

Water Company

Sludge

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 10m² up to 20,000m², 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.

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 through the system just like the process in conventional sewage treatment, but without using energy-intensive machinery.

With low maintenance requirements,

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.

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.

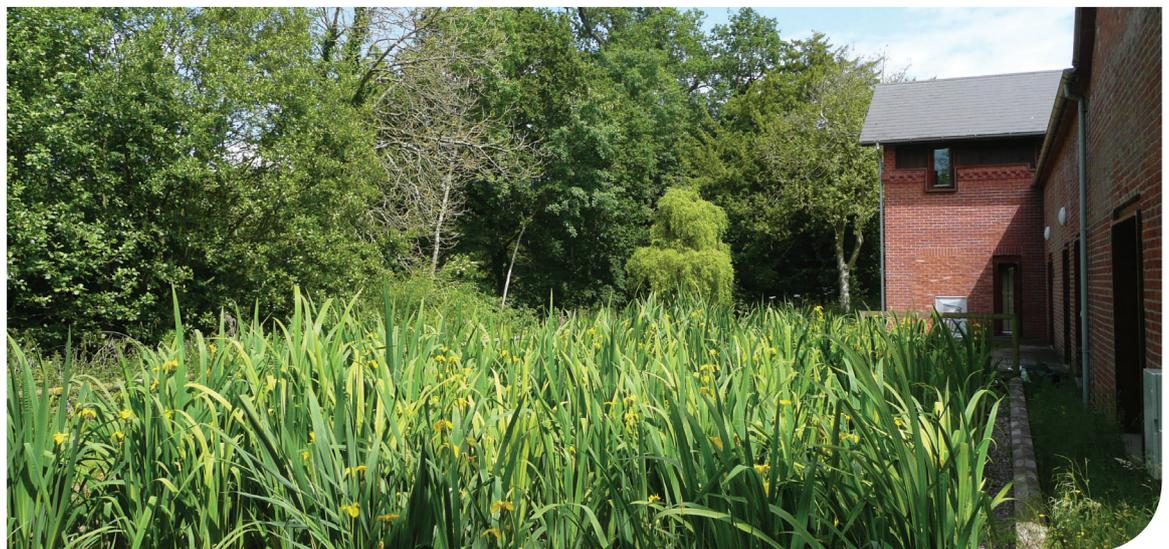
ARM Group Ltd has been trading since 1947 and was originally involved in development, design, manufacture, and construction within Agricultural Engineering. However, in the late 1980s ARM Group Ltd redefined its objectives and moved its customer and product bases into the global market of wastewater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





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



Essex & Suffolk Water, Hanningfield

Sludge treatment reed bed: Waterworks sludge



Project

Essex and Suffolk Water, Essex

Location

Hanningfield, Essex

Project type

Drinking water sludge treatment – trial

Wastewater type

Ferric sludge

Completion date

August 2010

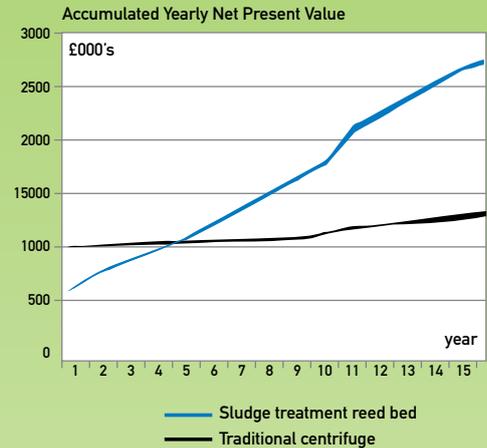
Treatment

Sludge treatment reed bed

Need

The asset management strategy for Essex and Suffolk Water identified a need for a new process for sludge handling at Hanningfield Water Treatment Works (WTW). Supplied with raw water from Hanningfield Reservoir (354 Ha), Hanningfield WTW produces 150 million litres of potable water a day. As part of the water treatment process, 2-4 million litres of ferric (Iron) sludge per day is generated primarily from the de-sludging of the Pulsator clarifiers. The sludge is primarily a mineral sludge with seasonally fluctuating levels of algae and suspended solids.

Comparison for 50,000 Population



This cost comparison graph has been produced to demonstrate the potential cost and CO₂ emission reduction achievable by introducing sludge treatment in reed beds as opposed to traditional disposal routes. The comparison is based on a sludge production of 1,000 tonnes of dry solids, equivalent to a population of 50,000.

Historically these sludge wastes have been pumped to the sludge lagoons at Hanningfield Reservoir. However, these are now nearing the end of their serviceable life and a new sludge handling process is required. The two options being

considered are a mechanical centrifugal solution and sludge treatment reed beds. A trial system was required to determine if ferric sludges are suitable for further treatment in Sludge Treatment Reed Beds. The proposed use of reed bed systems reduces the capital and operating cost and provides the site with an environmentally friendly operation area.



Essex & Suffolk Water, Hanningfield



Trial

ARM in partnership with Orbicon conducted the trial during 2008 and 2009. In order to make a reasonable estimate of the efficiency of Sludge Reed Beds under these particular circumstances, the Hanningfield test system was built with six basins each of 20 m² with a design comparable to a full-scale plant and planted with *Phragmites australis*.

The purpose of the test was to clarify:

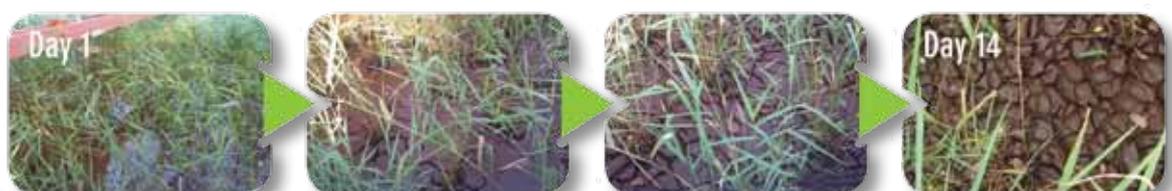
- Whether the sludge from Hanningfield Water Treatment Works is suitable for further treatment in a sludge reed bed system.
- The dimensions required (capacity, operations, loads, area, number of basins, etc.) for a full scale plant at Hanningfield Water Treatment Works.
- The quality of reject water from a sludge reed bed system treating sludge from Hanningfield Water Treatment Works.

The sludge was loaded onto the surface of the trial reed beds. As the sludge dewateres, the sludge residue remains on the surface whilst the water permeates through the filter media. The surface sludge cracks up in the dewatering process.

Results

The test confirmed that sludge treatment in reed bed system has many advantages compared with the mechanical treatment option.

- The reeds colonized the whole area without requiring additional fertilizer.
- Samples of the reject water show that the media filter has a good filtration capability.
- The sludge residue on the surface cracks well – a good indication of dewatering.
- The sludge volume is reduced to approximately 1/200 of its original volume.
- The dry solid content of the dewatered sludge residue is approximately 30 – 40% during operations and 50 – 60% dry solid content after the final resting period prior to emptying.
- A full scale system with a process area of 42,500 m² over 16 basins was ordered.
- A new trial investigating alum sludge is taking place.





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.

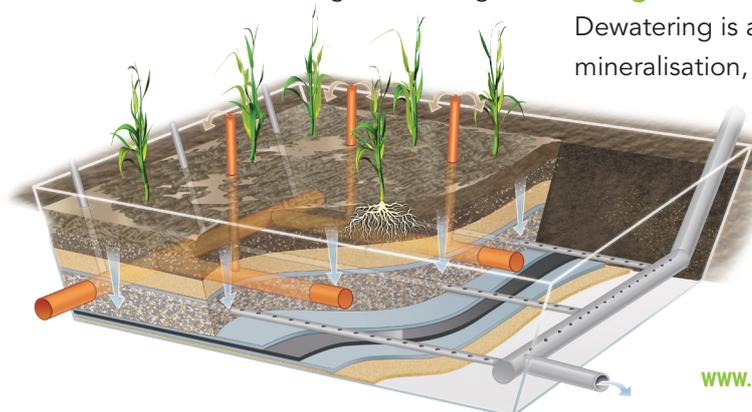
Dewatering occurs as a result of draining, evaporation, evapotranspiration and organics reduction (mineralisation). These systems are used on sites treating flows of up to 22,500 m³/day. The treatment systems consist of a minimum of eight individual lined reed bed basins which are 2.0 – 2.5m deep. Sludge, 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/m²/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 CO₂ – balance

Compared to other dewatering methods, an STRB system has reduced CO₂ 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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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@armgrouppltd.co.uk or telephone on 01889 583811.