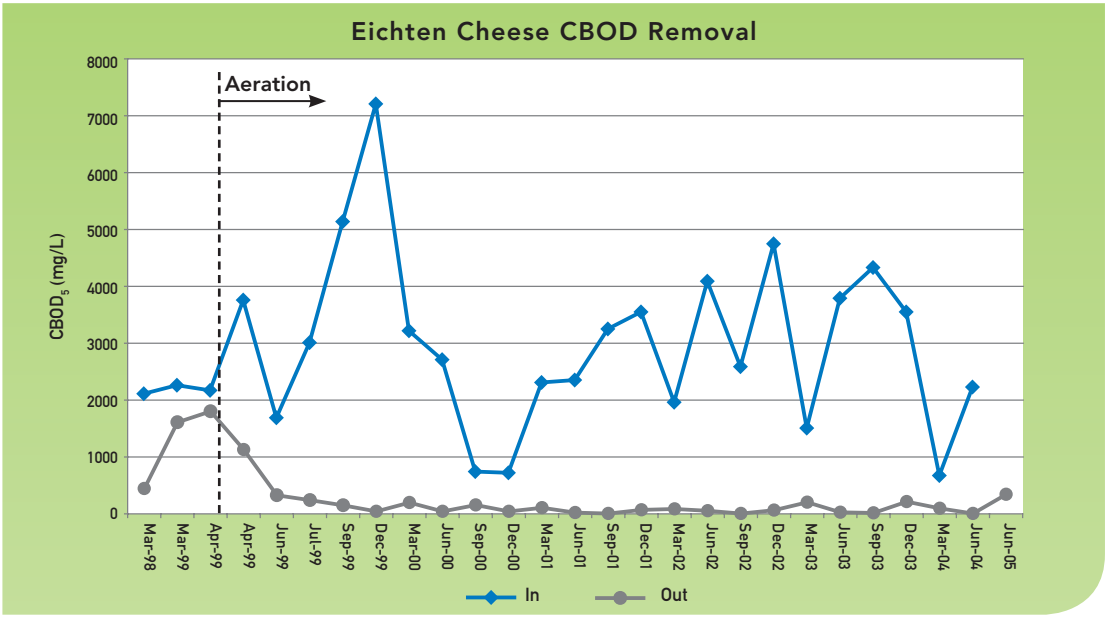
Adapting FBA™

FBA™ can be retrofitted to existing reed bed systems, especially those which are overloaded. This prolongs the life of the reed bed and enhance effluent treatment.



FBA™:

- Improves treatment capability.
- Reduces clogging rates.
- Requires minimum power input.



Graph indicating the treatment performance of an FBA™ wetland system treating cheese production effluent

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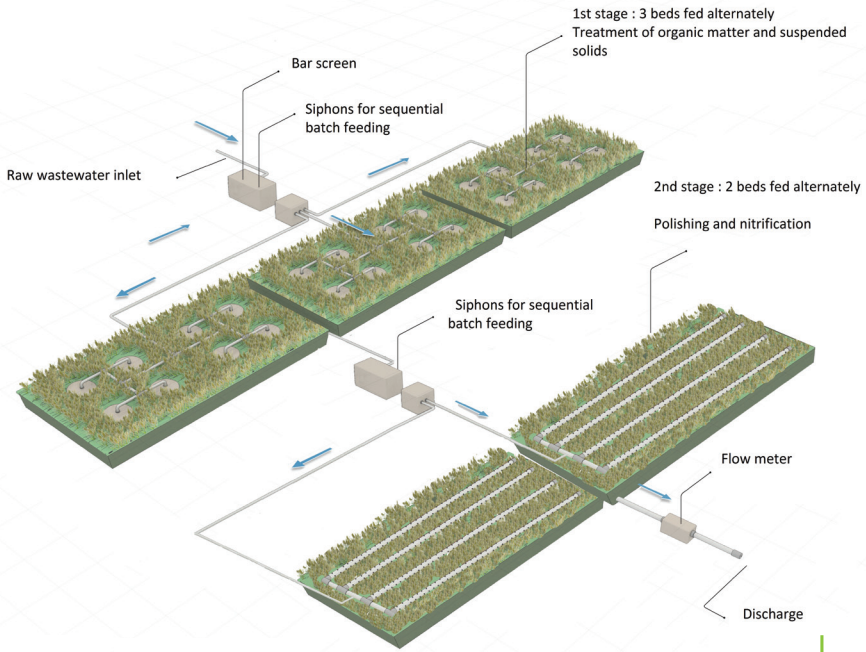
Phragmifiltre: Full sewage treatment by reed beds

Phragmifiltre exemplifies the rapid evolution of reed bed technology over the past 20 years, from the initial tertiary treatment application to the full treatment of sewage wastewater.

From their first application as a tertiary treatment, 'final polish', solution through secondary treatment, including nitrification, reed bed wastewater treatment systems are now widely being used for the full treatment of sewage all over the globe through the application of the **Phragmifiltre** system.

The **Phragmifiltre** system comprises vertical flow constructed wetlands (reed beds) for the full treatment of sewage and has been successfully operating in France through Epur Nature and SINT since the 1990's. To date there are over 800 **Phragmifiltre** systems treating raw sewage for loads from 20 to 5,000 PE (population Equivalents). The systems are typically designed to have two stages, the first with three beds, the second with two beds. The first stage filters out and dewaters the solids in the raw waste water on the surface of the bed. The filtrate passes down through the reed bed which acts as a typical batch flow vertical flow



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reed bed reducing BOD primarily but also undertaking nitrification of ammonia. The second stage vertical flow beds provide additional BOD reduction and completes nitrification of ammonia prior to discharge. Wastewater, preferably flowing by gravity, is fed to each bed in rotation thereby allowing all the beds to have a rest period. The use, where possible, of siphon technology for dosing both stages minimises, or eliminates, power requirements.

	INLET CONCENTRATION (MG/L)		OUTLET CONCENTRATION (MG/L)		REMOVAL EFFICIENCIES (%)	
	Mean	SD	Mean	SD	Mean	SD
COD	651	282	50	29	92	7
BOD5	291	140	8	9	97	3
SS	242	133	8	6	97	3
TKN	56	34	7	12	90	12
TP	7	4	6	3	32	25

In the past the UK sewage treatment industry has tended to use constructed wetlands as a back stop, a means to cover for upstream process deterioration. The recent adoption of **Phragmifiltre** by a major UK Water Company signifies a major step change in thinking and indicates recognition of the TOTEX benefits.

Conventional sewage treatment works (STW) generate sludges which have to be taken from small rural works to larger STW for treatment. **Phragmifiltre** stores and composts sludge on site and therefore no tanker costs (opex) and no roadways (capex) are required. **Phragmifiltre** also provides wildlife habitats that conventional STW do not. Conventional STW are hazardous areas and can be vulnerable to vandalism, they need security fencing around the whole site (capex). **Phragmifiltre** only requires security fencing around a few chambers. Conventional STW require weekly operator visits, **Phragmifiltre** require monthly visits (opex). **Phragmifiltre** constructed wetlands are an ideal replacement for aging STW and an environmentally attractive, low totex option for new developments. Typical treatment performance data from 70 plants is given in the table above.

There is potential for this technology to be aligned with other intensive reed bed treatment technologies such as Forced Bed Aeration™ to enhance treatment capabilities further if required.

- Full primary, secondary and tertiary sewage treatment by reed beds.
- Proven robustness with high tolerance of temporary hydraulic overloading.
- Low to zero energy consumption
- Integrated sludge treatment, therefore no tankering and associated access features required.
- Simple operation
- Low cost operation
- Excellent integration into the landscape and no nuisance such as odours or noise.

ARM Ltd in association with **Epur Nature** and **SINT** in France are proud to be bringing this technology to the UK and happy to supply further information on request.

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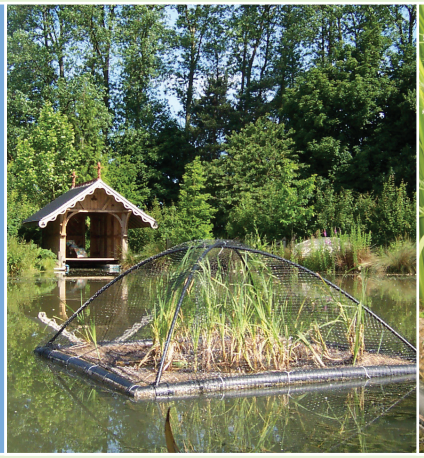
Floating Reed Beds

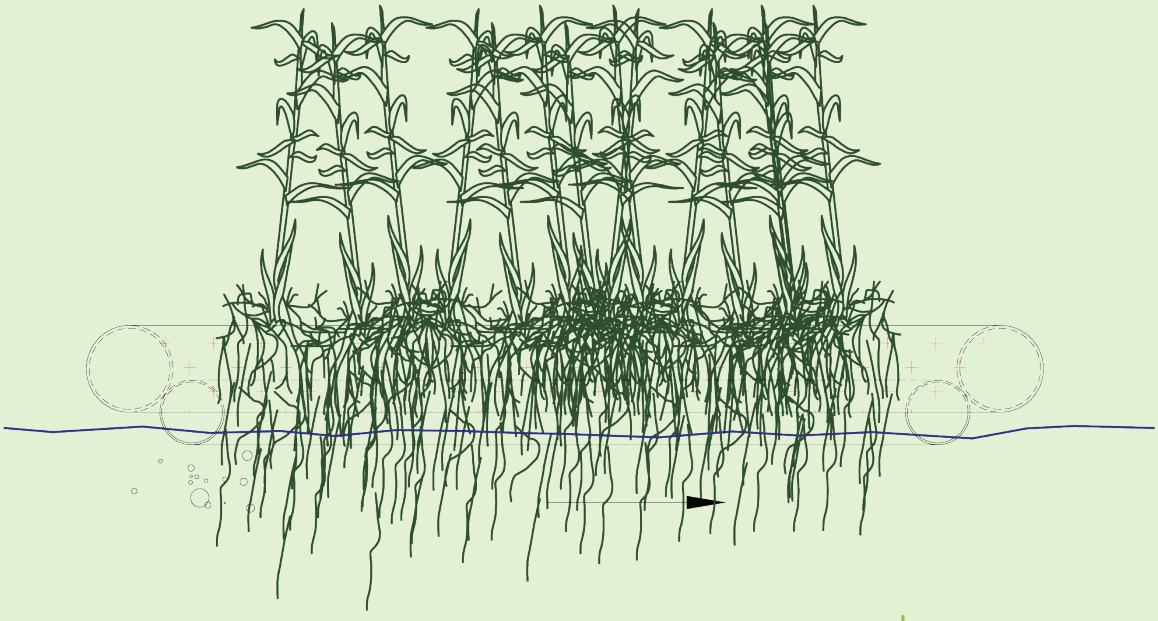
Floating reed beds provide an aesthetic solution to solids settlement enhancement in lagoons as well as fish protection, open water coverage and nutrient polishing.



Floating reed beds consist of a buoyant tubular framework of welded UV protected polyethylene, supporting a coir mattress, sandwiched between two layers of plastic mesh into which the reeds are planted. Constructed in 4m² units, the floating reed beds are modular in design and can be created in a variety of permutations to meet any area size or shape requirement. They can be installed on sludge lagoons, storm water lagoons, ponds, lakes, reservoirs and canals. They are inexpensive, easily installed, require little maintenance and provide a multifunction low energy "Soft Engineering" solution to effluent treatment.

Coir Mattress

The Coir mattress provides an ideal growing medium for the wetland plants to establish.



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Root system

The root systems grow down through the water column reducing effluent flow and increasing solids knock down, capture and settlement whilst providing effluent polishing for BOD and nutrient removal.

Modular Design

Modular in design, the floating reed beds can be joined together to meet any size or shape requirement. The raft system is anchored to prevent displacement of the reed raft by water flow or wind.

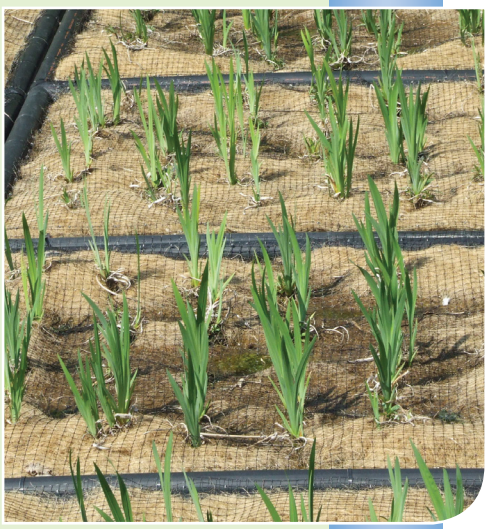
Floating Reed Bed Application

Floating Reed Beds are a "Soft Engineering" approach to treating effluent. The roots of the wetland plants encourage settlement of solids and provide a polishing treatment for BOD and nutrients, but they can also be used for the treatment of metals. Primarily designed for effluent treatment, they provide the additional function of discouraging large birds by reducing the area of open water. They are ideal for sludge lagoons to aid settlement of solids and for the treatment of surface water run off, as the rafts are able to withstand fluctuating water levels caused by storm events.

Contaminants

Floating reed beds provide enhanced effluent polishing for the following contaminants:

- Suspended Solids
- BOD
- Nutrients
- Metals



Applications

- Sewage Sludge Lagoons
- Minewater Drainage
- Stormwater Treatment
- Reservoirs
- Surface water run off
- Agricultural effluent
- Aquaculture

Bird Control

Each module can be netted to prevent birds from nesting, essential for treatment lagoons, ponds and lakes located near airports where the rafts can be used to reduce bird numbers by covering open water.

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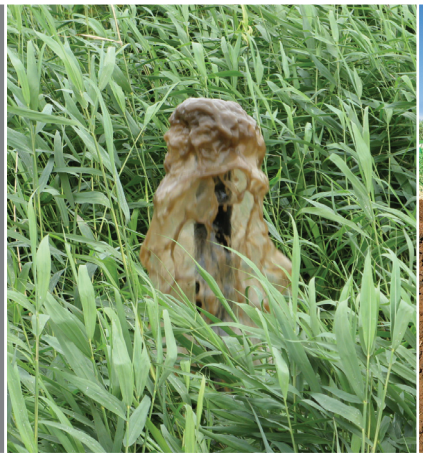
Sludge Treatment

Sludge Treatment Reed Beds eliminate sludge transport costs and their impact on the environment is minimal compared to alternative treatment methods.



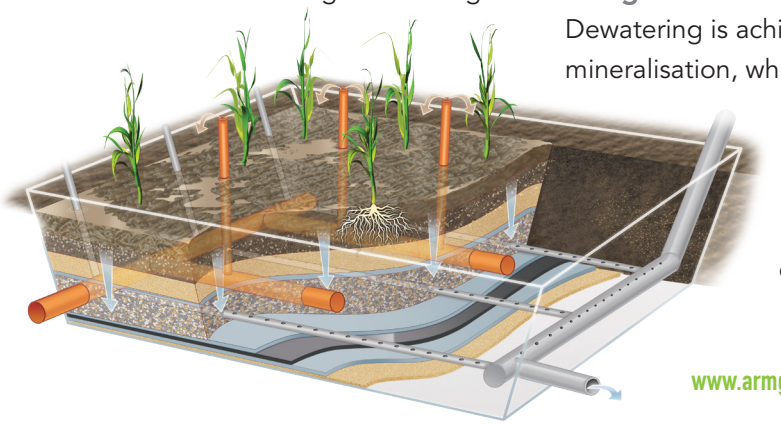
Sludge treatment reed beds (STRBs) have been used for the dewatering of sludge from wastewater treatment plants in Europe since 1988. Working in collaboration with Orbicon, ARM has introduced STRBs into the UK.

Dewatering occurs as a result of draining, evaporation, evapotranspiration and organics reduction (mineralisation). These systems are used on sites treating flows of up to 22,500 m^3/day. The treatment systems consist of a minimum of eight individual lined reed bed basins which are 2.0 – 2.5m deep. Sludge, with dry solids content of 0.5 – 5%, is pumped in sequence to each basin to a pre-determined fixed solids loading. The sludge loadings amount to a maximum of 40 – 60 DS/m^2/year dependent on the characteristics of the sludge. The sludge residue will, after approximately ten years of operation, reach a height of 1.20 – 1.50 meters with a dry solids content of 30 – 40%.

The establishment and operation of STRBs systems is seen as having a lower impact on the environment compared to the alternative mechanical sludge dewatering systems which require the use of chemicals, incinerators, transport and disposal. Experience has shown that the quality of the final product with respect to pathogen removal and mineralisation of hazardous organic compounds after treatment make it possible to recycle the biosolids to agriculture as an Enhanced Treated Product.

Effective reduction of sludge residue

Dewatering is achieved through mineralisation, which removes up to 25% of the organic matter in the sludge, drainage, evaporation and evapotranspiration.



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No chemicals needed

STRBs use no chemicals to treat sludge, reducing potential health and safety issues in the working environment, along with a reduction of the chemical residue in the treated wastewater.

Energy savings

STRBs utilise naturally occurring microbial fauna to reduce and treat sludge. The only appreciable power consumption is by the use of transfer pumps between the wastewater treatment plant and the STRB and by ejectors in the sludge buffer tanks.

No odour problems

Mineralisation occurs through aerobic degradation so that an STRB system has no odour problems.

Better CO_2 – balance

Compared to other dewatering methods, an STRB system has reduced CO_2 emissions.

Improved sludge quality

The content of substances detrimental to the environment can be reduced to a degree that the sludge conforms to the limits for deposition on agricultural land. A six log reduction in infectious solids is seen in residue removed from the STRB.

Good options for recycling

After treatment there are many options for recycling, including use as a fertiliser on agricultural land. Sludge quality is cleaner and better adapted to the natural cycle when put to agricultural use than mechanically dewatered sludge.

Reduction of transport and spreading costs

An STRB system will more than halve costs of transport and spreading, since the volume of sludge can be reduced to approx. 1/3 compared to mechanical dewatering.

Greater treatment capacity in wastewater treatment plant

Experience has shown that 5 – 15% of wastewater treatment plant capacity is freed at no extra cost, based on improvement in the quality and purification of reject water compared to existing dewatering systems.

Comparison of Sludge Treatment Reed Bed System with mechanical dewatering plant (Kolding, Denmark 2000 tonne dry solids per annum)

	AGRICULTURE	REED BED TREATMENT	CENTRAL DRYING / INCINERATION
EMISSIONS			
CO_2 (tonnes/Year)	157	37	335
NO_x (Kg/Year)	735	235	200,000
SO_2 (Kg/Year)	~0	~0	10,000
SMELL			
Spreading on Crop Field	YES	NO	n/a
Container transport	YES	NO	YES
Ventilation outlet/smoke	YES	NO	YES
TRAFFIC			
Number of trucks	910	300	1010
EXTERNAL NOISE			
Ventilation + cars	Yes	No	Yes
Other Considerations	Spreading	Emptying	YES
INTERNAL ENVIRONMENT			
Chemical Risks	YES	NO	YES
Heavy Traffic	YES	NO	YES
Dangerous Machines	MEDIUM	FEW	MANY
Noise	MEDIUM	LOW	HIGH
RESIDUAL SUBSTANCES			
Pathogens	YES	NO	NO
Heavy Metals	Unchanged	Unchanged	Fluegas / ash
Hazardous compounds	Unchanged	Reduced	Ash residue

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TAYA Technology

TAYA is a unique wastewater treatment system that combines the benefits and simplicity of natural wetland technology with the intensive high load treatment capabilities of mechanical systems.

The result is an operationally efficient, and cost effective intensive wetland solution for treating high strength effluents which provides the following treatment benefits:

- Small footprint
- Low maintenance requirement
- Low labour costs
- Minimal power requirement
- High strength effluent treatment capability
- High Hydraulic load capability

The Science

Developed from reciprocating wetland technology TAYA has been optimally engineered to maximise the efficiency of the microbial biomass through nutrient management and **effective natural aeration**. TAYA's proprietary pumping design, maximises the use of gravity during operation, to minimize power consumption, maintenance and operational costs.

Harmonising Technologies

TAYA is a hybrid technology, integrating aspects of process and biochemistry found in intensive systems, while maintaining the low maintenance and operational costs associated with wetlands. TAYA technology replaces active electro-mechanical wastewater treatment systems, by attaining the **same effluent quality at a significantly lower lifetime cost**.

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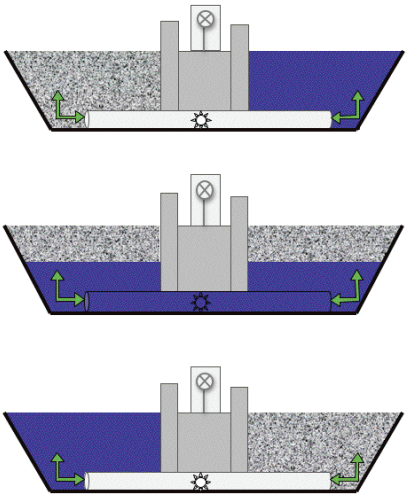
Combining anaerobic pre-treatment with an intensive, yet cost efficient TAYA wetland, provides a reliable solution for clients looking for a proven technology with compelling economics.

Operation

The TAYA model allows for operational adjustments to optimise performance based on determined pollutant loads, calculated oxygen transfer requirements, retention times and sludge yield. The design of the wetland incorporates the filling and draining of subsurface flow basins. The volume and rate of effluent transfer between the basins can be adjusted to optimise performance. The fluids are pumped from one side to the other using a proprietary pumping arrangement, maintaining the lowest energy consumption possible. Natural, effective aeration of the biomass permits high oxygen transfer rates, providing the capacity to treat high organic and amonia loads to tertiary treatment levels.



TAYA reciprocating operation

Applications

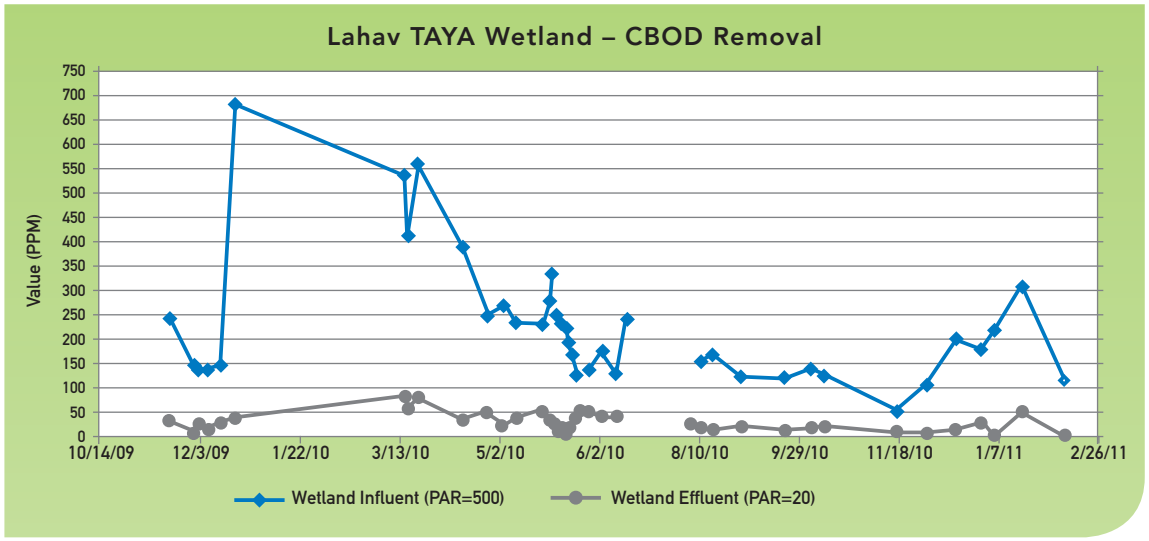
TAYA wetlands have been successfully implemented in a number of municipal and industrial wastewater systems including piggeries, dairies, poultry farms, abbatoirs, pickling factories and domestic wastewater. They have proven effective in treating wastewater with high loads of organic matter and ammonia.

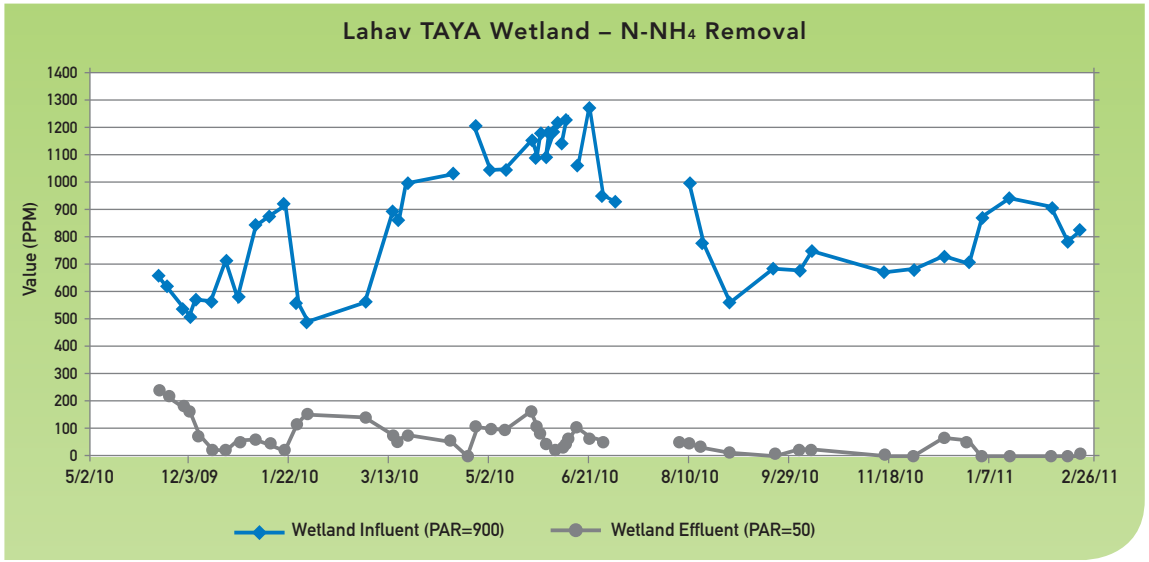
natural waste water treatment

Performance

In 2007 a TAYA system was installed as a retrofit for an existing water treatment plant at Kibbutz Lahav after the original system failed to comply with existing discharge requirements. The completed system was commissioned in 2009 and treats 300m^3/day of a complex effluent combining waste water from a piggery, abbatoir, and the kibbutz itself. This system has been operating successfully for two years treating to secondary treatment levels and maintaining consent. There are now plans to extend the system to treat a further 300m^3/day.

Below is the graphed operational data collected over two years from 2009 to 2011. The upstream heavy loads (20,000 mg/l COD; 15,000 mg/l TSS; 12,000 mg/l BOD; 900 mg/l ammonia) are reduced by the anaerobic pond and delivered to the TAYA system as illustrated below.





natural waste water treatment

ARM Group Ltd

Asset Assessment & Support Package

natural wastewater treatment

Knowledge and proactive management of assets is a key area where water companies can cut operational and capital expenditure. The optimisation and enhancement of remote reed bed treatment systems can secure performance for many years without the need for full site refurbishment and the associated costs.

In the September 2012 issue of *Water & Wastewater Treatment* it was reported by the editor that knowledge by the majority of water companies of the condition of their assets is poor. According to the report from the consultancy company E C Harris, some 90% of maintenance in the UK water industry is reactive. Yet it is well known that proactive maintenance will cut costs by upwards of 50%.

Although this is not the case with all water companies we thought it would be an ideal opportunity to offer a simple solution. ARM Ltd have been designing, constructing, refurbishing and retrofitting reed beds for many of the UK's water companies for decades. It is for this reason we feel best placed to offer you our new Asset Assessment and Support Package (**AASP**).

Reed beds are generally tucked away in Sewage Treatment Works and because they provide treatment with minimal maintenance requirements often get overlooked until the works are close to breaching consent. Our Asset Assessment and Support Package will highlight the condition of the system and give an indication of when refurbishment may be required. This allows expenditure to be planned and therefore controlled and ensures the works performs to its full capability.

Our Asset Assessment and Support Package works in two ways:

1. Asset Assessment

Visual Appraisal

- Condition of the reeds
- Extent of sludge build up on and in the gravel matrix
- Condition of the flow path
- Site layout and accessibility
- Photographic evidence

Fitness for Purpose

- Review design basis, 'as built' drawings and O & M Manual
- Review current and future loads and recent performance data

Monitoring program

- Sampling and monitoring program to include influent flows\loads and discharge levels to characterise performance

Reporting

- Verbal and written report of the assessment complete with conclusions, recommendations and indicative prices of any required remedial work

2. Support Service

- Asset longevity prediction
- Sampling and monitoring to establish performance
- Refurbish to 'as built'
- Re-engineering to improve performance
- Maintenance
- System operation
- Retrofit with latest technologies to enhance capability

We would be happy discuss any aspects of this service with you and can be contacted at info@armgroupltd.co.uk or telephone on 01889 583811.

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